

GEOCRES No. 30M11-102

DIST. \_\_\_\_\_ REGION \_\_\_\_\_

W.P. No. 97-72-01

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. \_\_\_\_\_

LOCATION C.N.E. RAPID TRANSITNo of PAGES -OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS: \_\_\_\_\_

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

30 M 11-102

GEOCRES No.

TO: Mr. M. D. Harmelink, (6)  
Head, Urban Systems Research,  
East Bldg., Downsview.

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

ATTENTION:

DATE: September 22, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT:

PRELIMINARY  
FOUNDATION INVESTIGATION REPORT  
For Proposed  
Intermediate Capacity Public Transit System  
(Pilot Scale Test)  
Canadian National Exhibition Grounds  
Metropolitan Toronto, Province of Ontario, Canada  
W.O. 72-11101 -- W.P. 97-72-01

In order to provide sufficient information with regard to Ministry's evaluation of new intermediate capacity transit systems with the objective of selecting the most appropriate system for a pilot scale testing on C.N.E. grounds, we are forwarding to you our Preliminary Foundation Investigation Report. Presented in this report are the results of this investigation, together with our comments pertaining to the elevated system foundations.

We believe that the information contained therein will be sufficient for your preliminary design and cost estimate of the system. Should you require further data, or clarification of the report, please do not hesitate to contact our Office.

*A. G. Stermac*

A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.

AGS/ao  
Attach.

cc: E. J. Orr  
B. R. Davis  
A. Rutka  
P. J. Harvey  
H. Greenland  
B. J. Giroux  
T. J. Kovich  
G. A. Wrong  
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Foundations Files  
Documents

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PRELIMINARY  
FOUNDATION INVESTIGATION REPORT  
For  
Proposed Intermediate Capacity Public Transit System  
(Pilot Scale Test)  
Canadian National Exhibition Grounds  
Metropolitan Toronto, Province of Ontario, Canada  
W.O. 72-11101 -- W.P. 97-72-01

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1. INTRODUCTION:

The Ministry of Transportation and Communications, Province of Ontario, is presently carrying out a study to evaluate new intermediate capacity transit systems. The objective of this study is to select the most promising system for a pilot scale section to be constructed in 1973-74 on the Canadian National Exhibition grounds, in Metropolitan Toronto. The Foundations Office was requested to carry out a subsurface investigation at the proposed site; the scope of the investigation should be such that it provides all the information necessary to carry out a preliminary design for the guideway as well as a cost estimate. This request was contained in a memo from Mr. M. D. Harmelink, Head, Urban Systems Research (dated August 25, 1972). An investigation was subsequently carried out to determine the soil, bedrock and groundwater conditions across the site.

This report contains the factual data obtained from this investigation, together with preliminary recommendations pertaining to the foundation support for the elevated Public Transit System trial pilot section. A detailed foundation investigation will be required once the finalized design details have been specified.



## 2. SITE AND GEOLOGY:

The site is located on the Canadian National Exhibition (C.N.E.) grounds, which is situated on the north shore of Lake Ontario, in Metropolitan Toronto. The C.N.E. grounds encompasses an area approximately 5,000 feet long from east to west and extending 2,000 feet inland from the present lake shore. As illustrated on Drawing No. 72-11101 A, the southern portion of this area is reclaimed land; the present shore line (1972) extends as much as 600 feet beyond the shore line that existed in 1912.

The terrain, within the confines of the C.N.E. grounds, is gently undulating in relief with the ground surface varying from elevation 250 feet, adjacent to the lake, increasing to elevation 285 feet in the north-west corner. Lake Ontario is at about elevation 246 feet. Numerous buildings are located on the Exhibition grounds as well as a football stadium and related recreational facilities. The area is linked by paved roadways. Major paved multi-lane expressway complexes provide access to and from the grounds, namely Lake Shore Boulevard on the shore of Lake Ontario and the Gardiner Expressway on the northern boundary of the C.N.E. The grade of the former is approximately 10 feet below the terrain on the C.N.E. grounds north of the roadway, while the latter is carried on an elevated structure extending up to 25 feet above the ground surface. In addition, east-west running Canadian National Railway tracks are located immediately north of the Gardiner Expressway. These are primarily used by rapid transit commuter trains which provide two way service to Toronto (GO Transit System).

Immediately opposite the Exhibition grounds a series of man made islands have been formed; various buildings and pavilions have been constructed on these islands. The islands have been joined by elevated walk ways. This complex, which has been developed by the Ontario Provincial Government for recreational purposes, is known as Ontario Place.

The geologic history of the Lake Ontario Basin is quite complex; a description of the events which led to the present

conditions are presented in detail by Chapman and Putman, 1966, and Hough, 1966. Toronto was selected as a site for urban development because of its harbour. The harbour in its natural state was a phenomenon of the Lake Ontario shoreline and a product of the waves and currents of that water body. The land on which the first settlement was made was an inheritance from the realm of a previous water body known as Lake Iroquois. The early stages of Lake Iroquois came into being about 9,000 years ago. At this time the glacial lake had its outlet at Rome, New York, U.S.A. (outlet elevation 440 feet), eventually running down the Mohawk and Hudson Valleys to the Atlantic Ocean. Lake Iroquois expanded as the glacial ice washed away and ultimately it spread over a vast area forming what is known as the Iroquois beach. The beach is not horizontal but instead is tilted up toward the north east; in general, the beach increases in elevation at the rate of 50 to 60 feet per mile. It is believed that this tilting is the result of isostatic rebound as the glacial ice was removed by melting. This tilting took place along a line; this uplift line passes through the north-eastern part of the Lake Erie basin, a few miles south-west of Buffalo, New York, U.S.A. (elevation 330 feet). A shore cliff, up to 75 feet in height, exists at the northern limits of the beach. In Toronto the shore cliff is located approximately 2 miles north of the C.N.E. grounds. Lake Iroquois underwent changes during more recent geologic periods. These changes, however, primarily affected the area east of the City of Toronto and had little bearing on the features at the site being investigated.

The Lake Ontario basin itself is oriented parallel to the strike of beds which dip gently to the south. The southern rim is formed by the cuesta or outcrop of the tilted Niagaran dolomite. The greater part of the basin has been excavated in the soft shale of the Queeston formation, Ordovician Period. The extreme northern portion, however, is underlain by a more resistant limestone of Ordovician age.

In the reclaimed area, adjacent to the north shore of Lake Ontario, it is known that up to 20 feet of fill is present.

This fill, which was obtained from random sources, is of a heterogeneous composition. The fill is generally underlain by a thin (5 feet or less) layer of silt and sand deposited by Lake Iroquois. North of the reclaimed area the Iroquois beach has cut into a previously deposited cohesive glacial till; the till varies from 10 to 25 feet in thickness.

The overburden is known to be underlain by weathered to fresh, dark grey shale of the Meaford-Dundas formation, Ordovician Period.

### 3. FIELD INVESTIGATION AND LABORATORY PROCEDURES:

#### 3.1) Field Investigation:

The field work consisted of sixty six sampled boreholes, twenty four of which were accompanied by dynamic cone penetration tests. In addition, one boring, put down during previous investigation (W.O. 72-11059) in this area is included because of its close proximity to the proposed alignment of the rapid transit system. The borings were drilled by five continuous flight auger machines and one conventional diamond drill rig; all machines are adapted for soil sampling purposes. Three of the continuous flight auger machines are equipped with hollow stem augers. The continuous flight augers are generally 4 inches in diameter, whereas the hollow stem augers are about 7 inches in diameter.

Relatively undisturbed samples in the cohesive soil were obtained by means of 2 inch I.D. Shelby tubes which were pushed into the soil hydraulically by the drilling machine. Disturbed samples in all deposits were recovered by means of a standard 2 inch O.D. split spoon sampler driven into the soil with an energy of 350 ft.-lb. per blow according to the specifications of Standard Penetration Test. The same method was used to advance the dynamic cone penetration test. BX or BXL size rock core samples were obtained at 29 boring locations to prove bedrock conditions.

Field vane tests were carried out, where possible, to determine the in situ undrained shear strength of the cohesive stratum, using a standard M.T.C. 2-5/8"  $\phi$  field vane having dimensions such that the undrained shear strength equals twenty time the applied torque at failure. The vane tip was advanced eighteen inches into the undisturbed soil in a single thrust without any rotation of the rod. The torque was then applied and the value at failure recorded. The vane was then rotated six complete turns and a remoulded test was carried out in the same fashion.

Groundwater level observations were carried out, during and after the period of the investigation, in the open boreholes. In addition, nine piezometers of 'TerraTest Type'\* were installed at seven boring locations. At each location, a piezometer connected to 1/2" plastic tubing, was installed within either the cohesive glacial stratum or the shale bedrock. A bentonite seal was made some 10 feet higher than the piezometer and the remainder of the hole made for piezometer installation was filled with sand and gravel. The tip elevations of the various piezometers were shown on individual Record of Borelog sheets, contained in Appendix I of this report. Piezometric water level readings were taken periodically and the results are also shown on the borelog sheets.

The soil, bedrock and groundwater conditions encountered at the boring locations, are presented in the Record of Borehole sheets. The location and elevation of the various boreholes were surveyed in the field by personnel from Engineering Surveys, Central Region, Ministry of Transportation and Communications. The elevations in this report are referred to a geodetic datum and the locations are referenced to a coordinate system. Boring locations and elevations are shown on Drawing No. 72-11101 A. Estimated stratigraphical profile along the alignment of the proposed rapid transit system and sections are also plotted on Drawings No. 72-11101 B, C and D.

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\*Manufactured by TerraTest Piezometers, Toronto, Ontario, Canada.

### 3.2) Laboratory Procedures:

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

Natural Moisture Content

Atterberg Limits

Grain-Size Distribution

Bulk Density

Undrained Shear Strength

The bedrock samples were carefully inspected by our geologist, Mr. K. Ingham. The results of the testing and visual examination of the bedrock are plotted on the Record of Borehole sheets and summarized on Figures No. 1 to 4, inclusive, all contained in Appendix II of this report.

## 4. SUBSOIL AND BEDROCK CONDITIONS:

### 4.1) General:

The extent and composition of the overburden, within the area under investigation, varies markedly. The predominant stratum in the northern part of this region, is composed of a heterogeneous mixture of clayey silt, some sand and trace of gravel (Glacial Till), which is overlain by a granular deposit of silty sand with gravel between Station 111+00 and Station 122+00. This cohesive stratum varies from 11 feet (B.H. #47) to 25 feet (B.H. #23) in thickness. Underlying the cohesive glacial till stratum is dark grey shale bedrock of Meaford-Dundas Formation. The northern part of the site is generally covered by fill material up to 11 feet in thickness.

The southern part of the site is located in a reclaimed area (Sta. 134+00 to Sta. 189+00). The composition of the fill material is quite random. In several boring locations, a thin layer of fine to medium sand was found between the fill material and the underlying dark grey shale bedrock.

The stratigraphical sequence encountered in the borings is plotted on the Record of Borelog sheets. Stratigraphical sections have been inferred from this data and plotted on Drawing No. 72-11101 B, C and D. The subsoil and bedrock encountered from ground surface downward, is presented in the subsections to follow.

#### 4.2) Fill Material:

##### 4.2.1) Reclaimed Area (Sta. 134+00 to Sta. 189+00):

Fill was placed to reclaim the southern portion of this site from Lake Ontario. The extent of this reclaimed area is illustrated on Drawing No. 72-11101 A. At these locations, between 10 and 22 feet of fill material was encountered. The composition of this fill is found to be quite variable, ranging from clayey silt with some sand and gravel at some locations to sand and gravel at others. Random pockets and/or layers of organic matter, wood chips, concrete and brick fragments are present throughout the fill.

Standard Penetration testing, carried out in the fill material, gave 'N' values ranging from 1 to 83 blows per foot. The higher values were encountered in the upper 3 to 4 feet, with the lower values being dominant. Based on these results, it is estimated that the fill has been well compacted in the upper zone, and negligible to no compactive effort has been provided in the lower portion of the fill. This lower zone, however, is below the groundwater level recorded during the period of the investigation. It is difficult to compact material placed below water; this would explain the reason for the variability of the compactive effort with depth.

In addition, results of grain-size distribution testing and Atterberg limit tests, performed on sample recovered in this stratum were plotted on the Record of Borehole sheets, as

well as on respectively Figure 1 and Figure 3 of Appendix II. They are also tabulated below:

		<u>Range</u>	<u>(Average)</u>
Liquid Limit	(W <sub>L</sub> ) %	16 - 32	(26)
Plastic Limit	(W <sub>p</sub> ) %	12 - 20	(15)
Natural Moisture Content	(W) %	11 - 23	(18)

Referring to the above table, it can be seen that the cohesive portion of the fill material has a plasticity in the low range.

4.2.2) North of Reclaimed Area (Refer to B.H.'s 19-50 Inclusive & B.H.'s 60-66 Inclusive):

A layer of fill material up to 11 feet thick was encountered in most of the boreholes put down in this area. In general, the fill material is composed of a mixture of clayey silt with some sand and gravel, which is similar in composition to the underlying cohesive glacial till. At certain locations where the borings penetrated through existing pavement, a layer of sand and gravel was found overlying the cohesive fill material mentioned above. Grain-size distribution curves and Atterberg limit testing results, for the samples of this stratum, are presented on Figures #1 and #3 of Appendix II, respectively.

Standard penetration testing was carried out within this stratum and the results were plotted on the individual Record of Borehole sheets. The 'N' values generally vary from 7 blows/ft. to 30 blows/ft. with exceptionally high values where gravel and/or cobbles exist. Based on these 'N' values, it is estimated that the consistency of the fill material varies from firm to very stiff.

4.3) Granular Deposits:

In the reclaimed area, between Sta. 173+00 to Sta. 182+00, a thin layer of fine to medium sand or sandy silt with trace of gravel was found overlying the shale bedrock. The thickness of this layer is between 2 and 5 feet. It is believed that this

granular stratum was deposited by Lake Iroquois. Standard Penetration testing carried out in this stratum gave 'N' values ranging from 3 blows/foot to 14 blows/foot. It is, therefore, estimated that the relative density of the granular stratum is very loose to compact.

At the north-west corner of the site (between Sta. 111+00 and Sta. 117+00), a layer of silty sand with gravel, between 4 and 6 feet thick, was found underlying the fill material. Standard Penetration testing was carried out in this stratum. The 'N' values vary between 32 blows/ft. and over 100 blows/ft. It is estimated that the relative density of this granular layer is compact to very dense.

4.4) Heterogeneous Mixture of Clayey Silt, Some Sand and Trace of Gravel (Glacial Till):

This stratum was encountered in all but those boreholes located within the reclaimed area. It consists of a heterogeneous mixture of clayey silt with some sand and trace of gravel. The thickness of this stratum varies between 10.5 feet and 24.5 feet. Occasional silty sand layers, up to 4 feet in thickness, were encountered within this stratum. In general, the upper 3 to 9 ft. of this stratum is brown in color whereas the lower portion is grey. However, the engineering properties of the soil in these two zones, are similar.

Grain-size distribution curves and results of Atterberg Limit tests for the samples of this stratum, are plotted on Fig. 2 and Fig. 4, respectively, of Appendix II. It is seen from Fig. 4 that the tests results plot in the CL region of the Plasticity Chart (except for four results) indicating in general, a low plasticity. The engineering properties of the cohesive glacial till deposit are tabulated below:

<u>Identity Tests</u>			<u>Range</u>	<u>(Average)</u>
Bulk Density	( $\gamma$ )	p.c.f.	134 - 136.5	(135)
Liquid Limit	( $W_L$ )	%	20 - 41	(28)
Plastic Limit	( $W_p$ )	%	10 - 20	(16)
Natural Moisture Content	(W)	%	8 - 23	(15)



Field vane tests were carried out in the cohesive glacial till deposit wherever possible. The results are plotted on the Record of Borehole sheets. In general, the in situ undrained shear strength is higher than 2,000 p.s.f. Relatively 'undisturbed' samples were obtained by hydraulically pushing 2" I.D. Shelby tubes into the subsoil, where the field vane tests or Standard Penetration tests indicate the existence of softer layers. Three laboratory unconfined compressive strength tests were carried out. The results are tabulated below:

	<u>Range</u>	<u>(Average)</u>
Field Vane Tests (p.s.f.)	1,700 - >2,000	( > 2,000)
Laboratory Tests (p.s.f.)	630 - 1,120	(900)

Based on these results, it is estimated that the consistency of this deposit ranges from stiff to hard.

#### 4.5) Bedrock:

Bedrock was found underlying the overburden. The bedrock was proven in 29 of the boring locations by obtaining 5 to 20 feet of BX or BXL size rock cores.

The bedrock samples were carefully examined by Mr. K. W. Ingham, Geologist, Ministry of Transportation and Communications. The description of the bedrock and an interpretation of geologic conditions existing at this site, are contained in a memorandum from Mr. Ingham to this Office. A copy of this memorandum is enclosed in Appendix III of this report.

The bedrock intersected in each hole was found to be typical of the Dundas Formation, which is the characteristic bedrock found in subcrop within the Toronto area. The rock is predominantly a platy bedded dark grey shale with interbeds of silty limestone and/or limestone ranging in thickness from 1/2 inch to 6 inches. The latter constitute only 20 percent or less of the formation, but in certain places may form as much as 30 to 40 percent of the section.

The bedrock surface was found to vary between elevations 232 and 260 ft. In general, the surface increases in elevation in a north-westerly direction.

A thin transition zone was encountered between the overburden and the bedrock. The shale bedrock in the upper portion is weathered and moderately to badly fragmented. The harder bands of silty limestone and limestone are generally moderately fragmented within this zone, which is rarely more than 2 to 4 ft. in thickness. At some locations there is a partially weathered zone overlying the sound bedrock in which incipient weathering is present along certain layers; however, for foundation purposes this is considered to be sound bedrock.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during and after the period of the investigation by recording the water level in the open borings. In addition, nine piezometers of 'TerraTest Type' were installed within either the cohesive glacial till or the shale bedrock. The tip elevations of the various piezometers were shown on individual Record of Borehole sheets, contained in Appendix I of this report. Piezometric water level readings were taken periodically. The observations are recorded on the Borelogs as well as summarized on Drawings 72-11101 B, C and D. At certain locations where it is necessary to backfill the borehole immediately after the completion of the drilling operations, groundwater level was not established.

The results of the measurements indicate that the groundwater level, varies from 2 to 23 feet below existing ground surface, which corresponds to elevation between 246 and 281 ft. Over the reclaimed area, however, the groundwater level ranges from elevations 246 to 248. It is believed that the groundwater level in the reclaimed area is affected by the lake level, which is at elevation 246 during the period of the field investigation.

6. DISCUSSION:

6.1) General:

At present, studies are in progress to evaluate new intermediate capacity transit systems with the objective of

selecting the most promising system for a pilot scale testing program on Canadian National Exhibition grounds in Metropolitan Toronto, Province of Ontario, during 1973-74 by the Provincial Ministry of Transportation and Communications. In order to obtain sufficient data for the design and cost estimate for the system, a preliminary foundation investigation consisting of 66 borings was carried out. These borings revealed that the subsoil consists of random fill material at the southern portion of the site and cohesive glacial till elsewhere. The overburden is underlain by dark grey shale bedrock of Dundas formation.

At this stage, the details of the system including the specific foundation locations have not been finalized. Preliminary profile (unnumbered) indicates that the system will be an elevated one except in one of the four proposed station locations. The present information indicates that the elevated system will be operating in a counter-clockwise direction, incorporating four stations at appropriate locations inside the C.N.E. grounds or Ontario Place.

#### 6.2) Foundation Considerations:

As discussed previously, subsoil and bedrock conditions are quite variable within the area under investigation. In the southern portion (Sta. 134+00 to Sta. 189+00), the predominant deposit consists of fill material utilized for reclaiming land from Lake Ontario, underlain by shale bedrock at a depth of 10 feet to 23 feet. At certain locations, bedrock is overlain by a thin layer of post-glacial granular deposit. In the northern portion (Sta. 100+00 to Sta. 134+00, and Sta. 189+00 to Sta. 217+90) the predominant deposit is a heterogeneous mixture of clayey silt, some sand and trace of gravel (glacial till) underlain by shale bedrock at a depth of 15 feet to 32 feet.

From a foundation point of view, it will be advantageous, especially in the southern reclaimed area, to select a scheme which can be anchored into the sound shale bedrock. A concise review of available literatures was carried out to obtain preliminary design criteria, for caissons socketed into shale bedrock. Since the overburden at this portion of the site is

incompetent and the system may be subjected to uplift loads, it is recommended that the proposed system elements be supported on caissons socketed from 4 feet to 6 feet into sound shale bedrock. It is estimated that a 30" diameter concrete caisson may be designed for a safe allowable load of 250 tons. In computing the uplift resistance, an allowable adhesion of 7.5 t.s.f. may be used between the concrete socket and the sound shale bedrock. It is suggested that the adhesion between the concrete and the weathered shale as well as the overburden material be neglected for preliminary computations. Most of the available design methods are mainly empirical with little or no relationship to the in situ quality of rock. In order to evaluate precisely the bearing capacity as well as the socket skin friction of caissons, it will be necessary to carry out full scale load and uplift tests when design details become available.

In order to minimize dewatering problems, caissons should be installed with a temporary liner. It should be noted that the shale bedrock is generally fractured and groundwater may readily percolate into the liner from the base of the caisson. In such a case, a tremie concrete seal will be necessary at the base of the caisson.

In the northern portion (Sta. 100+00 to Sta. 134+00 and Sta. 189+00 to Sta. 217+90), the overburden is generally competent. As a result of this, the foundation of the proposed system may be founded on spread footings, within the hard cohesive glacial till stratum using an allowable bearing capacity up to 5 tons per square foot. A minimum earth cover of 4 feet should be provided to the underside of the footings for frost protection purposes. The appropriate founding elevation at various locations are summarized in the following table.

<u>Location</u>	<u>Refer to</u>	<u>Founding Elevation</u>
Sta. 100+00 to Sta. 103+00	B.H.'s #32 - 33	265
Sta. 103+00 to Sta. 109+00	B.H.'s #34 - 36	272
Sta. 109+00 to Sta. 122+50	B.H.'s #37 - 44	278
Sta. 122+50 to Sta. 127+00	B.H.'s #45 - 46	270
Sta. 127+00 to Sta. 129+00	B.H. #47	265
Sta. 129+00 to Sta. 134+00	B.H.'s #48 - 50	260

<u>Location</u>	<u>Refer to</u>	<u>Founding Elevation</u>
Sta. 189+00 to Sta. 193+50	B.H.'s #19 - 20	258
Sta. 193+50 to Sta. 198+00	B.H.'s #21 - 23	262
Sta. 198+00 to Sta. 207+00	B.H.'s #24 - 27	265
Sta. 207+00 to Sta. 217+90	B.H.'s #28 - 31	268

As mentioned previously, this system may be subjected to uplift loads. In order to provide adequate uplift resistance it is necessary to anchor the footing to a sufficient depth into the underlying hard glacial till stratum or shale bedrock, if necessary. A number of uplift tests have been carried out by Ontario Hydro-electric Power Commission (J. I. Adams and T. W. Klym, 1971). After reviewing these results, we suggest that the footing should be grout-anchored into the hard glacial till stratum for a minimum depth of 15 feet. For example, a 5 inch diameter anchor rod installed as mentioned above may be subjected to a safe uplift load of 25 tons.

Excavations for the spread footing type of foundation will extend either through the fill material at certain locations or surficial granular deposits elsewhere, into the underlying cohesive glacial till deposit. In majority of the cases, the observed groundwater level is above the founding elevation of the spread footing. Care should be exercised to prevent any inflow of water into the excavations from the upper surficial granular layers.

Alternatively, this portion of the system can also be supported on concrete caissons socketed into the sound shale bedrock. The design considerations will be similar to those discussed elsewhere in this report.

It should be stressed that the comments given in this report are of a preliminary nature. A complete foundation investigation together with full scale field load and uplift tests will be required, once the system has been finalized and the design details become available.

7. MISCELLANEOUS:

The field work was carried out between September 5 and September 14, 1972, under the supervision of Mr. C. S. Poon, Project Foundations Engineer. He was assisted by Messrs. E. C. Ballinger, J. Cortabarría, V. Katic and G. Aubertin, Field Technicians.

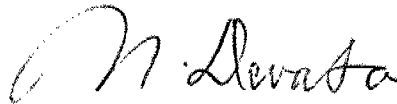
The equipment used was owned and operated by Dominion Soil Investigation Ltd. and Master Soils Investigation Ltd., Toronto.

This report was prepared by Mr. C. S. Poon, Project Foundations Engineer.

This project was under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.



C. S. Poon, P. Eng.



M. Devata, P. Eng.



CSP/ao

Sept. 25, 1972.

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APPENDIX I



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 1

JOB 72-11-101

LOCATION Co-ord 15,852,150 N; 2,058,750 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY 90

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXL Rockcore and Cone Test

CHECKED BY *SR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20 40 60 80 100	PLASTIC LIMIT — WP	WATER CONTENT — W		
						SHEAR STRENGTH P.S.F.		Wp — W — WL		WATER CONTENT %		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				10 20 30		P.C.F. GR. S.A. SI. CL.
250.4	Ground Level											
0.0	Fill Material					250						248.2
	Clayey silt with some sand and gravel, occasional brick pieces.		1	SS	15	245						
			2	SS	6	240						
			3	SS	5							
	Grey		4	SS	4							
236.4	Soft to Firm											
14.0	Fine to medium sand.											
235.1	Compact Black		5	SS	100 ft	235						
15.3	Shale Bedrock											
232.4	Dark Grey Weathered											
18.0	Shale with frequent layers of siltstone and limestone.		6	BXL RC	86% Rec.	230						
227.4	Dark Grey Sound											
23.0	End of Borehole					225						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 2

JOB 72-11101

LOCATION Co-ords. 15,852,048 N; 2,058,750.E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 14, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $W_L$		BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	PLASTIC LIMIT $W_P$		
248.5	Ground Level													
0.0	Fill Material													
	Clayey silt, sand, gravel, cinders and pieces of wood.		1	SS	13	245								
	Firm Grey		2	SS	6	240								
-233.8	Transition Zone		3	SS	60/2"	235								
14.7	End of Borehole Probable Bedrock					230								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 3

JOB 72-11101

LOCATION Co-ords. 852,135 N; 59,119 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 14, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Washboring &amp; BXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$ WATER CONTENT %				BULK DENSITY $\gamma$ P.C.F. GR. SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
248.3	Ground Level															
0.0	Fill Material					245									246.7	
	Sand with gravel and concrete fragments		1	SS	83											
239.3						240										
9.0	Clayey silt with trace of sand & gravel, pieces of decayed wood	2	SS	2												
	Grey-Brown Soft				235											
232.3	Transition Zone		3	SS	97/9"											
16.0	Shale Bedrock with occasional bands of limestone and siltstone, partially weathered throughout		4	BXL RC	98%	230										
	Dark Grey		5	BXL RC	70%	225										
224.1																
24.2	End of Borehole					220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 4

JOB 72-11101

LOCATION Co-ords. 852,248 N; 59,278 E.

ORIGINATED BY EB

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *SK*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
251.4	Ground Level														
0.0	Fill Material					250									
	Sand, trace of gravel, silt, brick, pieces of cinders.		1	SS	25										246.9
			2	SS	8	245									
242.4	Loose to Compact														
9.0	Clayey silt with trace of sand, gravel		3	SS	4	240									
237.9	brick pieces. Soft to Firm		4	SS	5										2 15 59 24
13.5	Brown-Grey Loose to Compact		5	SS	27	235									
232.8	Transition Zone		6	SS	100.7"										
18.6	End of Borehole Probable Shale Bedrock					230									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 5

JOB 72-11101

LOCATION Co-ords. 852,322 N; 59,467 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and BX Rock Core

CHECKED BY AR

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 100 800 1200 1600 2000			$W_p$ $W$ $W_L$ WATER CONTENT % 10 20 30				
250.9	Ground Level													
0.0	Fill Material					250								
	Clayey silt with trace of sand and gravel, and cinders.		1	SS	11									
244.9	Grey Stiff to Very Stiff		2	SS	17	245								245.9
6.0	Sandy silt to silty sand, with trace of clay and cinders		3	SS	10									
			4	SS	6									
			5	SS	8									
			6	SS	6	240								
237.9	Loose Transition Zone		7	SS	50/6"									
13.0	Shale Bedrock with occasional bands of limestone and siltstone, partially weathered layers throughout.		8	BX RC	25%	235								
	Dark Grey		9	BX RC	45%	230								
227.9														
23.0	End of Borehole					225								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 6

JOB 72-11101

LOCATION Co-ords. 852,363.N; 59,659 E.

ORIGINATED BY EB

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *SR*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000			WATER CONTENT % 10 20 30		
250.5	Ground Level											
0.0	Fill Material					250						
	Sand and Gravel											
247.5												
3.0	Clayey silt with some sand, gravel, brick pieces and cinders.		1	SS	7	245						
			2	SS	7							
			3	SS	9							
			4	SS	8	240						
			5	SS	7							
236.2	Firm to Stiff											
236.0	Weathered Shale		6	SS	79/9"							
14.5	End of Borehole					235						

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 7

JOB 72-11101

LOCATION Co-ords. 852,400 N; 59,821 E.

ORIGINATED BY EB

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 10 20 30				
250.5	Ground Level															
0.0	Fill Material					250									248.5	
	Clayey silt with some sand and gravel, occasional sand layers.		1	SS	12											
			2	SS	4	245										
			3	SS	4	240										
	Grey Firm		4	SS	6											
235.0			5	SS	100	235									35 42 17 6	
15.5	Weathered Shale															
233.4	Dark Grey		6	SS	50											
17.1	End of Borehole					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 8

JOB 72-11101

LOCATION Co-ords. 852,473 N; 60,057 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Power Auger; Cone Test

CHECKED BY SK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100					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	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 100 800 1200 1600 2000					WATER CONTENT % 10 20 30				
258.4	Ground Level														
0.0	Fill Material														
	Clayey silt with some sand and gravel & brick pieces		1	SS	30										
	changing to sandy silt with depth		2	SS	36										
			3	SS	39										
	Brown Hard or Dense		4	SS	52										
244.9	Clayey silt with some sand, gravel and cinders		5	SS	10										
13.5			6	SS	11										
	Grey-Brown Stiff														
235.9	Weathered Shale Dark Grey		7	SS	100										
234.9	End of Borehole														
23.5															

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 9

JOB 72-11101

LOCATION Co-ords. 852,518 N; 60,266 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core, Cone Test

CHECKED BY *[Signature]*

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	$W_P$	$W$	$W_L$		
252.0	Ground Level															
0.0	Fill Material															
	Clayey silt with trace of sand and gravel, occasional layers of sand and gravel.		1	SS	16	250										
244.5	Grey Stiff		2	SS	15	245										
7.5	Sandy silt to silty sand with occasional clayey silt layers		3	SS	7											
	organic matter throughout		4	SS	6	240										
235.9	Brown Loose Transition Zone		5	SS	111.7"											
16.1	Shale Bedrock with limestone bands.		6	BXL R.C.	38%	235										
	Weathered Dark Grey		7	BXL R.C.	6%	230										
228.0	Shale with bands of limestone and silt-stone.		8	BXL R.C.	100%	225										
24.0	Dark Grey		9	BXL R.C.	100%	220										
218.0	Sound															
34.0	End of Borehole					215										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>10

JOB 72-11101

LOCATION Co-ords. 852,554 N; 60,432 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger; Cone Test

CHECKED BY *SR*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT					PLASTIC LIMIT — $w_p$				
						20	40	60	80	100	WATER CONTENT — $w$				
						SHEAR STRENGTH P.S.F.					WATER CONTENT %				
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					$w_p$ — $w$ — $w_L$			$\gamma$	
						400 800 1200 1600 2000					10 20 30			P.C.F.	GR. SA. SI. CL.
252.6	Ground Level														
0.0	Fill Material														
	Clayey silt with trace of sand and gravel organics.		1	SS	16										
			2	SS	6										
242.1	Grey Firm		3	SS	7										
10.5	Sandy silt to silty sand with organics.		4	SS	2										
			5	SS	2										
	Grey Very Loose														
233.5	Transition Zone		6	SS	70/8"										
19.1	End of Borehole Probable Shale Bedrock														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 11

JOB 72-11101

LOCATION Co-ords. 852,615 N; 60,627 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, AXT Rock Core &amp; Cone Test

CHECKED BY *FLK*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT $W_L$		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT 20 40 60 80 100	PLASTIC LIMIT $W_P$	WATER CONTENT $W$		
252.3	Ground Level										
0.0	Fill Material Clayey silt with trace of sand and gravel, organics		1	SS	14						
	Grey-Brown		2	SS	7						
243.3	Firm		3	SS	13						
9.0	Sandy silt to silty sand with trace of gravel, clay and organics.		4	SS	1						
	Grey		5	SS	3						
234.3	Very Loose to Loose		6	SS	65/4"						
18.0	Bedrock Dark grey shale with occasional bands of limestone, partially weathered layers throughout		7	AXT R.C.	50%						
			8	AXT R.C.	34%						
225.3											
27.0	End of Borehole										

## RECORD OF BOREHOLE N°12

JOB 72-11101

LOCATION Co-ords. 852,718 N; 60,809 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and Cone Test

CHECKED BY                     

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

15  $\phi$  5 % STRAIN AT FAILURE

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE N°13

JOB 72-11101

LOCATION Co-ords. 852,836 N; 60,959 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY 50

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, AXT Rock Core &amp; Cone Test

CHECKED BY *[Signature]*

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	$W_P$	$W$	$W_L$		
251.8	Ground Level															
0.0	Fill Material					250										
	Clayey silt with trace of sand gravel and organics		1	SS	22											
			2	SS	2	245										
	Very Stiff to Very Soft		3	SS	2											
	Grey-Brown		4	SS	5	240										
238.3	Sand with some silt, trace of gravel		5	SS	9											
13.5	Loose					235										
233.3	Transition-Zone		6	SS	100											
18.5	Bedrock		7	AXT R.C.	21%	230										
227.8	Weathered															
24.0	Sound		8	AXT R.C.	95%	225										
222.8	Shale with occasional bands of limestone and siltstone.															
222.8	Dark Grey															
29.0	End of Borehole					220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 14

JOB 72-11101

LOCATION Co-ords. 852,987 N; 61,093 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Power Auger and Cone Test

CHECKED BY *SK*

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 <sub>p</sub>	W	W <sub>L</sub>		
252.3	Ground Level															
0.0	Fill Material															
	Clayey silt with trace of sand and gravel, brick pieces and glass		1	SS	18											
			2	SS	15											
	Brown to Grey		3	SS	9											
	Firm to Very Stiff		4	SS	17											
239.3	Clayey silt with trace of sand and gravel (Glacial Till)															
13.0	Grey. Very Stiff															
236.3	Bedrock Shale		5	SS	100/6"											
16.0	Dark Grey Weathered															
232.3	End of Borehole															
20.0																

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 15

JOB 72-11101

LOCATION Co-ords. 853, 160 N, 61, 199 E

ORIGINATED BY G.A.

W.P. 97-72-01

BORING DATE 5 &amp; 6 Sept., 1972

COMPILED BY S.O.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core &  
Dynamic Cone TestCHECKED BY *SL*

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		SHEAR STRENGTH P.S.F.		$w_p$ — $w$ — $w_L$			
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT %				
						400 800 1200 1600 2000	10 20 30					
252.2	Ground Level											GR. SA. SI. CL
0.0	Fill Material - sandy silt with some gravel & Brick pieces					250						
	compact to brown dense		1	SS	32							
246.2												246.1
6.0	Organic clay, organic silt, brick pieces, sand and gravel		2	SS	9	245						
			3	SS	8							
239.7	Grey Firm					240						22-56-21-1
12.5	Silty sand with some gravel compact		4	SS	14							
237.2	Black weathered		5	SS	100	3"						
15.0												
15.5	Bedrock - shale		6	BXL R.C.	78%	235						
231.7	Dark grey sound											
20.5	End of Borehole					230						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>16

JOB 72-11101

LOCATION Co-ords. 853,280 N; 61,257 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Power Auger &amp; Cone Test

CHECKED BY *[Signature]*

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	$W_P$	$W$	$W_L$	
252.5	Ground Level														
0.0	Fill Material														
248.5	Clayey silt with trace of sand and gravel. Very Stiff		1	SS	19	250									
4.0	Sand with trace of silt		2	SS	11	245									
	Grey-Brown		3	SS	12										
239.5	Compact					240									
13.0	Gravelly sand		4	SS	74										
237.5	Brown Very Dense														
15.0	Bedrock Shale														
234.3	Dark Grey Weathered		5	SS	120	235									
18.2	End of Borehole					230									



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>17

JOB 72-11101

LOCATION Co-ords. 853,691 N; 61,325 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Goodetic

BOREHOLE TYPE Hollow Stem Auger, BX Rock Core &amp; C one Test

CHECKED BY JRC

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	$W_P$	$W$	$W_L$		
258.3	Ground Level															
0.0	Fill Material															
	Sand with some gravel and trace of organics		1	SS	46	255										28 53 (19)
	Grey		2	SS	100.6"											
218.8	Dense to Very Dense		3	SS	6	250										Hole Caved
9.5																247.5
	Organic silt, sand, metal pieces and coal		4	SS	15	245										WL assumed
	Dark Grey to Black		5	SS	3											Org. 2.5%
	Very Loose to Compact															Org. 13.8%
232.8			6	SS	77.1"	240										
18.5	Bedrock															
236.3	Weathered		7	BX R.C.	50%											
22.0	Shale with thin bands of limestone and siltstone					235										
	Dark Grey		8	BX R.C.	97%											
229.3	Sound					230										
29.0	End of Borehole					225										



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 19

JOB 72-11101

LOCATION Co-ords. 854,158 N; 61, 182 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY SO

DATUM Geodetic

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

CHECKED BY *SR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— $w_L$			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT ——— $w_p$						
							20	40	60	80	100	WATER CONTENT ——— $w$				
												$w_p$			$w$	$w_L$
SHEAR STRENGTH P.S.F.							WATER CONTENT %			P.C.F.						
○ UNCONFINED + FIELD VANE							10 20 30									
● QUICK TRIAXIAL × LAB VANE																
400 800 1200 1600 2000																
265.1	Ground Level					265										
0.0	Fill Material													260.9		
	Clayey silt to silty sand.															
260.1	Stiff		1	SS	16	260										
5.0			2	SS	30											
			3	SS	30	255								3 25 41 31		
253.1			4	SS	21											
12.0	Brown Grey		5	SS	15	250										
	Heterogeneous mixture of clayey silt with some sand & gravel (Glacial Till)		6	TW	PH											
	Firm to Stiff		7	TW	PH	245										
241.1			8	SS	50/60"	240										
24.0	Weathered															
25.0	Bedrock - Shale		9	BXL RC	100% Rec											
	occasional bands of siltstone and limestone.															
235.1	Dark Grey Sound					235										
30.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>20

JOB 72-11101

LOCATION Co-ords. 85<sup>4</sup>,398 N; 61,073 E.ORIGINATED BY EB

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXL Rock Cone &amp; Cone Test

CHECKED BY [Signature]

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	$W_P$	$W$	$W_L$		
268.9	Ground Level															
0.0	Fill Material															
	Clayey silt with some sand and gravel, trace of organics.		1	SS	22	265										
	Brown-Grey		2	SS	25											
258.4	Stiff		3	SS	23	260										
10.5	Heterogeneous mixture of clayey silt, some sand and trace of gravel. (Glacial Till)		4	SS	11	255										
			5	SS	9											
			6	SS	13	250										
			7	SS	16											
	Grey		8	SS	11	245										
	Stiff		9	SS	100	240										
240.9	Bedrock		10	SS	150	235										
238.9	Weathered		11	BXL R.C.	95%	230										
30.0	Shale with occasional thin bands of siltstone and limestone		12	BXL R.C.	95%											
	Dark Grey															
228.9	Sound															
40.0	End of Borehole					225										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 21

JOB 72-11101

LOCATION Co-ords. 854,503 N; 61,008 E.

ORIGINATED BY \_\_\_\_\_

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *MR.*

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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 10 20 30				
271.8	Ground Level															
0.0	Fill Material															
	Sand with silt, trace of organics.		1	SS	7	270										
265.8	Brown loose		2	SS	8	265									266.6	
6.0	Heterogeneous Mixture of clayey silt, some sand, trace of gravel (Glacial Till)		3	SS	25											
			4	SS	18	260										
258.3	Brown		5	SS	16											
13.5	Grey		6	TW	PH	255										
	stiff to very stiff		7	TW	PH	250										
	with weathered shale fragments below el. 245.		8	TW	PH											
			9	SS	48	245										
240.8	Weathered Shale Bedrock		10	SS	124	10"										
240.5			11	SS	100											
31.5	End of Borehole					240										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 22

JOB 72-11101

LOCATION Co-ords. 854,653 N; 60,847 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY SD

DATUM Geodetic

BOREHOLE TYPE Power Auger and Cone Test

CHECKED BY *SK*

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	$W_P$	$W$	$W_L$		
273.1	Ground Level															
0.0	Fill Material															
	Clayey silt with some sand and gravel, cinders.		1	SS	17	270										
			2	SS	36											
	Brown					265										
262.6	Stiff to Hard		3	SS	34											
10.5	Heterogeneous mixture of clayey silt with some sand and gravel		4	SS	58	260										
	(Glacial Till)		5	SS	12											
			6	SS	13	255										
			7	SS	14											
			8	SS	57	250										
	Grey															
245.1	Stiff to Hard					245										
28.0	Shale Bedrock layers of clayey silt.		9	SS	156											
240.6	Dark Grey. Weathered		10	SS	100.2"											
32.5	End of Borehole					240										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup> 23

JOB 72-11101

LOCATION Co-ords. 854,772 N; 60, 680 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

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

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	$W_P$	$W$	$W_L$	
274.3	Ground Level														
0.0	Fill Material														
	Sand		1	SS	2/18"	270									
267.3	Brown Very Loose		2 <sup>A</sup> 2 <sup>B</sup>	SS	1/16"										
7.0	Heterogeneous mixture of clayey silt, with trace of sand and gravel		3	SS	19	265									
	(Glacial Till)		4	SS	43										
			5	SS	21	260									
			6	SS	14	255									
	shale fragments below el. 250.		7	SS	12										
			8	SS	60	250									
	cobbles up to 5"		9	BXL RC	Rec 38%	245									
	Stiff to Hard														
	Grey		10	SS	39										
242.8	Transition Zone														
31.5	Shale Bedrock with minor bands of limestone and siltstone.		11	BXL RC	100% Rec.	240									
	Dark Grey														
237.8	Sound														
36.5	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 24

JOB 72-11101

LOCATION Co-ords. 854,782 N; 60,547 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 13, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % 10 20 30				
274.8	Ground Level												
0.0	Fill Material												
272.8	Sand and Gravel												WL not established
2.0	Clayey silt with some sand and gravel.												
269.8	Brown Hard		1	SS	34	270							
5.0	Heterogeneous mixture of clayey silt, trace of sand and gravel (Glacial Till)												
	Hard		2	SS	144	265							
262.8	Brown												
12.0	Grey												
	with shale fragments below El. 254.		3	SS	30	260							
	Stiff to Very Hard		4	SS	9	255							
252.8	End of Borehole												
22.0	Probable Shale Bedrock					250							

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 25

JOB 72-11101

LOCATION Co-ords. 854,784 N; 60,239 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Rock Core

CHECKED BY

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	ELEV. SCALE	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % $W_P$ $W$ $W_L$ 10 20 30			
274.4	Ground Level												
0.0	Fill Material												
269.9	Sand and gravel to clayey silt, trace of organics. Brown Loose or Stiff.		1	SS	9	270							269.4
4.5	Heterogeneous mixture of clayey silt with some sand and gravel (Glacial Till)		2	SS	12								
	Stiff to Hard		3	SS	32	265							
260.9	----- Brown Grey		4	SS	22	260							11 20 36 3
13.5			5	SS	14								
	with shale fragments below el. 253.		6	SS	8	255							
	Firm to Hard		7	SS	100/5"								
250.4			8	SS	50/2"	250							
24.0	Bedrock		9	BX RC	60% Rec.								
	Shale with bands of limestone and silt-stone.		10	BX RC	18% Rec.	245							
	Dark Grey												
241.4	Weathered												
33.0	Sound		11	BX Rc	98% Rec.	240							
236.4													
38.0	End of Borehole					235							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 26

JOB 72-11101

LOCATION On-ords. 854,697 N; 59,961 E.

ORIGINATED BY VK

W.P. 97-72-01



BORING DATE Sept. 7, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Power Auger

CHECKED BY *JK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
273.8	Ground Level													
0.0	Fill Material					270       265       260       255       250								268.5
269.3	Crushed stone and cinders to clayey silt.		1	SS	10									
4.5	Loose or Stiff													
	Heterogeneous mixture of clayey silt with trace of sand and gravel		2	SS	18									
	(Glacial Till)		3	SS	30									
261.8	Brown													
12.0	Grey		4	SS	37									
		5	SS	18										
	with shale fragments below El. 255.	6	SS	108.9"										
	Very Stiff to Hard													
250.3			7	SS	100.0"									
23.5	End of Borehole Probable shale bedrock													

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE No 27

JOB 72-11101

LOCATION Co-ords. 854,622 N; 59,776 E.

ORIGINATED BY JO

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000				WATER CONTENT % $W_p$ — $W$ — $W_L$ 10 20 30				
274.0	Ground Level														
0.0	Fill Material Sand and gravel														
271.0															
3.0	Heterogeneous mixture of clayey silt with trace of sand & gravel. (Glacial Till)		1	SS	19	270									269.1
			2	SS	20										
			3	SS	21	265									
262.0	Brown		4	SS	17										
12.0	Grey		5	SS	9	260									15 28 32 25
			6	SS	36	255									
	with shale fragments below el. 255.		7	SS	100/13"										
			8	SS	100/2"	250									
	Stiff to Hard		9	SS	100/1 1/2"										
246.0															
28.0	Bedrock		10	FX RC	Rec. 50%	245									
240.5	Partially weathered														
33.5	Shale with occasional bands of limestone & siltstone		11	FX RC	Rec. 60%	240									
235.5	Dark Grey Sound														
38.5	End of Borehole					235									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 28

JOB 72-11101

LOCATION Co-ords. 851,549 N; 59,520 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Power Auger

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			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.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
274.9	Ground Level													
0.0	Fill Material Silty sand with gravel and cinders.													
270.4	Dark Brown Compact		1	SS	19									
4.5	Heterogeneous mixture of clayey silt with trace of sand and gravel  (Glacial Till)		2	SS	28	270								
			3	SS	27	265								
			4	SS	34									
259.9	Brown					260								
15.0	Grey		5	SS	27									
			6	SS	18	255								
	with shale fragments below el. 255 Cobbles		7	SS	100/30"									
249.7	Very Stiff to Hard					250								
25.2	End of Borehole Probable shale bedrock					245								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 29

JOB 72-11101

LOCATION Co-ords. 854,472 N; 59,408 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 8, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$ $w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
275.6	Ground Level													
0.0	Fill Material					275								
	Clayey silt with trace of sand and gravel.													
270.6	Brown Stiff		1	SS	12									
5.0			2	SS	87	270								
			3	SS	36	265								
264.6	Brown Grey													
11.0	Heterogeneous mixture of clayey silt with some sand and gravel (Glacial Till)		4	SS	16									
			5	SS	15	260								
			6	SS	21									
			7	SS	22	255								
	with shale fragments below el. 253.		8	SS	100.3"	250								
			9	SS	100.3"									
246.6	Stiff to Hard													
29.0	Weathered													
30.0	Bedrock		10	BX RC	70% Rec.	245								
	Shale with bands of limestone & siltstone		11	BX RC	58% Rec.	240								
236.6	Dark Grey Sound													
39.0	End of Borehole					235								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup> 30

JOB 72-11101

LOCATION Co-ords. 854,394 N; 59,218 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 8, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Power Auger

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT $W_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS/FOOT	BLows/foot	PLASTIC LIMIT $W_P$	WATER CONTENT $W$	WATER CONTENT %		
275.5	Ground Level												
0.0	Fill Material Sand and gravel with cinders, brick pieces, changing to clayey silt.		1	SS	18	275							
269.5	Compact or Very Stiff					270							
6.0	Heterogeneous mixture of clayey silt with trace of sand & gravel (Glacial Till)		2	SS	38								
263.5			3	SS	38	265							
12.0	Brown Grey		4	SS	48								
	with shale and lime- stone fragments below El. 259.		5	SS	27	260							
	Very Stiff to Hard					255							
250.5													
25.0	End of Borehole Refusal to augering probable bedrock					250							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 31

JOB 72-11101

LOCATION Co-ords. 854,305 N; 59,041 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 8, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY *SL*

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	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30			
273.9	Ground Level														
0.0	Fill Material Clayey silt														
270.4															
3.5	Heterogeneous mixture of clayey silt with some sand & gravel (Glacial Till)		1	SS	11	270									269.6
			2	SS	26										
			3	SS	27	265									
262.9	Brown														
11.0	Grey		4	SS	10	260									4 26 39 31
			5	SS	32										
	with shale fragments below el. 256.		6	SS	50/0"	255									
	Stiff to Hard														
252.9			7	SS	100 1 1/2"										
21.0	Bedrock														
249.2	weathered					250									
24.0	Shale with bands of limestone and silt- stone		8	BX RC	70% Rec										
244.9	Dark Grey Sound					245									
29.0	End of Borehole														
						240									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 32

JOB 72-11101

LOCATION Co-ords. 854,230 N; 58,847 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 9, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Power Auger

CHECKED BY *HL*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % 10 20 30				
274.7	Ground Level												
0.0	Fill Material												WL not established
	Sand and gravel		1	SS	10	270							
268.7	Loose or Stiff												
6.0	Heterogeneous mixture		2	SS	17								
	of clayey silt, trace												
	of sand and gravel		3	SS	60	265							
	(Glacial Till)												
262.7	Brown												
12.0	Grey		4	SS	22	260							
	with shale fragments												
	below El. 259.		5	SS	160								
256.7	Very Stiff to Hard												
18.0	End of Borehole					255							
	Refusal to augering												
	probable bedrock												



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 33

JOB 72-11101

LOCATION Co-ords. 854,180N. 58, 711 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 9/72

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX, Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT —WL PLASTIC LIMIT —WP 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 x LAB VANE			Wp — W — Wl WATER CONTENT % 10 20 30				
276.2	Ground Level												P.C.F.	GR.SA.SI.CL.
	Fill Material					275								
	Sand and gravel changing to clayey silt													
	Compact or stiff		1	SS	11									
270.2	Brown					270								WL not established
6.0	Heterogeneous Mixture of clayey silt with some sand, trace of gravel (glacial till)		2	SS	40									
			3	SS	44									
265.2	Brown					265								
11.0	Grey													
	(With shale fragments below elev. 259)		4	SS	27									4-25-45-26
			5	SS	82	260								
257.7	Very stiff to hard													
18.5	Bedrock													
256.2	weathered		6	SS	100/3"									
20.0	Shale with frequent siltstone and limestone bands			BX	Rec.	255								
			7	R.C.	94%									
251.2	dark grey sound													
25.0	End of borehole.					250								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 34

JOB 72-11101

LOCATION Co-ords. 854,108 N; 58,529 E.

ORIGINATED BY ECB

W.P. 97-72-01

BORING DATE Sept. 8, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY MR.

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30			
278.4	Ground Level											
0.0	Fill Material					275						WL not established
	Sand and gravel changing to clayey silt.											
	Loose to Firm.		1	SS	6							
272.4	Brown											
6.0	Heterogeneous mixture of clayey silt with some sand and gravel (Glacial Till)		2	SS	49	270						
			3	SS	64							
266.4	Brown											
12.0	Grey		4	SS	32	265						
	with shale fragments below El. 257.		5	SS	65							
						260						
			6	SS	28							
	Very Stiff to Hard		7	SS	123							
256.4												
22.0	End of Borehole Refusal to augering probable bedrock					255						

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>35

JOB 72-11101

LOCATION Co-ords. 854,039 N; 58,356 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 9, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY *ML*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
280.7	Ground Level													
0.0	Fill Material Clayey silt with trace of sand and gravel													
274.7	Brown Stiff		1	SS	9	275								277.3
6.0			2	SS	63									
271.7	Brown Grey		3	SS	36	270								
9.0	Heterogeneous mixture of clayey silt with some sand, trace of gravel (Glacial Till)		4	SS	30									5 30 42 23
			5	SS	51	265								
			6	SS	60	260								
	with shale fragments below El. 257.		7	SS	53									
	Hard		8	SS	100	255								
253.7	Bedrock													
251.7	Weathered													
29.0	Shale with occasional siltstone and limestone bands.		9	EX RC	90%	250								
246.7	Dark Grey Sound													
34.0	End of Borehole					245								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 36

JOB 72-11101

LOCATION Co-ords. 853,971 N; 58,163 E.

ORIGINATED BY GP

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *SLR*

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		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							$\circ$ UNCONFINED + FIELD VANE $\bullet$ QUICK TRIAXIAL x LAB VANE				$w_p$ — $w$ — $w_L$ 10 20 30				
286.3	Ground Level														
0.0	Fill Material					285									
	Sand with some silt and organics		1	SS	6										
			2	SS	5	280									279.1
	Brown														
275.3	Loose to Very Dense		3	SS	97										
11.0	Heterogeneous mixture of clayey silt with some sand and gravel (Glacial Till)		4	SS	95	275									
			5	SS	165	270									
			6	SS	175/10"										
			7	SS	100/1"	265									34 25 27 11
	sandy silt														
	with shale fragments below El. 259.		8	SS	108										
			9	SS	155/9"	260									
257.8	Grey Hard														
28.5	End of Borehole refusal to augering probable bedrock					255									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>37

JOB 72-11101

LOCATION Co-ords. 853,893 N., 58, 007 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 9/72

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BXL Rock Core

CHECKED BY *SK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$ $w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30		BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
288.5	Ground Level											
0.0	Fill Material											
	Sand with some silt		1	SS	8	285						
			2	SS	87							
279.5	Brown Loose to very dense					280						
9.0			3	SS	40							
	Silty Sand		4	SS	60	275						
			5	SS	63							
	Silty sand to sandy silt		6	SS	108	270						
	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		7	SS	108/7"							
			8	SS	140	265						
	Hard					260						
	Grey		9	SS	105							
256.5												
32.0	Bedrock					255						
255.0	Weathered											
33.5	Shale with frequent siltstone bands, minor limestone bands		10	BXL RC	96%							
250.0	Dark Grey sound					250						
38.5	End of borehole											

## RECORD OF BOREHOLE №38

JOB 72-11101

LOCATION Co-ords. 853,825 N; 57,839 E.

ORIGINATED BY VK

W.P. 97-72-91

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM      Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY AK

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>39

JOB 72-11101

LOCATION Co-ords. 853,770.N; 57,702 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY *VR*

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		SHEAR STRENGTH P.S.F.		$W_P$ — $W$ — $W_L$			
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE	WATER CONTENT % 10 20 30			
285.0	Ground Level											
0.0	Fill Material Sand, gravel and cinders chainging to clayey silt Loose or Stiff											
279.0	Brown		1	SS	10	280						
6.0			2	SS	34							
276.0	Brown											
9.0	Grey		3	SS	60	275						
	Heterogeneous mixture of clayey silt with trace of sand and gravel (Glacial Till)		4	SS	80							
			5	SS	122	270						
	with silty sand layers throughout		6	SS	140							
			7	SS	150	265						
	Hard		8	SS	113	260						
258.0												
27.0	Bedrock											
255.0	Weathered		9	SS	100	255						
30.0	Shale with occasional bands of siltstone and limestone		10	RC	100							
250.0	Dark Grey Sound					250						
35.0	End of Borehole					245						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 40

JOB 72-11101

LOCATION Co-ords. 853,678 N; 57,518 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 9, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			$W_P$ — $W$ — $W_L$ WATER CONTENT % 10 20 30				
284.8	Ground Level													GR.SA.SI.CL.
0.0	Fill Material													
	Sand with silt and trace of organics.													
279.8	Brown Compact		1	SS	16	280								
5.0	Silty sand with some gravel.		2	SS	32									5 46 34 15
	Brown-Grey		3	SS	90	275								
273.8	Dense to Very Dense													
11.0	Heterogeneous mixture of clayey silt to silt with some sand and gravel		4	SS	90	270								
	(Glacial Till)		5	SS	82									
			6	SS	75	265								2 20 42 36
			7	SS	76									
			8	SS	180									Hole caved 261.7
	Grey Hard		9	SS	205	260								WL assumed
			10	SS	121.6"									
256.4			11	SS	100.8"									
28.4	End of Borehole Refusal probable bedrock					255								

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 41

JOB 72-11101

LOCATION Co-ords. 853,590 N; 57,370 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 9, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Power Auger &amp; BXL Rock Core

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F.			WATER CONTENT % 10 20 30				
							$\circ$ UNCONFINED $\bullet$ QUICK TRIAXIAL	+ FIELD VANE x LAB VANE		$w_p$ — $w$ — $w_L$				
285.4	Ground Level					285								
0.0	Fill Material Clayey silt with some sand and gravel, and trace of organics.  Brown		1	SS	18	280								
277.9	Soft to Very Stiff		2	SS	4									
7.5	Silty sand with some gravel  Grey		3	SS	160	275								33 36 18 1
271.9	Very Dense		4	SS	60									
13.5	Heterogeneous mixture of clayey silt to silt with some sand and gravel  (Glacial Till)  Grey Hard		5	SS	54	270								
			6	SS	120	265								265.3
			7	SS	101									264.2
			8	SS	169.8"	260								P-6 Piez. Tip elev. 259.4
257.4			9	SS	100.1"									
28.0	Bedrock Shale with frequent bands of siltstone and limestone  Dark Grey		10	BXL R.C.	100%	255								
			11	BXL R.C.	100%	250								P-5 Piez. Tip el. 247.9
247.8	Sound													
37.6	End of Borehole					245								

265.2  
264.2P-6  
Piez.  
Tip elev.  
259.4P-5  
Piez. Tip el.  
247.9

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 42

JOB 72-11101

LOCATION Co-ords. 853,463 N; 57,236 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT $W_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT $W_P$				
							SHEAR STRENGTH P.S.F.				WATER CONTENT $W$				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				$W_P$ $W$ $W_L$				
287.2	Ground Level										WATER CONTENT % 10 20 30				
0.0	Fill Material					285									
	Silty sand with gravel		1	SS	6										
	changing to clayey														
	silt with cinders and														
	brick pieces.														
281.2	Loose or Firm		2	SS	30	280									
6.0															
			3	SS	28										
275.2			4	SS	29	275									
12.0															
	Heterogeneous mixture		5	SS	33										
	of clayey silt with														
	trace of sand and														
	gravel														
	(Glacial Till)		6	SS	53	270									
			7	SS	128										
	with weathered shale		8	SS	88	265									
	fragments below														
	El. 260.														
	Very Stiff to Hard														
256.7			9	SS	115.6"	260									
30.5	End of Borehole					255									
	Probable Bedrock														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 43

JOB 72-11101

LOCATION Co-ords. 853,382 N; 56,980E

ORIGINATED BY G.A.

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY H.S.

DATUM GEODETIC

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

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT $W_L$			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT $W_P$						
							20	40	60	80	100	WATER CONTENT $W$				
												$W_P$			$W$	$W_L$
SHEAR STRENGTH P.S.F.							+ FIELD VANE			WATER CONTENT %						
○ UNCONFINED							x LAB VANE			10 20 30						
287.8	Ground Level															
0.0	Fill Material silty sand with gravel changing to clayey silt					285										
282.8	Compact or V.Stiff Brown		1	SS	19											
5.0	Silty sand with gravel		2	SS	133	280										
	Brown to Grey Very Dense		3	SS	114											
275.8	Heterogeneous Mixture of Clayey silt with trace of sand and gravel (glacial till)		4	SS	100/9"	275										
12.0	(with layers of silty sand)		5	SS	100											
			6	SS	111	270										
			7	SS	100	265										
	Grey Hard		8	SS	115											
260.3	Weathered		9	SS	100/5	260										
27.5	Bedrock -															
28.0	Shale with minor limestone bands		10	BXL REC. R.C. 94%												
254.6	dark grey sound					255										
33.2	End of Borehole															

18-72-10

W.L. 279.7

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 44

JOB 72-11101

LOCATION Co-ords. 853,325 N; 56,843 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							$\circ$ UNCONFINED $\bullet$ QUICK TRIAXIAL	$+$ FIELD VANE $\times$ LAB VANE	$W_P$	$W$	$W_L$	10	20		
287.1	Ground Level														
0.0	Fill Material					285									2 2 57 20
	Clayey silt changing to sand.		1	SS	10										
	Compact to Dense														
	Brown		2	SS	51	280									
279.1															
8.0			3	SS	60										
	Heterogeneous mixture of clayey silt with traces of sand and gravel		4	SS	54	275									
	(Glacial Till)		5	SS	47										
			6	SS	34	270									
	with silty sand layers throughout.		7	SS	150										
		8	SS	117											
	Grey Hard	9	SS	79											
259.3		10	SS	173	260										
27.8	End of Borehole														Hole caved ▼ 268.6 WL assumed
	Refusal to augering probable bedrock					255									

2 2 57 20

Hole caved  
268.6  
WL assumed

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 45

JOB 72-11101

LOCATION Co-ords. 853, 198 N, 56, 694 E

ORIGINATED BY C.P.

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Power Auger &amp; BXL Rock Core

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F.			$w_p$ $w$ $w_L$				
							$\circ$ UNCONFINED $\bullet$ QUICK TRIAXIAL	$+$ FIELD VANE $\times$ LAB VANE		WATER CONTENT % 10 20 30				
278.0	Ground Level												P.C.F.	GR. SA. SI. CL.
0.0 276.0	Fill Material - Sand													
2.0	Heterogeneous Mixture of clayey silt to silt with trace of sand and gravel (glacial till)		1	SS	34	275								
			2	SS	41									
			3	SS	79	270								
	sandy silt		4	SS	72									
			5	SS	118/9"	265								
259.5	grey hard		6	SS	80/6"	260								
18.5 257.0	bedrock weathered													
21.0	Shale with frequent siltstone and limestone bands		7	BXL R.C.	86%	255								
			8	BXL RC	75%									
250.8	dark grey sound		9	BXL RC	99%									
27.2	End of borehole					250								

0.43 42.15

265.0

P-7 Piez

Tip elev.

259.0

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 46

JOB 72-11101

LOCATION CO-ORDS. 853, 012N; 56, 613E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY HO

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *ME*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
275.4	Ground Level					275								
0.0	Fill Material - Clayey silt trace of sand and gravel		1	SS	10	270								
269.4	Brown Stiff					270								
6.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	52	265								
			3	SS	44	265								
	Very Stiff to Hard		4	SS	28	260								
260.0	Brown		5	SS	30	260								
15.0	Grey					260								
257.4			6	SS	125	255								
18.0	Weathered Shale Bed-					255								
256.4	Rock					255								
19.0	End of Borehole					255								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 47

JOB 72-11101

LOCATION CO-ORDS 852, 891N; 56, 580E

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY HS

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem Auger BXL Rock Core &amp; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	WP	W	WL		
271.0	Ground Level															
0.0	Fill Material - Clayey silt trace of sand and gravel					270										
266.5	Brown Hard		1	SS	53											
4.5	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	55	265										
261.0	Brown		3	SS	100	3"										
10.0	Grey		4	SS	100	5"										
256.0	Hard		5	SS	100	3"										
15.0	Bedrock					255										
253.0	Weathered															
18.0	Shale with occ. bands of silty limestone and minor limestone seams		6	BXL RC	Rec 88%	250										
247.2	dark grey Sound															
23.8	End of Borehole					245										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 48

JOB 72-11101

LOCATION CO-ORDS. 852, 738N; 56, 600E

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY JC

DATUM GEODETIC

BOREHOLE TYPE Power Auger

CHECKED BY *JK*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % $W_P$ $W$ $W_L$ 10 20 30				
267.4	Ground Level												
0.0	Fill Material - Clayey silt with trace of sand, gravel - & organics					265							
262.9	brown Hard		1	SS	40								
4.5	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	157	260							
			3	SS	72								
	Brown-grey Hard		4	SS	180	255							
	(with shale fragments below elev. 255)		5	SS	120	250							
250.4			6	SS	130	250							
17.0	End of borehole probably bedrock		Refusal										

Hole Caved  
El. 252.9  
WL  
Assumed



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 49

JOB 72-11101

LOCATION CO-ORDS. 852, 565N., 56, 683E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BXL Rock Core

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					$W_P$	$W$	$W_L$		
254.7	Ground Level															
0.0	Fill Material - clayey silt with trace of sand and gravel															
261.7	Brown															
3.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		1	SS	38	260										
			2	SS	37											
255.7	Brown		3	SS	37	255										
9.0	Grey		4	SS	38											
	(with shale fragments below elev. 250)		5	SS	100	250										
248.7	Hard															
16.0	Bedrock - Shale and Limestone															
246.5	Weathered															
18.2	Limestone and sound silty limestone					245										
244.8	shale		6	BXL RC	90%											
19.9	with bands of limestone															
241.7	Dark-Grey sound															
23.0	End of borehole					240										

WL  
253.3P-8  
Piez. Tip  
el. 248.2  
16.5

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>50

JOB 72-11101

LOCATION CO-ORDS. 852, 492N; 56, 807E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY HS

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *JK*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % 10 20 30			
266.5	Ground Level											
0.0	Fill Material - clayey silt with trace of sand, gravel & organice		1	SS	12	265						
260.5	brown stiff					260						
6.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	45							
			3	SS	34	255						
	Brown Hard		4	SS	50							
			5	SS	85	250						
248.5	Weathered shale		6	SS	125 1/6"							
248.0	bedrock											
19.0	End of Borehole					245						

Hole Caved  
El. 248.8  
W.L.  
Assumed

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>51

JOB 72-11101

LOCATION Co-ords. 852,380 N; 56,970 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Sept. 12, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Power Auger, BXL Rock Core, Cone Test

CHECKED BY 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 γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
260.8	Ground Level															
0.0	Fill Material					260										
	Clayey silt with some sand, gravel, wood chips & organics.		1	SS	9											
	Brown-Grey		2	SS	21	255										
250.3	Soft to Very Stiff		3	SS	3	250										
10.5	Organic silt with sand wood chips and glass.		4	SS	5											
	Black		5	SS	5	245										
243.3	Loose															
17.5	Shale Bedrock with minor bands of limestone & siltstone		6	BXL RC	65%	240										
239.0	Dark Grey Partially weathered															
21.8	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>52

JOB 72-111-01

LOCATION CO-ORDS. 852, 338N; 57, 086E

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY JC

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *[Signature]*

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	10	20	30		
261.2	Ground Level															
0.0	Fill Material -					260										
	Clayey silt with organics		1	SS	14											
	(with sand to silty sand layers)		2	SS	17	255										
	Firm to Very Stiff		3	SS	8	250										
			4	SS	25											
246.2																
15.0	Organic silt with sand, wood chips and brick pieces		5	SS	3	245										
242.7	black Loose															
241.7	Weathered Shale		6	SS	100	240										
19.5	End of hole															

WL 246.0

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>53

JOB 72-11101

LOCATION Co-ords. 852,297 N; 57,300 E.

ORIGINATED BY G.P.

W.P. 97-72-01

BORING DATE Sept. 12, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Power Auger, BXL Rock Core &amp; Cone Test

CHECKED BY

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.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
261.4	Ground Level									
0.0	Fill Material									
	Clayey silt with trace of sand and gravel, brick pieces and organics.		1	SS	10					
			2	SS	9					
251.9	Brown-Grey									
9.5	Stiff		3	SS	4					
	Organic sand, silt, wood chips and cinders		4	SS	7					
	Black Loose		5	SS	4					
242.7										
18.7	Bedrock									
240.3	Silty limestone									
21.1	Shale, minor bands of siltstone and limestone with partially weathered section (2" - 6" thick)		6	BXL R.C.	94%					
	Dark Grey									
232.7	Sound									
28.7	End of Borehole									

246.0

p-9

Piez. Tip  
el. 233.3  
28.1

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup> 54

JOB 72-11101

LOCATION Co-ords. 852, 322 N, 57, 503 E

ORIGINATED BY G.A.

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; Dynamic Cone Test

CHECKED BY *AK.*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$	BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	$w_p$ $w$ $w_L$ WATER CONTENT % 10 20 30		
261.7	Ground Level									
0.0	Fill Material clayey silt with trace of sand and gravel					260				
	Very stiff to hard		1	SS	24					
			2	SS	20	255				
	brown-grey		3	SS	60					
250.7						250				
11.0	Organic sand, silt & cinders		4	SS	5					
			5	SS	5					
243.7	dark grey loose		6	SS	60/6"	245				
18.0	End of borehole Probable shale bedrock					230				

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>55

JOB 72-11101

LOCATION Co-ords. 852, 348 N, 57, 661 E

ORIGINATED BY C.P.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Power Auger BXL Rock Core &amp; Cone Test

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F.		$w_p$ $w$ $w_L$				WATER CONTENT % 10 20 30
							$\circ$ UNCONFINED $\bullet$ QUICK TRIAXIAL	$+$ FIELD VANE $\times$ LAB VANE					
260.1	Ground Level											GR.SA.SI.CL.	
0.0	Fill Material Clayey silt with some sand, gravel & organics  Firm to stiff		1	SS	13	260							
			2	SS	6	255							
251.1	Brown-Grey												
9.0	Sand and Gravel changing to organic silt with sand		3	SS	54	250							
			4	SS	2								
			5	SS	3	245							
	Dark grey loose												
240.6	Transition Zone		6	SS	100								
19.5	Bedrock					240							
	Shale with bands of siltstone and limestone, with partially weathered sections throughout		7	BXL RC	73%								
233.8	Dark grey		8	BXL RC	85%	235							
26.3	End of Borehole					230							

245.1

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>56

JOB 72-11101

LOCATION CO-ORDS. 852, 195N; 57, 888E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY JE

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % $W_P$ $W$ $W_L$			
251.6	Ground Level											
0.0	Fill Material											
	Sand and gravel with pockets of clayey silt, brick pieces and cinders		1	SS	6	250						
			2	SS	10	245						
	brown loose											
240.6	Transition Zone		3	SS	128							
11.0	End of borehole					240						
	Probable bedrock Shale											

WL 246.6  
6-60-21-13

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>57

JOB 72-11101

LOCATION Co-ords. 852, 210 N, 58, 008 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ $w$ $w_L$ WATER CONTENT %				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
251.8	Ground Level															
0.0	Fill Material - silty sand, gravel brick pieces & cinders					250									247.8  0, 86 14	
245.8	Brown Compact		1	SS	24											
6.0	Fine sand, some silt		2	SS	2/18"	245										
242.3	Grey very loose															
9.5	Bedrock - dark grey shale with minor bands of limestone & siltstone					240										
239.3	2- weathered		3	SS	100, 4"											
12.5	Dark grey shale with occasional siltstone bands		4	BX RC	88%	235										
234.7																
17.1	End of Borehole					230										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>58

JOB 72-11101

LOCATION Co-ords. 852,242 N; 58,239 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 12, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F.			$W_p$ $W$ $W_L$				
							<input type="radio"/> UNCONFINED <input checked="" type="radio"/> QUICK TRIAXIAL	<input type="radio"/> + FIELD VANE <input checked="" type="radio"/> x LAB VANE						
250.4	Ground Level													
0.0	Fill Material					250								
	Sand, gravel, cinders and brick pieces.		1	SS	1h									246.4
244.4	Brown Compact					245								
6.0	Silty sand, some gravel and organics		2	SS	2/18"									14 40 30 16
	Grey		3	SS	7									
239.4	Very Loose to Loose					240								
11.0	End of Borehole Refusal to augering probable shale bedrock					235								

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup>59

JOB 72-11101

LOCATION Co. Ords. 852, 264 N, 58, 445 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY *HR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$ WATER CONTENT %				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
250.0	Ground Level														GR. SA. SI. CL.	
0.0	Fill Material Sand & Gravel with cinders					250									↓ 246.0  2.70.17.11.	
			1	SS	14											
244.0	Compact					245										
6.0	Sand with some silt & occasional clay pockets, & organics		2	SS	2/18"											
	Very loose to compact	3	SS	13	240											
237.5	Grey Black		4	SS	150/3"											
12.5	Bedrock Weathered															
236.4																
13.6	Shale, minor thin bands of limestone		5	BXL RC	68%	235										
232.2	Dark Grey Sound															
17.8	End of Borehole					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 60

JOB 72-11101

LOCATION Co-ords. 853,205 N; 60,425 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 12, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30				
264.0	Ground Level													
0.0	Fill Material					260								WL not established
	Clayey silt with pockets of sand and bricks.		1	SS	7									
258.0	Brown Firm													
6.0			2	SS	42	255								
			3	SS	33									
252.0	Brown					250								
12.0	Grey		4	SS	22									
	Heterogeneous mixture of clayey silt with trace of sand and gravel		5	SS	33									
	(Glacial Till)				245									
	Very Stiff to Hard (with shale fragments below El. 244)	6	SS	34										
243.0														
21.0	End of Borehole					240								
	Probable Shale Bedrock													

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 61

JOB 72-11101

LOCATION Co-ords. 853,752 N, 60,233 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F.			$w_p$ — $w$ — $w_L$				
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE		WATER CONTENT % 10 20 30				
266.9	Ground Level													
0.0	Fill Material - sand and gravel					265								
264.9	Brown													
2.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		1	SS	36									
			2	SS	58	260								
			3	SS	28									
254.9	Brown					255								
12.0	Grey		4	SS	21									253.5
	Very stiff to hard		5	SS	29	250								
			6	SS	18									
245.9			7	SS	18									
21.0	End of borehole Probable shale bedrock					245								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE No 62

JOB 72-11101

LOCATION Co-ords. 854, 170 N, 60, 044 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Augers

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				$w_p$ $w$ $w_L$				
270.2	Ground Level														
0.0	Fill material					270									
	Sandy silt with trace of clay & wood		1	SS	22										
264.2	Compact					265									264.3
6.0	Heterogeneous mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	9										
			3	SS	27	260									
			4	SS	19										
255.2	Brown Grey					255									
15.0			5	SS	20										
			6	SS	13										
248.9	Stiff to Very Stiff		7	SS	100/4"	250									
21.3	End of Borehole probable shale bedrock					245									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 63

JOB 72-11101

LOCATION CO-ORDS. 852, 815N; 59, 163E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY JC

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *AL*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % $W_P$ — $W$ — $W_L$ 10 20 30				
264.3	Ground Level														
0.0	Fill Material - sand and gravel														WL not established
262.3															
2.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)														
			1	SS	58										
			2	SS	68										
251.2	----- brown														
250.0	----- grey														
	hard (with shale fragments below elev. 247)														
			3	SS	74										
246.3															
18.0	End of borehole Probable shale bedrock														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

 RECORD OF BOREHOLE N<sup>o</sup>64

FOUNDATIONS OFFICE

JOB 72-11101

LOCATION CO-ORDS. 853, 660N; 58, 917E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY JC

DATUM GBODETTIC

BOREHOLE TYPE Hollow Stem Auger

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____			LIQUID LIMIT _____ $w_L$ PLASTIC LIMIT _____ $w_p$ WATER CONTENT _____ $w$ $w_p$ — $w$ — $w_L$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
272.4	Ground level													
0.0	Fill Material - Sand and Gravel					270								WL not established
270.4														
2.0	Clayey silt with trace of gravel													
	dark brown soft		1	SS	4	265								
265.4	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)													
7.0			2	SS	50	260								
257.4	Brown													
15.0	Grey		3	SS	43	255								
	Hard													
250.4			4	SS	64	250								
22.0	End of borehole Probable shale bedrock													

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup> 65

JOB 72-11101

LOCATION CO-ORDS. 852, 601N; 57, 204E

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY JC

DATUM GEODETIC

BOREHOLE TYPE Power Auger &amp; Cone Test

 CHECKED BY *[Signature]*

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. PLOT	NUMBER	TYPE	BLOWS/FOOT					
270.1	Ground Level					270				
0.0	Fill Material sand & silt with organics		1	SS	2	265				
262.1	grey to black very loose									
8.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	80	260				
			3	SS	45	255				
252.6	Brown-Grey Hard									
17.5	End of Borehole Probable shale bedrock					250				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 66

JOB 72-11101

LOCATION CO-ORDS. 852, 964N; 57, 109E

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY JC

DATUM GEODETIC

BOREHOLE TYPE Power Auger &amp; Cone Test

CHECKED BY *JR*

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	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
271.8	Ground Level															
0.0	Fill Material - Clayey silt with trace of sand and gravel & organics					270										
266.3	Brown Hard		1	SS	35											
5.5	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)					265										
	(with shale fragments below elev. 256)		2	SS	47	260										
	Brown - Grey Hard		3	SS	81/2"	255										
251.5			4	SS	60/0"	250										
20.3	End of borehole probable shale bedrock															

↓ WL 262.7

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup> 67 (B.H. 2, 72-11059)

JOB 72-11101

LOCATION Co-ords. 15,852,263 N; 2,058,602 E.

ORIGINATED BY CSP

W.P. 97-72-01

BORING DATE May 9, 10, 1972

COMPILED BY TB

DATUM Geodetic

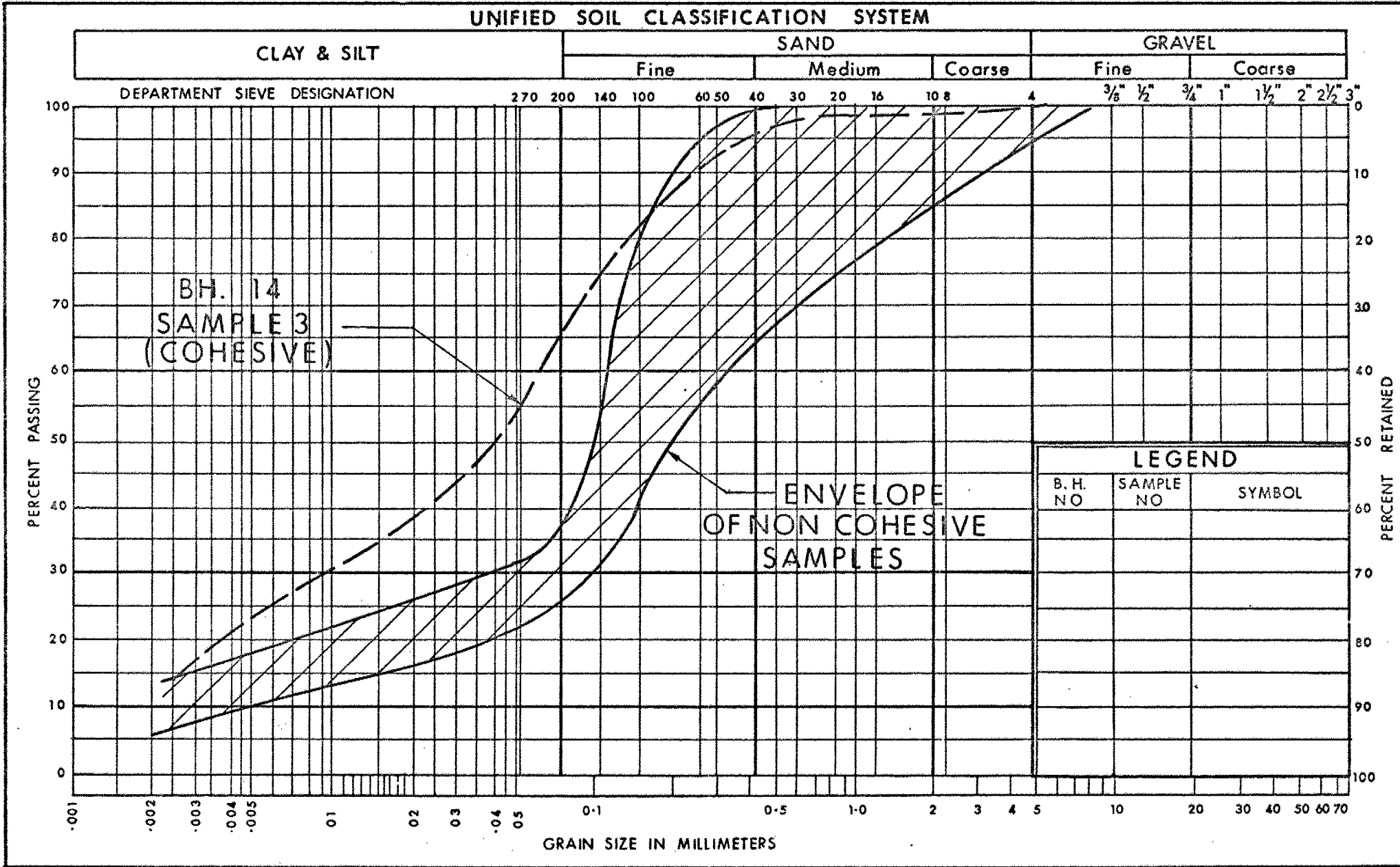
BOREHOLE TYPE Auger

CHECKED BY *JK*

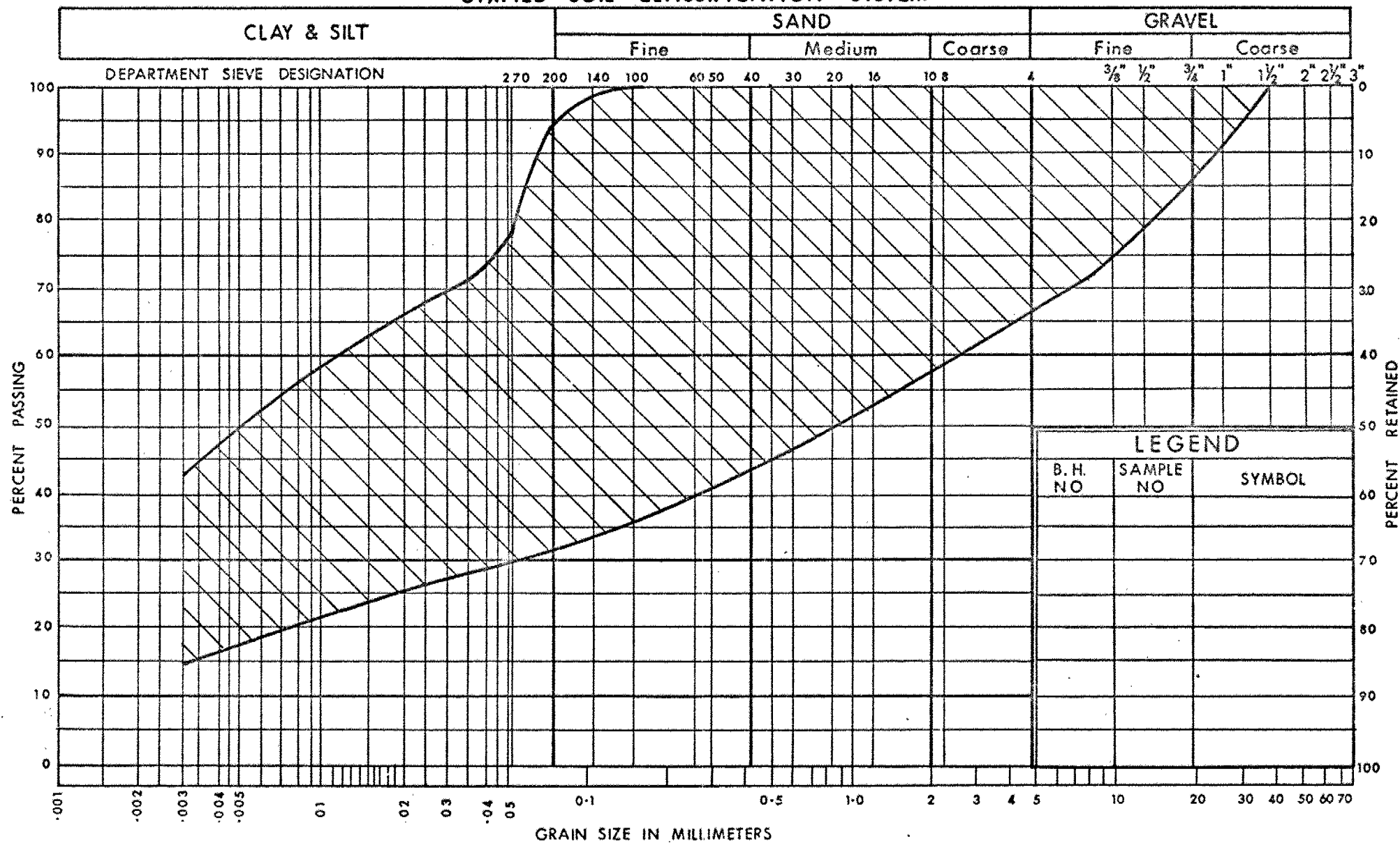
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT _____w <sub>L</sub> PLASTIC LIMIT _____w <sub>p</sub> WATER CONTENT _____w w <sub>p</sub> _____ w _____ w <sub>L</sub> WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
250.8	Ground Level															
250.1	Black Topsoil		1	SS	55/1"	250										249.8
0.7	Grey sand & gravel, broken bricks		2	SS	56											May 10/72
247.8																
3.0	Fill		3	SS	39											
	Clayey silt with some sand & gravel, occasional organic pockets, brick pieces		4	SS	14	245										
			5	SS	14											
			6	SS	13											
	Firm to Stiff		7	SS	14											
239.8			8	SS	60/4"	240										
11.0			9	SS	50/2"											
236.8	Weathered		10	SS	100/3"											
14.0	Sound															
	Grey shale bedrock		11	BX RC	80% Rec	235										
			12	BX RC	80% Rec	230										
226.8																
24.0	End of Borehole					225										

OFFICE REPORT ON SOIL EXPLORATION

APPENDIX II



# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS



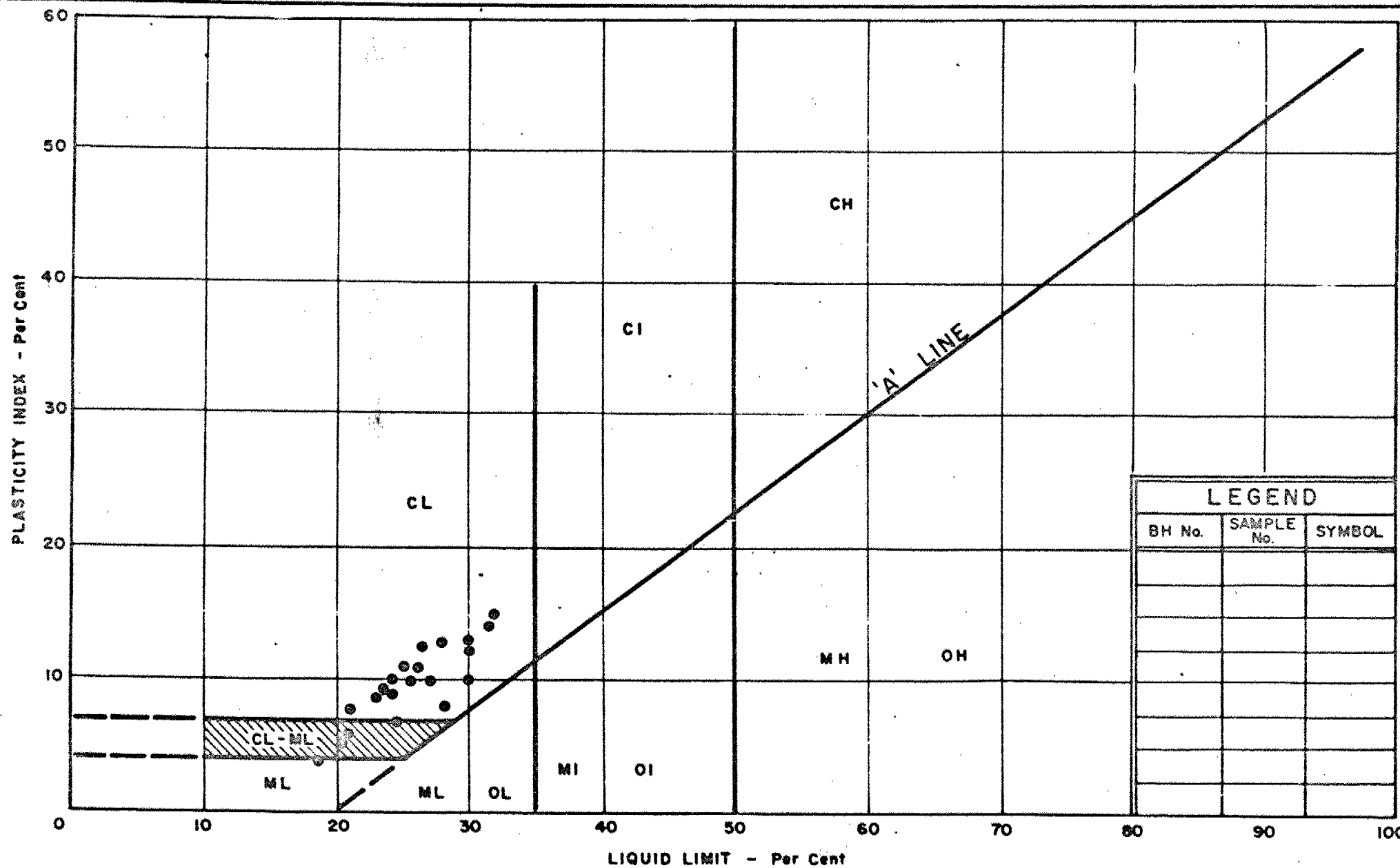
DESIGN SERVICES  
BRANCH

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

W.P. No. 97-72-01

JOB No. 72-11101

FIG. No. 2



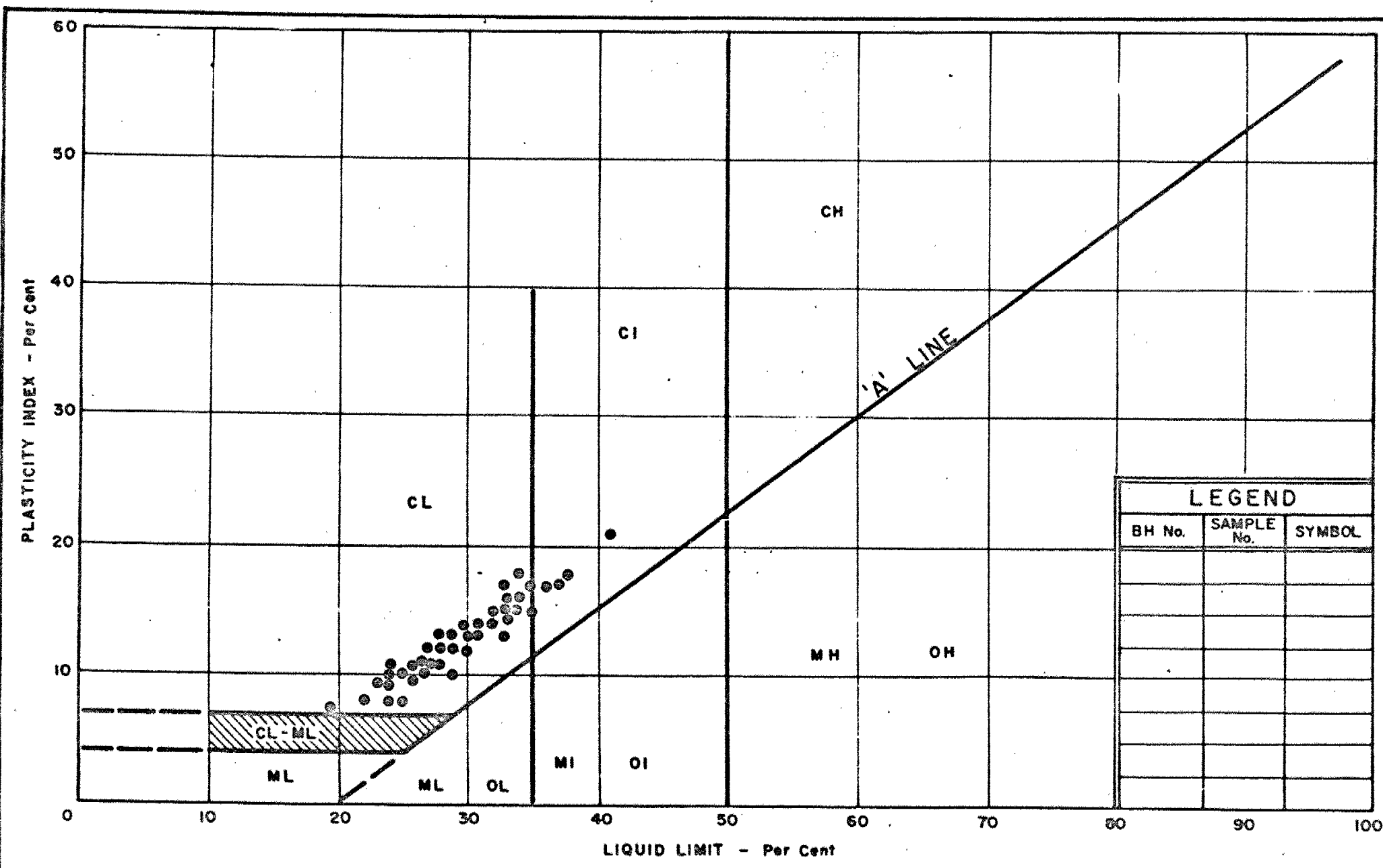
DEPARTMENT OF HIGHWAYS  
 MATERIALS and  
 TESTING  
 DIVISION

# PLASTICITY CHART FILL MATERIAL (CLAYEY SILT WITH SAND & GRAVEL)

W.P. No. 97-72-01

JOB No. 72-11101

FIG. 3



DEPARTMENT OF HIGHWAYS  
**MATERIALS and  
 TESTING  
 DIVISION**

**PLASTICITY CHART**  
**GLACIAL TILL**  
 (HET. MIXTURE OF CLAYEY SILT, SOME SAND, TRACE OF GRAVEL)

W.P. No. 97-72-01  
 JOB No. 72-11101  
**FIG. 4**



## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

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

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

### DESCRIPTION OF SOIL

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

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

### TYPE OF SAMPLE

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

### SOIL TESTS

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

# ABBREVIATIONS USED IN THIS REPORT

## SOIL PROPERTIES

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

APPENDIX III

## DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

## MEMORANDUM

TO: Mr. A. Stermac,  
Pr. Foundation Engineer.

FROM: K. W. Ingham

ATTENTION:

DATE: September 20, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation - 7211101  
Experimental Rapid Transit Line  
C.N.E. Grounds, Toronto

A series of rock cores and soil samples were examined from 29 boreholes out of a total of 67 drilled at the site. The bedrock intersected in each hole was found to be typical of the Dundas formation, which is itself the characteristic bedrock found in subcrop within the Toronto area.

The rock is predominantly a platy bedded dark grey shale with interbeds of silty limestone and limestone ranging in size from 0.05 ft. to 0.5 ft. The latter constitute only 20 percent or less of the formation but may locally form as much as 30 to 40 percent of the section.

Generally the upper layers of the shale are weathered and moderately to badly fragmented and grade through a thin transition zone of shaly till into the overlying till material. The harder bands of silty limestone and limestone are generally moderately fragmented within this zone which is rarely more than 2 to 4 ft. thick. At some locations there is a partially weathered zone overlying the fresh bedrock in which incipient weathering is present along certain layers, however, for foundation purposes this is considered to be the same as the fresh bedrock.

A brief description of each rock core is given below together with the appropriate bedrock elevation.

Hole No. 1

Bedrock at 234.9

15.5 - 18.0      Dark grey shale; weathered.

18.0 - 23.0      Dark grey shale; frequent thin  
layers of silty limestone and  
limestone.

Hole No. 3

Bedrock at 232.3

16.0 - 24.2      Dark grey shale; occasional  
thin beds of silty limestone and  
limestone, partially weathered  
layers throughout.

Hole No. 5

Bedrock at 237.9

13.0 - 23.0      Dark grey shale, occasional  
beds of silty limestone and  
limestone 0.3 ft. to 0.5 ft.  
in thickness, partially  
weathered layers throughout.

Hole No. 9

Bedrock at 235.9

16.1 - 24.0      Dark grey shale; thin limestone  
bands, weathered.

24.0 - 34.0      Dark grey shale; frequent thin  
bands of silty limestone and  
limestone.

Hole No. 11

Bedrock at 234.3

18.0 - 27.0      Dark grey shale; occasional thin beds  
of silty limestone and limestone,  
partially weathered sections  
throughout.

Hole No. 13

Bedrock at 233.3

18.5 - 24.0      Dark grey shale, minor thin beds  
of limestone and silty limestone,  
weathered.

24.0 - 29.0      Dark grey shale; occasional beds  
of silty limestone and limestone  
0.2 to 0.6 ft. in thickness.

Hole No. 15

Bedrock at 237.5

15.0 - 15.5      Dark grey shale; weathered.

15.5 - 20.5      Dark grey shale.

Hole No. 17

Bedrock at 239.8

18.5 - 22.0      Dark grey shale; thin beds of  
limestone, weathered.

22.0 - 29.0      Dark grey shale; minor thin beds of  
silty limestone and limestone.

Hole No. 19 Bedrock at 241.1

24.0 - 25.0 Dark grey shale; weathered.

25.0 - 30.0 Dark grey shale; occasional thin  
beds of silty limestone and  
limestone.

Hole No. 23 Bedrock at 242.8

31.5 - 36.5 Dark grey shale; minor thin  
limestone beds.

Hole No. 25 Bedrock at 250.4

24.0 - 33.0 Dark grey shale; minor thin  
limestone beds, weathered.

33.0 - 38.0 Dark grey shale; minor thin  
limestone beds.

Hole No. 27 Bedrock at 246.0

28.0 - 33.5 Dark grey shale; occasional  
thin beds of silty limestone  
and limestone, partially  
weathered throughout.

33.5 - 38.5 Dark grey shale; occasional beds  
of silty limestone.

Hole No. 29 Bedrock at 246.6

29.0 - 30.0 Dark grey shale; minor thin  
beds of limestone and silty  
limestone, weathered.

30.0 - 35.2 Dark grey shale; occasional beds  
of silty limestone and limestone.  
0.2 ft. to 0.5 ft. in thickness.

Hole No. 31 Bedrock at 252.8

21.0 - 24.0 Dark grey shale; weathered.

24.0 - 29.0 Dark grey shale; occasional thin  
beds of silty limestone and  
limestone.

<u>Hole No. 33</u>	Bedrock at 257.7
18.5 - 20.0	Dark grey shale; weathered.
20.0 - 25.0	Dark grey shale; frequent beds of silty limestone and limestone 0.1 ft. to 0.6 ft. in thickness.
<u>Hole No. 35</u>	Bedrock at 253.7
27.0 - 29.0	Dark grey shale; weathered.
29.0 - 34.0	Dark grey shale; occasional beds of limestone and silty limestone.
<u>Hole No. 37</u>	Bedrock at 256.5
32.0 - 33.7	Dark grey shale; weathered.
33.7 - 38.5	Dark grey shale; frequent beds of silty limestone 0.2 ft. to 0.5 ft. in thickness, minor thin beds of limestone.
<u>Hole No. 39</u>	Bedrock at 257.9
27.0 - 30.0	Dark grey shale; weathered.
30.0 - 35.0	Dark grey shale; occasional thin beds of silty limestone and limestone.
<u>Hole No. 41</u>	Bedrock at 257.4
28.0 - 37.5	Dark grey shale; frequent beds of silty limestone and limestone 0.1 ft. to 0.4 ft. in thickness.
<u>Hole No. 43</u>	Bedrock at 260.3
27.5 - 28.0	Dark grey shale; weathered.
28.0 - 33.2	Dark grey shale; minor thin limestone beds.
<u>Hole No. 45</u>	Bedrock at 259.5
18.5 - 21.0	Dark grey shale; weathered, may include part of transition zone from overlying till.
21.0 - 27.2	Dark grey shale; frequent beds of silty limestone, minor thin beds of limestone.

Hole No. 47

Bedrock at 256.0

15.0 - 18.0

Dark grey shale; weathered.

18.0 - 23.1

Dark grey shale; occasional  
beds of silty limestone, minor thin  
beds of limestone.

Hole No. 49

Bedrock at 248.7

16.0 - 18.2

Dark grey shale; minor thin  
limestone bands, weathered.

18.2 - 19.9

Silty limestone and limestone  
in beds 0.3 ft. to 0.8 ft. in  
thickness.

19.9 - 22.4

Dark grey shale; occasional beds  
of limestone, minor thin beds of  
silty limestone.

Hole No. 51

Bedrock at 243.3

17.5 - 21.8

Dark grey shale; minor thin  
beds of limestone and silty  
limestone, partially weathered  
throughout.

Hole No. 53

Bedrock at 242.7

18.7 - 21.1

Silty limestone; minor thin  
beds of limestone and shale.

21.1 - 28.7

Dark grey shale; minor beds of  
silty limestone and limestone,  
occasional partially weathered  
sections.

Hole No. 55

Bedrock at 240.6

19.5 - 26.3

Dark grey shale; occasional  
beds of silty limestone and  
limestone, partially weathered  
throughout.

Hole No. 57

Bedrock at 242.3

9.5 - 12.5

Dark grey shale; minor thin beds  
of silty limestone and limestone,  
weathered in the top 2.0 ft. partially  
weathered in the lower 1.0 ft.



Hole No. 59

Bedrock at 237.4

12.6 - 13.6

Dark grey shale; minor beds of silty limestone and limestone, partially weathered throughout.

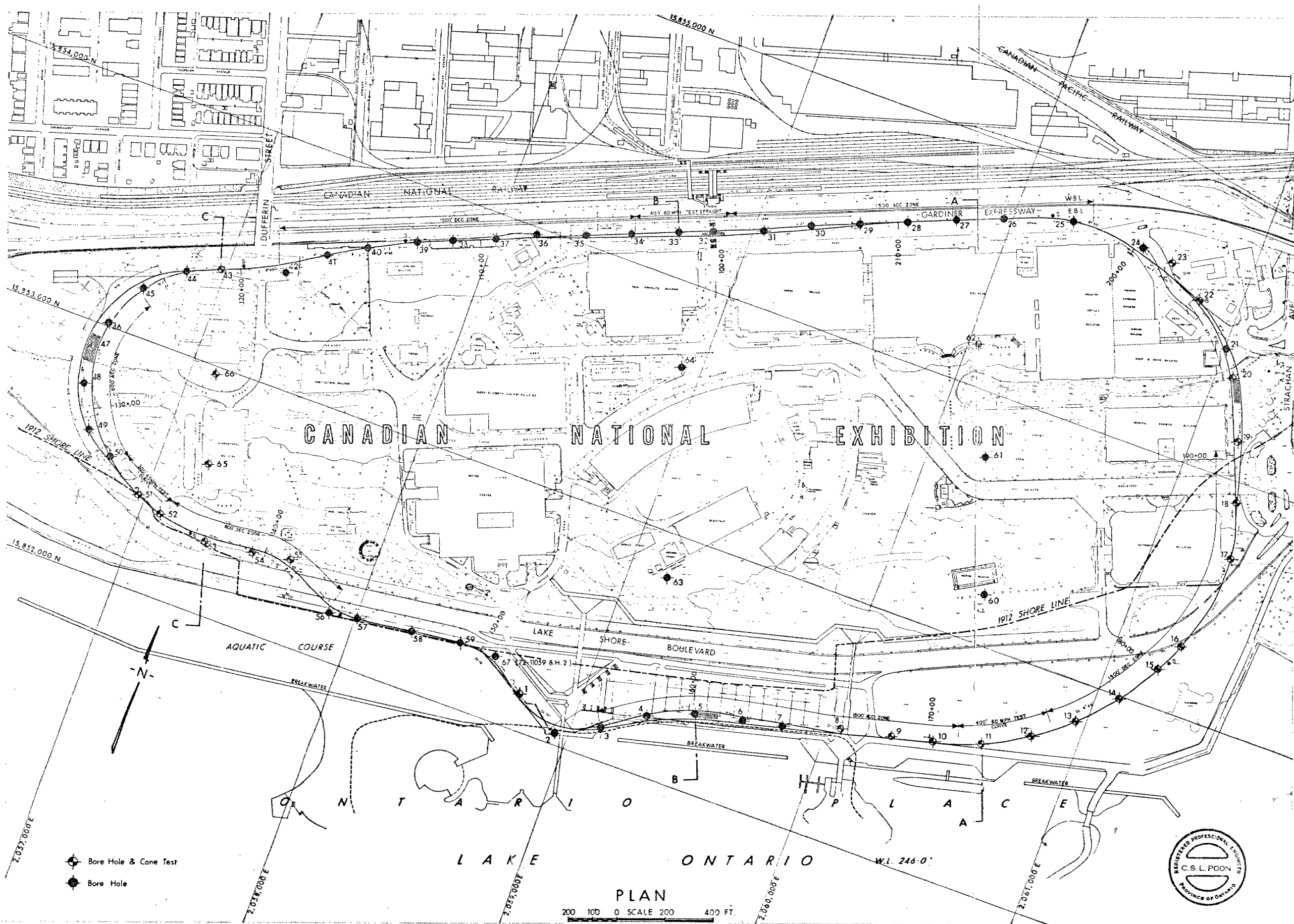
13.6 - 17.8

Dark grey shale; minor thin beds of limestone.

A handwritten signature in black ink, appearing to read 'K. W. Ingham', with a long horizontal stroke extending to the right.

K. W. Ingham,  
Geologist.

KWI:mv



BORE HOLE ELEVATIONS & LOCATIONS			
NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	250.4	15,852,150	2,052,750
2	248.1	15,852,048	2,058,940
3	248.3	15,852,135	2,059,119
4	251.4	15,852,248	2,059,278
5	250.9	15,852,322	2,059,467
6	250.5	15,852,303	2,059,659
7	250.5	15,852,400	2,059,821
8	250.4	15,852,473	2,060,057
9	252.0	15,852,518	2,060,265
10	252.6	15,852,554	2,060,437
11	252.3	15,852,615	2,060,627
12	252.2	15,852,718	2,060,809
13	251.8	15,852,859	2,061,059
14	252.2	15,852,957	2,061,295
15	252.2	15,853,160	2,061,199
16	252.5	15,853,280	2,061,257
17	258.3	15,853,691	2,061,325
18	262.0	15,853,919	2,061,264
19	262.0	15,854,158	2,061,392
20	268.9	15,854,398	2,061,008
21	271.3	15,854,503	2,061,008
22	273.1	15,854,653	2,060,847
23	274.3	15,854,772	2,060,680
24	274.8	15,854,782	2,060,547
25	274.8	15,854,744	2,060,230
26	273.8	15,854,657	2,059,917
27	274.0	15,854,622	2,059,720
28	274.9	15,854,548	2,059,590
29	275.6	15,854,472	2,059,408
30	275.5	15,854,394	2,059,218
31	273.9	15,854,305	2,059,041
32	274.7	15,854,230	2,058,847
33	276.2	15,854,180	2,058,711
34	278.4	15,854,108	2,058,520
35	280.7	15,854,039	2,058,356
36	286.3	15,853,971	2,058,165
37	288.5	15,853,953	2,058,007
38	287.8	15,853,925	2,057,930
39	285.9	15,853,770	2,057,930
40	284.8	15,853,678	2,057,518
41	285.4	15,853,600	2,057,370
42	287.2	15,853,463	2,057,236
43	287.8	15,853,382	2,056,980
44	287.1	15,853,325	2,056,843
45	278.0	15,853,198	2,056,694
46	275.4	15,853,072	2,056,615
47	271.0	15,852,891	2,056,580
48	267.4	15,852,738	2,056,600
49	264.7	15,852,565	2,056,683
50	266.5	15,852,492	2,056,807
51	260.8	15,852,350	2,056,900
52	261.1	15,852,338	2,057,084
53	261.4	15,852,297	2,057,300
54	261.7	15,852,322	2,057,507
55	260.1	15,852,348	2,057,661
56	251.6	15,852,195	2,057,888
57	251.8	15,852,210	2,058,080
58	250.4	15,852,242	2,058,239
59	250.0	15,852,264	2,058,445
60	264.0	15,853,205	2,060,425
61	266.9	15,853,742	2,060,233
62	270.2	15,854,170	2,060,044
63	264.3	15,852,815	2,059,193
64	272.4	15,853,640	2,058,917
65	270.1	15,852,601	2,057,204
66	271.8	15,852,944	2,057,109
67	250.8	15,852,263	2,058,602

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

PROPOSED ELEVATED RAPID TRANSIT SYSTEM  
(INTERMEDIATE CAPACITY)

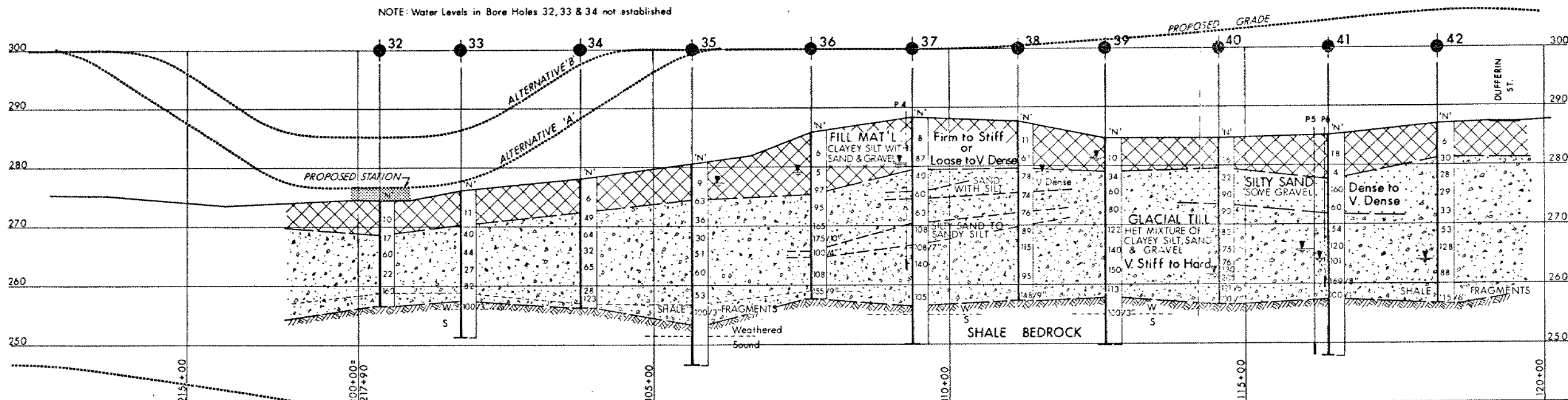
HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
TWP. \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

BORE HOLE LOCATION PLAN

SUBMD C.P.	CHECKED <input checked="" type="checkbox"/>	WP NO. 97-72-31	DRAWING NO.
DRAWN S.O.	CHECKED <input checked="" type="checkbox"/>	WO NO. 72-11101	<b>72-11101A</b>
DATE	22 SEPT 1972	SITE NO.	BRIDGE DRAWING NO.
APPROVED	<i>[Signature]</i>	CONF. NO.	
PRINCIPAL FOUNDATION ENGINEER			



NOTE: Water Levels in Bore Holes 32, 33 & 34 not established



SEE DRAWING NO 72-11101 A



KEY PLAN  
SCALE IN MILES

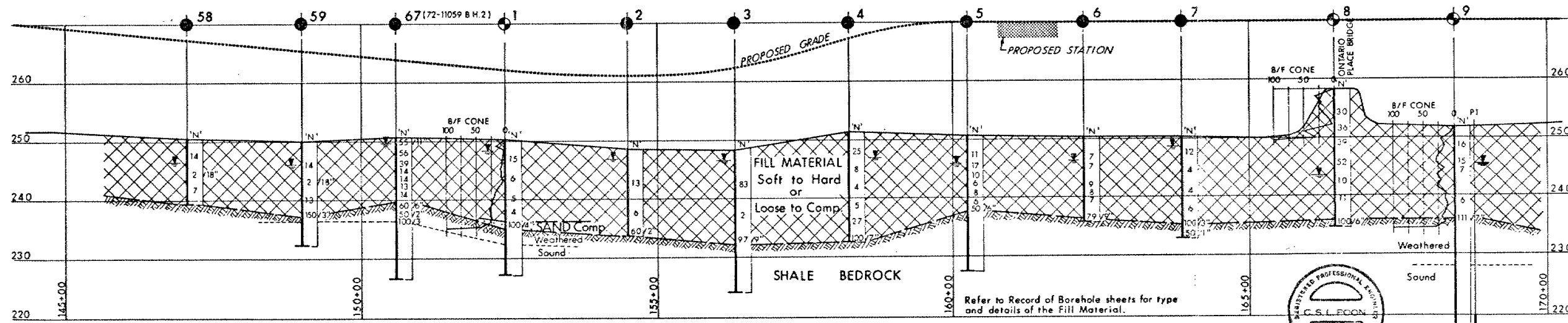
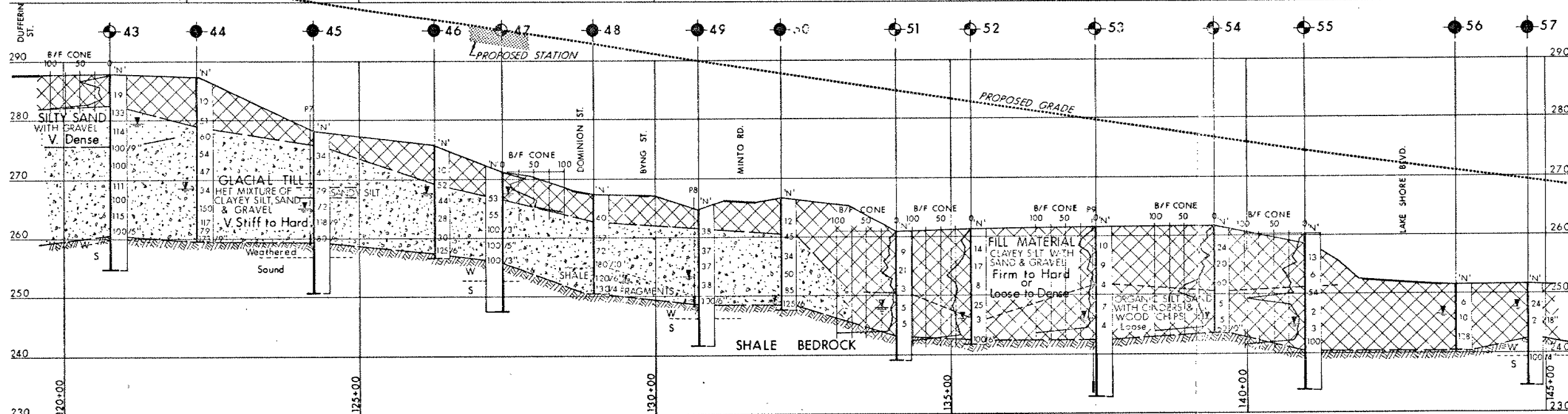
### LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, SEPT 1972
- Water Levels assumed
- Piezometer

NO.	ELEVATION		

### NOTE

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



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

Refer to Record of Borehole sheets for type and details of the Fill Material.



REVISIONS	DATE	BY	DESCRIPTION

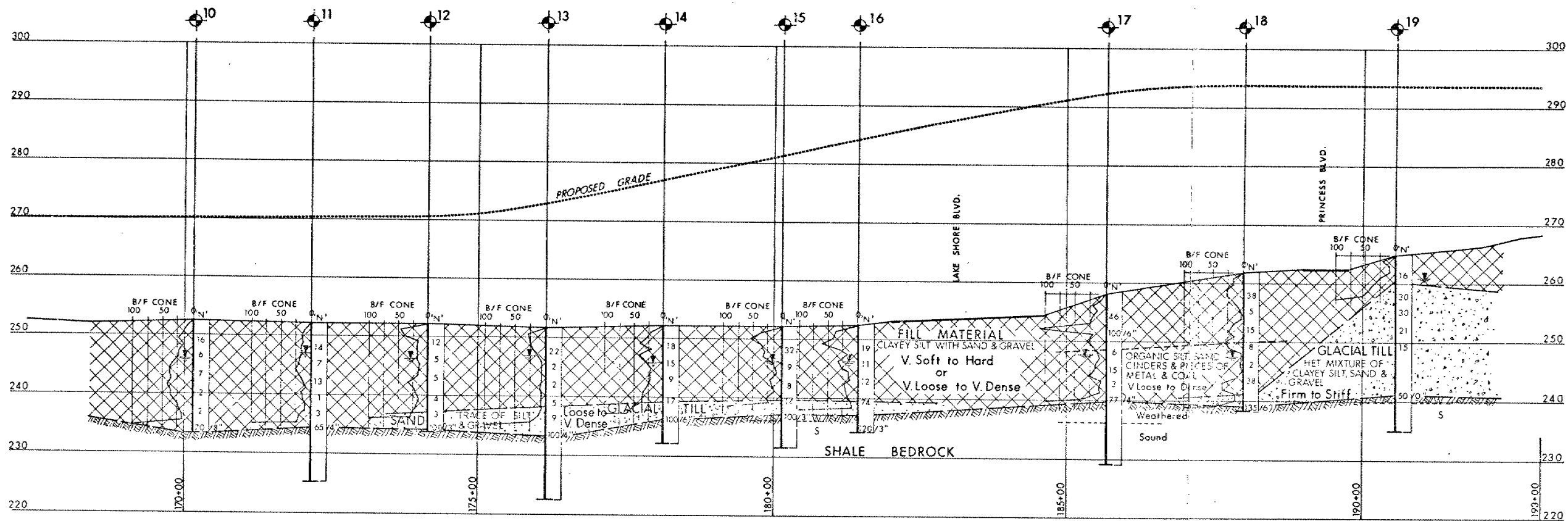
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

PROPOSED ELEVATED RAPID TRANSIT SYSTEM  
(INTERMEDIATE CAPACITY)

HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
TWP. \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

PROFILE & SOIL STRATA

SUBMD. C.P.	CHECKED <input checked="" type="checkbox"/>	W.R. NO. 97-72-01	DRAWING NO. 72-11101 B
DRAWN S.O.	CHECKED <input checked="" type="checkbox"/>	W.D. NO. 72-11101	BRIDGE DRAWING NO.
DATE 22 SEPT 1972	SITE NO.		
APPROVED <i>[Signature]</i>	CONT. NO.		



SEE DRAWING NO 72-11101A



KEY PLAN  
SCALE IN MILES

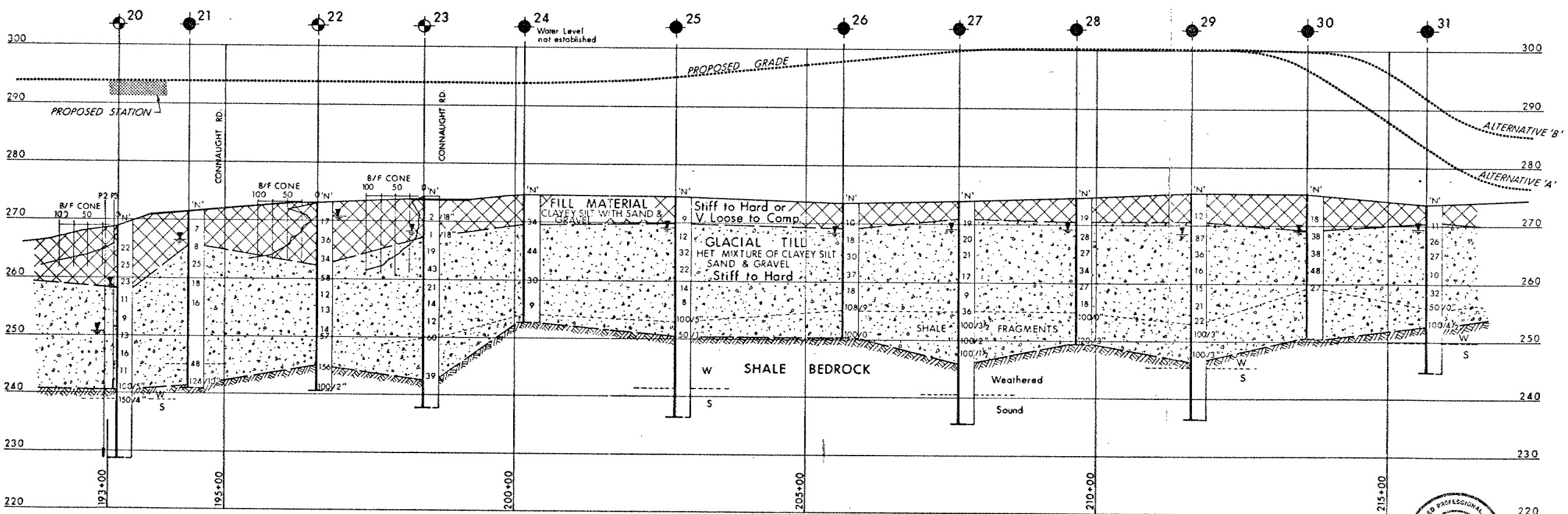
### LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, SEPT. 1972
- Water Levels assumed
- Piezometer

NO.	ELEVATION		

### NOTE

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



### PROFILE

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



REVISIONS	DATE	BY	DESCRIPTION

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

PROPOSED ELEVATED RAPID TRANSIT SYSTEM  
(INTERMEDIATE CAPACITY)

HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
TWP. \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

### PROFILE & SOIL STRATA

SUBMD C.P. CHECKED <input checked="" type="checkbox"/>	WP NO. 97-72-01	DRAWING NO.
DRAWN S.O. CHECKED <input checked="" type="checkbox"/>	WO NO. 72-11101	<b>72-11101 C</b>
DATE 22 SEPT 1972	SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>	CONT. NO.	
PRINCIPAL FOUNDATION ENGINEER		



## MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

## MEMORANDUM

TO: Mr. M. D. Harmelink, (7) FROM: Foundations Office,  
Head, Urban Systems Research, Design Services Branch,  
East Bldg., Downsview. West Bldg., Downsview.

ATTENTION: DATE: May 10, 1973.

OUR FILE REF. IN REPLY TO

SUBJECT:

72-11-101-1

FOUNDATION INVESTIGATION REPORT

For

Proposed Intermediate Capacity Public Transit System  
(Pilot Scale Test)

Canadian National Exhibition Grounds  
Metropolitan Toronto, Province of Ontario, Canada  
W.O. 72-11101-1 -- W.P. 97-72-01

In order to provide sufficient subsoil information for the New Intermediate Capacity Public Transit System on C.N.E. grounds, we are forwarding to you our Foundation Report. This report contains the results of the recent investigation together with our additional recommendations pertaining to the foundation design of this system. The text and the related information of our preliminary foundation investigation report (submitted September 25, 1972) is also included in the Appendix of this report. As a result of this, the preliminary foundation report is superseded.

The co-ordinate grid system now has been revised to the M.T.C. Grid. The enclosed borehole logs and drawings incorporate this system.

We believe that the information contained therein will be sufficient for your present requirements. Should you require further data, or clarification of the report, please do not hesitate to contact our Office.

CSP/ao  
Atch.

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

for *M. Dwata*  
A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.

G. A. Wrong  
B. A. Singh  
Foundations Files  
Documents



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  5. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Intermediate Capacity Public Transit System  
(Pilot Scale Test)  
Canadian National Exhibition Grounds  
Metropolitan Toronto, Province of Ontario, Canada  
W.O. 72-11101-1 -- W.P. 97-72-01

---

1. INTRODUCTION:

The Ministry of Transportation and Communications, Province of Ontario, is presently carrying out a study to evaluate new intermediate capacity transit systems. The objective of this study is to select the most promising system for a pilot scale section to be constructed in 1973-74 on the Canadian National Exhibition Grounds, in Metropolitan Toronto. The Foundations Office carried out a detailed subsurface investigation at the proposed site between September 5 and 14, 1972. The results of this investigation, together with preliminary recommendations pertaining to the foundation support for the elevated structure, were presented in our Foundation Report W.O. 72-11101 (dated September 22, 1972).

Following the submission of the Preliminary Foundation Report, some changes in the alignment and the station locations were made. As a result of this, an additional foundation investigation was carried out by this office to determine the subsoil, bedrock and groundwater conditions along the revised alignment and at the proposed maintenance area.

This report contains the factual data obtained from the additional investigation, together with recommendations pertaining to the design of the foundations for the elevated transit system.



## 2. SUBSOIL AND BEDROCK CONDITIONS:

### 2.1) General:

In order to obtain the subsurface conditions at the proposed stations, maintenance area and along the revised alignment, a total of thirty four sampled boreholes was put down using two continuous flight auger machines equipped with hollow stem augers (commercially known as C.M.E. 750). These machines are adapted for soil sampling purposes. In addition, six boreholes, in which Menard Pressure Meter Tests were carried out, were put down to determine the shear strength, lateral bearing capacity and elastic modulus of the overburden and shale bedrock by Golder and Associates. The results were presented in Golder's report, dated March 21, 1973.

The soil, bedrock and groundwater conditions encountered are presented on the Record of Borehole sheets appended to this report. The location and elevation of the various boreholes were surveyed in the field by personnel from Engineering Surveys, Central Region, Ministry of Transportation and Communications. The elevations in this report are referenced to a Geodetic datum. Boring locations and elevations are shown on Drawing No. 72-11101-1A. Estimated stratigraphical profile along the revised alignment of the proposed rapid transit system and sections are also plotted on Drawings No. 72-11101-1B and -1C.

The additional investigation revealed similar subsoil conditions to those encountered in the initial investigation. The subsoil and bedrock encountered from ground surface downward, will briefly be described in the subsections to follow.

### 2.2) Fill Material:

#### 2.2.1) Reclaimed Area (Refer to B.H.'s #101, #143, and #119 to #136 Inclusive):

Fill was placed to reclaim the southern portion of this site from Lake Ontario. The extent of this reclaimed area is illustrated on Drawing No. 72-11101-1A. At this location,

between 12 and 20 feet of fill material was found overlying shale bedrock. The composition of this fill is found to be quite variable, ranging from clayey silt with some sand and gravel at some locations to sand and gravel at other locations. Random pockets and/or layers of organic matter, wood chips, concrete and brick fragments are present throughout the fill.

Standard penetration testing, carried out within the fill material, gave 'N' values ranging from 1 to 75 blows per foot, with the lower values being dominant. The higher values were encountered at the upper portion of the fill material or at the transition zone directly overlying the shale bedrock. Based on these values, it is estimated that the fill has been well compacted in the upper zone and that negligible to no compactive effort has been provided for the lower portion of the fill, which is believed to have been dumped under water.

Results of grain-size distribution testing performed on samples recovered in this fill material were plotted on the Record of Borehole sheets, as well as on Figures #1, #2 and #3. Atterberg limit tests were carried out on the cohesive portion of the fill and the results are plotted on the Plasticity Chart (Figure #5) as well as tabulated below:

			<u>Range</u>	<u>(Average)</u>
Liquid Limit	(W <sub>L</sub> )	%	17 - 34	(25)
Plastic Limit	(W <sub>p</sub> )	%	13 - 22	(17)
Natural Moisture Content	(W)	%	9 - 23	(16)

Referring to the above table, it can be seen that the cohesive portion of the fill material has a plasticity in the low range.

2.2.2) North of Reclaimed Area (Refer to B.H.'s #102 to #118 and #137 to #145):

Between 2 and 8 feet of fill material was encountered in most of the boreholes put down in this area. In general, the fill material is composed of a mixture of clayey silt with some sand and gravel, which is similar in composition to the

underlying glacial till. In two boreholes (B.H.'s #103 and #104) put down behind the existing retaining wall, up to 28 feet of granular backfill consisting of sand and gravel was encountered. Typical grain-size distribution curves of the backfill material are presented on Figure No. 4.

Standard penetration testing, carried out within this fill material, gave 'N' values generally ranging from 12 to 55 blows per foot, indicating that the fill material has been moderately to well compacted.

2.3) Heterogeneous Mixture of Clayey Silt, Some Sand and Traces of Gravel (Glacial Till):

This stratum was found underlying the fill material where it exists or a thin layer of topsoil (up to 1.5 feet thick) elsewhere. It consists of a heterogeneous mixture of clayey silt with some sand and traces of gravel. The thickness of this stratum varies between 9.5 feet (B.H. #104) and 27 feet (B.H. #140). In general, the upper 4 to 14 feet of the cohesive glacial till is brown in colour whereas the lower portion is grey. However, the engineering properties of the soil in these two zones, are similar.

Grain size distribution testing and Atterberg Limit tests were carried out on samples recovered within this stratum. The results are plotted on the Record of Borehole sheets as well as summarized on Figure No.'s 5 to 7. The Atterberg Limits are also tabulated as follows:

		<u>Range</u>	<u>(Average)</u>
Liquid Limit	(W <sub>L</sub> ) %	22 - 45	(29)
Plastic Limit	(W <sub>p</sub> ) %	13 - 24	(17)
Natural Moisture Content	(W) %	9 - 25	(15)

Referring to the above table, it can be concluded that the cohesive glacial till is inorganic with a plasticity being generally in low range.

The glacial till at the north-east corner of the site (refer to B.H.'s #19 to #31, and B.H.'s #137 to #141) was found

to be weaker than that elsewhere. This is illustrated on Figures No. 8 and 9 (plots of Atterberg Limits and 'N' values against elevation). From these figures, it can be seen that the weaker till has 'N' values ranging from 10 to 30 blows/foot, while the more competent till has 'N' values varying from 40 to over 100 blows/foot.

#### 2.4) Bedrock:

The bedrock was proven in 22 of the boring locations by obtaining 4 to 14 feet of NXL size rock core samples.

The bedrock samples were carefully examined by Mr. K. W. Ingham, Geologist, Ministry of Transportation and Communications. Following this examination, uniaxial compression tests were carried out on selected samples. The detailed results of the testing, together with detailed description of the bedrock, are contained in a memorandum from Mr. Ingham to this Office. A copy of this memorandum is included in the Appendix of this report.

The bedrock surface was found to vary between elevations 232 and 262. In general, the surface decreases in elevation towards Lake Ontario.

The bedrock intersected in each hole was found to be typical of the Dundas Formation. It is a dark grey platy bedded shale, with occasional fine grained limestone beds up to about 1 foot thick.

A thin transition zone was encountered between the overburden and the bedrock. The shale bedrock in the upper 1 to 5 feet is generally in a weathered condition. At some locations, there are thin partially weathered layers overlying the "fresh bedrock"; however, for foundation purposes this is considered to be sound bedrock.

#### 3. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during and after the period of investigation by recording the water level in the open borings. The observations are recorded on the

Record of Borehole sheets as well as summarized on Drawings 72-11101-1B and -1C.

The results of the measurements indicate that the groundwater level varies from 2 to 18 feet below the existing ground surface, which corresponds to elevations between 246 and 277. Over the reclaimed area, however, the groundwater level ranges from elevation 246 to elevation 249. It is believed that the groundwater level in the reclaimed area is affected by the lake level, which is at about elevation 248 during the period of investigation.

#### 4. DISCUSSIONS:

##### 4.1) General:

Following the submission of our Preliminary Foundation Report, some changes in the alignment were made; namely, the western portions were shifted westerly by some 200 feet whereas the alignment at the south-eastern corner was moved some 100 feet in an easterly direction. In addition, the locations of the passenger stations were revised slightly. A maintenance area was also proposed at the north-west corner of the C.N.E. grounds.

##### 4.2) Revised Alignment:

The additional investigation at the revised alignment revealed similar subsoil and bedrock conditions to those encountered in the initial investigation. Therefore, the general recommendations given in our Preliminary Foundations Report will be applicable for the new alignment.

As mentioned previously (Section 2.2.2), the glacial till at the north-east corner of the C.N.E. grounds (refer to B.H.'s #19 to #31, and B.H.'s #137 to #141) was found to be somewhat weaker than that at elsewhere. It is, therefore, recommended that the spread footings in this portion of the alignment be designed using a lower allowable bearing value of 4 t.s.f. Elsewhere, however, an allowable bearing value of up to 5 t.s.f., as quoted in the Preliminary Foundation Report, may be used.

4.3) Pressuremeter Tests (Refer to B.H.'s #101, #102, #104, #129, #139 and #143):

In order to determine the modulus of horizontal subgrade reaction ( $K_h$ ) for the various soil types and weathered and sound bedrock, Golder and Associates, Geotechnical Consulting Engineers, was retained by this Office to carry out Menard Pressuremeter testing at six locations along the new alignment. The design values of the modulus of horizontal subgrade reaction for various soil and bedrock types are tabulated below:

Modulus of Horizontal Subgrade Reaction ( $K_h$ )  
For Pile Foundations

Soil and Bedrock Type	Modulus of Horizontal Subgrade Reaction ( $K_h$ ) in Tons/sq. ft./ft. for 2R =				
	18 in.	24 in.	30 in.	36 in.	48 in.
Fill Material (Reclaimed Area)	0	0	0	0	0
Stiff Glacial Till ( $N$ value $\leq 40$ blows/ft.)	60	50	40	35	30
Hard Glacial Till ( $N$ value $> 40$ blows/ft.)	245	200	170	150	120
Weathered Shale	490	400	340	295	240
Sound Shale	5,000	4,225	3,700	3,300	2,760

The detailed descriptions and results of these tests were presented in a report prepared by Golder and Associates, Geotechnical Consulting Engineers, dated March 21, 1973, one copy of which has been forwarded to you.

4.4) Unconfined Compressive Strength of Shale Bedrock:

As mentioned previously (Section 2), unconfined uniaxial compressive strength testing was carried out on seven selected core samples of the bedrock. The detailed description of each core sample was presented in the Geologist's report, contained in the Appendix of this report. The dimensions and testing results are tabulated below.

<u>Sample No.</u>	<u>Dimensions</u>	<u>Length to Diameter Ratio</u>	<u>Unconfined Compressive Strength (p.s.i.)</u>
S1	2-1/8" x 3-1/2"	1.7:1	11,550
S2	2-1/8" x 4-1/4"	2.0:1	10,140
S3	2-1/8" x 2-7/8"	1.4:1	9,440
S4	2-1/8" x 3-5/8"	1.7:1	5,980
S5	2-1/8" x 4-1/8"	1.9:1	1,160
S6	2-1/8" x 3-7/8"	1.8:1	1,340
S7	2-1/8" x 3-7/8"	1.8:1	1,900

It should be noted that samples S1, S2 and S3 are inter-bedded shale and limestone, which resulted with higher compressive strengths. The other four samples are more or less pure shale. Since the shale is bedded, it was found impossible to prevent a certain amount of separation along the bedding planes before being tested, thereby introducing undue differential pressures and premature failure. This will explain the low compressive strengths (S5, S6 and S7). Based on the test results and available information, it is our recommendation that unconfined compressive strengths ( $q_u$ ) of 5,000 p.s.i. and 1,200 p.s.i. be used respectively for sound shale and weathered and/or fractured shale in the design of the foundations.

4.5) Proposed Maintenance Area (Refer to B.H.'s #107, #109 and #112 to #118 Inclusive):

The proposed maintenance area is located at the northwest corner of the C.N.E. grounds. At this stage, the alignment of the service track and the location of the maintenance buildings are not yet finalized. Therefore, only general recommendations will be given.

The predominant stratum in this general area is a heterogeneous mixture of clayey silt, with some sand and gravel (glacial till) which is competent. At certain locations, the glacial till is overlain by heterogeneous fill up to 8 ft. thick (B.H. #107). It is, therefore, recommended that the proposed structure be founded on spread footings within the hard cohesive glacial till stratum using an allowable bearing pressure of up

to 5 tons per square foot. A minimum earth cover of 4 feet should be provided to the underside of the footings for frost protection purposes. The exact founding elevations will, however, not be able to determine until the foundation locations become available. Recommendations regarding excavation for the footings and dewatering, which were given in the Preliminary Report, are applicable in this area.

4.6) Proposed Passenger Stations:

According to available information, this rapid transit system will incorporate four passenger stations. Since the exact footing locations for the stations are not available, only general comments will be discussed.

i) South Station (Refer to B.H.'s #1, #126, #128 and #129):

The south station is located within the reclaimed area, where the composition and the compaction of the fill material are variable. It is, therefore, recommended that the station foundations be supported on drilled-in caissons socketed into sound bedrock. Recommendations pertaining to the design and installation of the caissons have been discussed in our Preliminary Foundation Report and elsewhere in this addendum.

ii) West Station (Refer to B.H.'s #106 - #109 Inclusive):

At this location, up to 8 feet of miscellaneous fill material was found overlying the hard glacial till, which, in turn was underlain by shale bedrock. Therefore, the station foundations be supported on spread footings within the hard glacial till stratum, using an allowable bearing value of up to 5 t.s.f.

iii) North Station (Refer to B.H.'s #32, #144 & #145):

At this location, 6 feet of fill material was found overlying the cohesive glacial till, which extends to some 18 feet below the ground level. Spread footings founded at or below elevation 265 may be designed using an allowable bearing value of up to 4 t.s.f.



iv) East Station (Refer to B.H.'s #137, #139 & #140):

The overburden at this location consists of 23 to 28 feet of clayey silt till. The consistency of this stratum decreases from hard at the upper 5 to 10 feet to stiff with depth. It is, therefore, recommended that the station foundations be supported on spread footings located within the upper hard glacial till, using an allowable bearing value of up to 4 t.s.f.

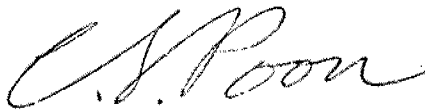
Recommendations with regard to foundation excavations and dewatering, discussed under appropriate headings in the Preliminary Foundation Report, are still applicable at the station locations.

5. MISCELLANEOUS:

The field work for this project was carried out between February 20 and March 14, 1973, under the supervision of Mr. C. S. Poon, Project Foundations Engineer, who also prepared this report.

The equipment used was owned and operated by Dominion Soils Investigation Ltd., Toronto.

This project was under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.

  
C. S. Poon, P. Eng.

  
M. Devata, P. Eng.



CSP/ao  
May 4, 1973.

APPENDIX I

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. M. D. Harmelink, (6)  
Head, Urban Systems Research,  
East Bldg., Downsview.

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

ATTENTION:

DATE: September 22, 1972.

OUR FILE REF.

IN REPLY TO

SEP 25 1972

SUBJECT:

PRELIMINARY  
FOUNDATION INVESTIGATION REPORT  
For Proposed  
Intermediate Capacity Public Transit System  
(Pilot Scale Test)  
Canadian National Exhibition Grounds  
Metropolitan Toronto, Province of Ontario, Canada  
W.O. 72-11101 -- W.P. 97-72-01

In order to provide sufficient information with regard to Ministry's evaluation of new intermediate capacity transit systems with the objective of selecting the most appropriate system for a pilot scale testing on C.N.E. grounds, we are forwarding to you our Preliminary Foundation Investigation Report. Presented in this report are the results of this investigation, together with our comments pertaining to the elevated system foundations.

We believe that the information contained therein will be sufficient for your preliminary design and cost estimate of the system. Should you require further data, or clarification of the report, please do not hesitate to contact our Office.

*A. G. Stermac*

A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.

AGS/ao  
Attach.

cc: E. J. Orr  
B. R. Davis  
A. Rutka  
P. J. Harvey  
H. Greenland  
B. J. Giroux  
T. J. Kovich  
G. A. Wrong  
B. A. Singh

Foundations Files ✓  
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-

PRELIMINARY  
FOUNDATION INVESTIGATION REPORT  
For  
Proposed Intermediate Capacity Public Transit System  
(Pilot Scale Test)  
Canadian National Exhibition Grounds  
Metropolitan Toronto, Province of Ontario, Canada  
W.O. 72-11101 -- W.P. 97-72-01

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1. INTRODUCTION:

The Ministry of Transportation and Communications, Province of Ontario, is presently carrying out a study to evaluate new intermediate capacity transit systems. The objective of this study is to select the most promising system for a pilot scale section to be constructed in 1973-74 on the Canadian National Exhibition grounds, in Metropolitan Toronto. The Foundations Office was requested to carry out a subsurface investigation at the proposed site; the scope of the investigation should be such that it provides all the information necessary to carry out a preliminary design for the guideway as well as a cost estimate. This request was contained in a memo from Mr. M. D. Harmelink, Head, Urban Systems Research (dated August 25, 1972). An investigation was subsequently carried out to determine the soil, bedrock and groundwater conditions across the site.

This report contains the factual data obtained from this investigation, together with preliminary recommendations pertaining to the foundation support for the elevated Public Transit System trial pilot section. A detailed foundation investigation will be required once the finalized design details have been specified.

## 2. SITE AND GEOLOGY:

The site is located on the Canadian National Exhibition (C.N.E.) grounds, which is situated on the north shore of Lake Ontario, in Metropolitan Toronto. The C.N.E. grounds encompasses an area approximately 5,000 feet long from east to west and extending 2,000 feet inland from the present lake shore. As illustrated on Drawing No. 72-11101 A, the southern portion of this area is reclaimed land; the present shore line (1972) extends as much as 600 feet beyond the shore line that existed in 1912.

The terrain, within the confines of the C.N.E. grounds, is gently undulating in relief with the ground surface varying from elevation 250 feet, adjacent to the lake, increasing to elevation 285 feet in the north-west corner. Lake Ontario is at about elevation 246 feet. Numerous buildings are located on the Exhibition grounds as well as a football stadium and related recreational facilities. The area is linked by paved roadways. Major paved multi-lane expressway complexes provide access to and from the grounds, namely Lake Shore Boulevard on the shore of Lake Ontario and the Gardiner Expressway on the northern boundary of the C.N.E. The grade of the former is approximately 10 feet below the terrain on the C.N.E. grounds north of the roadway, while the latter is carried on an elevated structure extending up to 25 feet above the ground surface. In addition, east-west running Canadian National Railway tracks are located immediately north of the Gardiner Expressway. These are primarily used by rapid transit commuter trains which provide two way service to Toronto (GO Transit System).

Immediately opposite the Exhibition grounds a series of man made islands have been formed; various buildings and pavilions have been constructed on these islands. The islands have been joined by elevated walk ways. This complex, which has been developed by the Ontario Provincial Government for recreational purposes, is known as Ontario Place.

The geologic history of the Lake Ontario Basin is quite complex; a description of the events which led to the present

conditions are presented in detail by Chapman and Putman, 1966, and Hough, 1966. Toronto was selected as a site for urban development because of its harbour. The harbour in its natural state was a phenomenon of the Lake Ontario shoreline and a product of the waves and currents of that water body. The land on which the first settlement was made was an inheritance from the realm of a previous water body known as Lake Iroquois. The early stages of Lake Iroquois came into being about 9,000 years ago. At this time the glacial lake had its outlet at Rome, New York, U.S.A. (outlet elevation 440 feet), eventually running down the Mohawk and Hudson Valleys to the Atlantic Ocean. Lake Iroquois expanded as the glacial ice washed away and ultimately it spread over a vast area forming what is known as the Iroquois beach. The beach is not horizontal but instead is tilted up toward the north east; in general, the beach increases in elevation at the rate of 50 to 60 feet per mile. It is believed that this tilting is the result of isostatic rebound as the glacial ice was removed by melting. This tilting took place along a line; this uplift line passes through the north-eastern part of the Lake Erie basin, a few miles south-west of Buffalo, New York, U.S.A. (elevation 330 feet). A shore cliff, up to 75 feet in height, exists at the northern limits of the beach. In Toronto the shore cliff is located approximately 2 miles north of the C.N.E. grounds. Lake Iroquois underwent changes during more recent geologic periods. These changes, however, primarily affected the area east of the City of Toronto and had little bearing on the features at the site being investigated.

The Lake Ontario basin itself is oriented parallel to the strike of beds which dip gently to the south. The southern rim is formed by the cuesta or outcrop of the tilted Niagaran dolomite. The greater part of the basin has been excavated in the soft shale of the Queeston formation, Ordovician Period. The extreme northern portion, however, is underlain by a more resistant limestone of Ordovician age.

In the reclaimed area, adjacent to the north shore of Lake Ontario, it is known that up to 20 feet of fill is present.

This fill, which was obtained from random sources, is of a heterogeneous composition. The fill is generally underlain by a thin (5 feet or less) layer of silt and sand deposited by Lake Iroquois. North of the reclaimed area the Iroquois beach has cut into a previously deposited cohesive glacial till; the till varies from 10 to 25 feet in thickness.

The overburden is known to be underlain by weathered to fresh, dark grey shale of the Meaford-Dundas formation, Ordovician Period.

### 3. FIELD INVESTIGATION AND LABORATORY PROCEDURES:

#### 3.1) Field Investigation:

The field work consisted of sixty six sampled boreholes, twenty four of which were accompanied by dynamic cone penetration tests. In addition, one boring, put down during previous investigation (W.O. 72-11059) in this area is included because of its close proximity to the proposed alignment of the rapid transit system. The borings were drilled by five continuous flight auger machines and one conventional diamond drill rig; all machines are adapted for soil sampling purposes. Three of the continuous flight auger machines are equipped with hollow stem augers. The continuous flight augers are generally 4 inches in diameter, whereas the hollow stem augers are about 7 inches in diameter.

Relatively undisturbed samples in the cohesive soil were obtained by means of 2 inch I.D. Shelby tubes which were pushed into the soil hydraulically by the drilling machine. Disturbed samples in all deposits were recovered by means of a standard 2 inch O.D. split spoon sampler driven into the soil with an energy of 350 ft.-lb. per blow according to the specifications of Standard Penetration Test. The same method was used to advance the dynamic cone penetration test. BX or BXL size rock core samples were obtained at 29 boring locations to prove bedrock conditions.



Field vane tests were carried out, where possible, to determine the in situ undrained shear strength of the cohesive stratum, using a standard M.T.C. 2-5/8"  $\emptyset$  field vane having dimensions such that the undrained shear strength equals twenty times the applied torque at failure. The vane tip was advanced eighteen inches into the undisturbed soil in a single thrust without any rotation of the rod. The torque was then applied and the value at failure recorded. The vane was then rotated six complete turns and a remoulded test was carried out in the same fashion.

Groundwater level observations were carried out, during and after the period of the investigation, in the open boreholes. In addition, nine piezometers of 'TerraTest Type'\* were installed at seven boring locations. At each location, a piezometer connected to 1/2" plastic tubing, was installed within either the cohesive glacial stratum or the shale bedrock. A bentonite seal was made some 10 feet higher than the piezometer and the remainder of the hole made for piezometer installation was filled with sand and gravel. The tip elevations of the various piezometers were shown on individual Record of Borelog sheets, contained in Appendix I of this report. Piezometric water level readings were taken periodically and the results are also shown on the borelog sheets.

The soil, bedrock and groundwater conditions encountered at the boring locations, are presented in the Record of Borehole sheets. The location and elevation of the various boreholes were surveyed in the field by personnel from Engineering Surveys, Central Region, Ministry of Transportation and Communications. The elevations in this report are referred to a geodetic datum and the locations are referenced to a coordinate system. Boring locations and elevations are shown on Drawing No. 72-11101 A. Estimated stratigraphical profile along the alignment of the proposed rapid transit system and sections are also plotted on Drawings No. 72-11101 B, C and D.

....6

\*Manufactured by TerraTest Piezometers, Toronto, Ontario, Canada.

### 3.2) Laboratory Procedures:

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

Natural Moisture Content

Atterberg Limits

Grain-Size Distribution

Bulk Density

Undrained Shear Strength

The bedrock samples were carefully inspected by our geologist, Mr. K. Ingham. The results of the testing and visual examination of the bedrock are plotted on the Record of Borehole sheets and summarized on Figures No. 1 to 4, inclusive, all contained in Appendix II of this report.

## 4. SUBSOIL AND BEDROCK CONDITIONS:

### 4.1) General:

The extent and composition of the overburden, within the area under investigation, varies markedly. The predominant stratum in the northern part of this region, is composed of a heterogeneous mixture of clayey silt, some sand and trace of gravel (Glacial Till), which is overlain by a granular deposit of silty sand with gravel between Station 111+00 and Station 122+00. This cohesive stratum varies from 11 feet (B.H. #47) to 25 feet (B.H. #23) in thickness. Underlying the cohesive glacial till stratum is dark grey shale bedrock of Meaford-Dundas Formation. The northern part of the site is generally covered by fill material up to 11 feet in thickness.

The southern part of the site is located in a reclaimed area (Sta. 134+00 to Sta. 189+00). The composition of the fill material is quite random. In several boring locations, a thin layer of fine to medium sand was found between the fill material and the underlying dark grey shale bedrock.

The stratigraphical sequence encountered in the borings is plotted on the Record of Borelog sheets. Stratigraphical sections have been inferred from this data and plotted on Drawing No. 72-11101 B, C and D. The subsoil and bedrock encountered from ground surface downward, is presented in the subsections to follow.

4.2) Fill Material:

4.2.1) Reclaimed Area (Sta. 134+00 to Sta. 189+00):

Fill was placed to reclaim the southern portion of this site from Lake Ontario. The extent of this reclaimed area is illustrated on Drawing No. 72-11101 A. At these locations, between 10 and 22 feet of fill material was encountered. The composition of this fill is found to be quite variable, ranging from clayey silt with some sand and gravel at some locations to sand and gravel at others. Random pockets and/or layers of organic matter, wood chips, concrete and brick fragments are present throughout the fill.

Standard Penetration testing, carried out in the fill material, gave 'N' values ranging from 1 to 83 blows per foot. The higher values were encountered in the upper 3 to 4 feet, with the lower values being dominant. Based on these results, it is estimated that the fill has been well compacted in the upper zone, and negligible to no compactive effort has been provided in the lower portion of the fill. This lower zone, however, is below the groundwater level recorded during the period of the investigation. It is difficult to compact material placed below water; this would explain the reason for the variability of the compactive effort with depth.

In addition, results of grain-size distribution testing and Atterberg limit tests, performed on sample recovered in this stratum were plotted on the Record of Borehole sheets, as

well as on respectively Figure 1 and Figure 3 of Appendix II. They are also tabulated below:

		<u>Range</u>	<u>(Average)</u>
Liquid Limit	(W <sub>L</sub> ) %	16 - 32	(26)
Plastic Limit	(W <sub>P</sub> ) %	12 - 20	(15)
Natural Moisture Content	(W) %	11 - 23	(18)

Referring to the above table, it can be seen that the cohesive portion of the fill material has a plasticity in the low range.

4.2.2) North of Reclaimed Area (Refer to B.H.'s 19-50 Inclusive & B.H.'s 60-66 Inclusive):

A layer of fill material up to 11 feet thick was encountered in most of the boreholes put down in this area. In general, the fill material is composed of a mixture of clayey silt with some sand and gravel, which is similar in composition to the underlying cohesive glacial till. At certain locations where the borings penetrated through existing pavement, a layer of sand and gravel was found overlying the cohesive fill material mentioned above. Grain-size distribution curves and Atterberg limit testing results, for the samples of this stratum, are presented on Figures #1 and #3 of Appendix II, respectively.

Standard penetration testing was carried out within this stratum and the results were plotted on the individual Record of Borehole sheets. The 'N' values generally vary from 7 blows/ft. to 30 blows/ft. with exceptionally high values where gravel and/or cobbles exist. Based on these 'N' values, it is estimated that the consistency of the fill material varies from firm to very stiff.

4.3) Granular Deposits:

In the reclaimed area, between Sta. 173+00 to Sta. 182+00, a thin layer of fine to medium sand or sandy silt with trace of gravel was found overlying the shale bedrock. The thickness of this layer is between 2 and 5 feet. It is believed that this

granular stratum was deposited by Lake Iroquois. Standard Penetration testing carried out in this stratum gave 'N' values ranging from 3 blows/foot to 14 blows/foot. It is, therefore, estimated that the relative density of the granular stratum is very loose to compact.

At the north-west corner of the site (between Sta. 111+00 and Sta. 117+00), a layer of silty sand with gravel, between 4 and 6 feet thick, was found underlying the fill material. Standard Penetration testing was carried out in this stratum. The 'N' values vary between 32 blows/ft. and over 100 blows/ft. It is estimated that the relative density of this granular layer is compact to very dense.

4.4) Heterogeneous Mixture of Clayey Silt, Some Sand and Trace of Gravel (Glacial Till):

This stratum was encountered in all but those boreholes located within the reclaimed area. It consists of a heterogeneous mixture of clayey silt with some sand and trace of gravel. The thickness of this stratum varies between 10.5 feet and 24.5 feet. Occasional silty sand layers, up to 4 feet in thickness, were encountered within this stratum. In general, the upper 3 to 9 ft. of this stratum is brown in color whereas the lower portion is grey. However, the engineering properties of the soil in these two zones, are similar.

Grain-size distribution curves and results of Atterberg Limit tests for the samples of this stratum, are plotted on Fig. 2 and Fig. 4, respectively, of Appendix II. It is seen from Fig. 4 that the tests results plot in the CL region of the Plasticity Chart (except for four results) indicating in general, a low plasticity. The engineering properties of the cohesive glacial till deposit are tabulated below:

<u>Identity Tests</u>			<u>Range</u>	<u>(Average)</u>
Bulk Density	( $\gamma$ )	p.c.f.	134 - 136.5	(135)
Liquid Limit	( $W_L$ )	%	20 - 41	(28)
Plastic Limit	( $W_p$ )	%	10 - 20	(16)
Natural Moisture Content	(W)	%	8 - 23	(15)

Field vane tests were carried out in the cohesive glacial till deposit wherever possible. The results are plotted on the Record of Borehole sheets. In general, the in situ undrained shear strength is higher than 2,000 p.s.f. Relatively 'undisturbed' samples were obtained by hydraulically pushing 2" I.D. Shelby tubes into the subsoil, where the field vane tests or Standard Penetration tests indicate the existence of softer layers. Three laboratory unconfined compressive strength tests were carried out. The results are tabulated below:

	<u>Range</u>	<u>(Average)</u>
Field Vane Tests (p.s.f.)	1,700 - >2,000	( >2,000)
Laboratory Tests (p.s.f.)	630 - 1,120	(900)

Based on these results, it is estimated that the consistency of this deposit ranges from stiff to hard.

#### 4.5) Bedrock:

Bedrock was found underlying the overburden. The bedrock was proven in 29 of the boring locations by obtaining 5 to 20 feet of BX or BXL size rock cores.

The bedrock samples were carefully examined by Mr. K. W. Ingham, Geologist, Ministry of Transportation and Communications. The description of the bedrock and an interpretation of geologic conditions existing at this site, are contained in a memorandum from Mr. Ingham to this Office. A copy of this memorandum is enclosed in Appendix III of this report.

The bedrock intersected in each hole was found to be typical of the Dundas Formation, which is the characteristic bedrock found in subcrop within the Toronto area. The rock is predominantly a platy bedded dark grey shale with interbeds of silty limestone and/or limestone ranging in thickness from 1/2 inch to 6 inches. The latter constitute only 20 percent or less of the formation, but in certain places may form as much as 30 to 40 percent of the section.

The bedrock surface was found to vary between elevations 232 and 260 ft. In general, the surface increases in elevation in a north-westerly direction.

A thin transition zone was encountered between the overburden and the bedrock. The shale bedrock in the upper portion is weathered and moderately to badly fragmented. The harder bands of silty limestone and limestone are generally moderately fragmented within this zone, which is rarely more than 2 to 4 ft. in thickness. At some locations there is a partially weathered zone overlying the sound bedrock in which incipient weathering is present along certain layers; however, for foundation purposes this is considered to be sound bedrock.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during and after the period of the investigation by recording the water level in the open borings. In addition, nine piezometers of 'TerraTest Type' were installed within either the cohesive glacial till or the shale bedrock. The tip elevations of the various piezometers were shown on individual Record of Borehole sheets, contained in Appendix I of this report. Piezometric water level readings were taken periodically. The observations are recorded on the Borelogs as well as summarized on Drawings 72-11101 B, C and D. At certain locations where it is necessary to backfill the borehole immediately after the completion of the drilling operations, groundwater level was not established.

The results of the measurements indicate that the groundwater level, varies from 2 to 23 feet below existing ground surface, which corresponds to elevation between 246 and 281 ft. Over the reclaimed area, however, the groundwater level ranges from elevations 246 to 248. It is believed that the groundwater level in the reclaimed area is affected by the lake level, which is at elevation 246 during the period of the field investigation.

6. DISCUSSION:

6.1) General:

At present, studies are in progress to evaluate new intermediate capacity transit systems with the objective of

selecting the most promising system for a pilot scale testing program on Canadian National Exhibition grounds in Metropolitan Toronto, Province of Ontario, during 1973-74 by the Provincial Ministry of Transportation and Communications. In order to obtain sufficient data for the design and cost estimate for the system, a preliminary foundation investigation consisting of 66 borings was carried out. These borings revealed that the subsoil consists of random fill material at the southern portion of the site and cohesive glacial till elsewhere. The overburden is underlain by dark grey shale bedrock of Dundas formation.

At this stage, the details of the system including the specific foundation locations have not been finalized. Preliminary profile (unnumbered) indicates that the system will be an elevated one except in one of the four proposed station locations. The present information indicates that the elevated system will be operating in a counter-clockwise direction, incorporating four stations at appropriate locations inside the C.N.E. grounds or Ontario Place.

#### 6.2) Foundation Considerations:

As discussed previously, subsoil and bedrock conditions are quite variable within the area under investigation. In the southern portion (Sta. 134+00 to Sta. 189+00), the predominant deposit consists of fill material utilized for reclaiming land from Lake Ontario, underlain by shale bedrock at a depth of 10 feet to 23 feet. At certain locations, bedrock is overlain by a thin layer of post-glacial granular deposit. In the northern portion (Sta. 100+00 to Sta. 134+00, and Sta. 189+00 to Sta. 217+90) the predominant deposit is a heterogeneous mixture of clayey silt, some sand and trace of gravel (glacial till) underlain by shale bedrock at a depth of 15 feet to 32 feet.

From a foundation point of view, it will be advantageous, especially in the southern reclaimed area, to select a scheme which can be anchored into the sound shale bedrock. A concise review of available literatures was carried out to obtain preliminary design criteria, for caissons socketed into shale bedrock. Since the overburden at this portion of the site is



incompetent and the system may be subjected to uplift loads, it is recommended that the proposed system elements be supported on caissons socketed from 4 feet to 6 feet into sound shale bedrock. It is estimated that a 30" diameter concrete caisson may be designed for a safe allowable load of 250 tons. In computing the uplift resistance, an allowable adhesion of 7.5 t.s.f. may be used between the concrete socket and the sound shale bedrock. It is suggested that the adhesion between the concrete and the weathered shale as well as the overburden material be neglected for preliminary computations. Most of the available design methods are mainly empirical with little or no relationship to the in situ quality of rock. In order to evaluate precisely the bearing capacity as well as the socket skin friction of caissons, it will be necessary to carry out full scale load and uplift tests when design details become available.

In order to minimize dewatering problems, caissons should be installed with a temporary liner. It should be noted that the shale bedrock is generally fractured and groundwater may readily percolate into the liner from the base of the caisson. In such a case, a tremie concrete seal will be necessary at the base of the caisson.

In the northern portion (Sta. 100+00 to Sta. 134+00 and Sta. 189+00 to Sta. 217+90), the overburden is generally competent. As a result of this, the foundation of the proposed system may be founded on spread footings, within the hard cohesive glacial till stratum using an allowable bearing capacity up to 5 tons per square foot. A minimum earth cover of 4 feet should be provided to the underside of the footings for frost protection purposes. The appropriate founding elevation at various locations are summarized in the following table.

<u>Location</u>	<u>Refer to</u>	<u>Founding Elevation</u>
Sta. 100+00 to Sta. 103+00	B.H.'s #32 - 33	265
Sta. 103+00 to Sta. 109+00	B.H.'s #34 - 36	272
Sta. 109+00 to Sta. 122+50	B.H.'s #37 - 44	278
Sta. 122+50 to Sta. 127+00	B.H.'s #45 - 46	270
Sta. 127+00 to Sta. 129+00	B.H. #47	265
Sta. 129+00 to Sta. 134+00	B.H.'s #48 - 50	260

<u>Location</u>	<u>Refer to</u>	<u>Founding Elevation</u>
Sta. 189+00 to Sta. 193+50	B.H.'s #19 - 20	258
Sta. 193+50 to Sta. 198+00	B.H.'s #21 - 23	262
Sta. 198+00 to Sta. 207+00	B.H.'s #24 - 27	265
Sta. 207+00 to Sta. 217+90	B.H.'s #28 - 31	268

As mentioned previously, this system may be subjected to uplift loads. In order to provide adequate uplift resistance it is necessary to anchor the footing to a sufficient depth into the underlying hard glacial till stratum or shale bedrock, if necessary. A number of uplift tests have been carried out by Ontario Hydro-electric Power Commission (J. I. Adams and T. W. Klym, 1971). After reviewing these results, we suggest that the footing should be grout-anchored into the hard glacial till stratum for a minimum depth of 15 feet. For example, a 5 inch diameter anchor rod installed as mentioned above may be subjected to a safe uplift load of 25 tons.

Excavations for the spread footing type of foundation will extend either through the fill material at certain locations or surficial granular deposits elsewhere, into the underlying cohesive glacial till deposit. In majority of the cases, the observed groundwater level is above the founding elevation of the spread footing. Care should be exercised to prevent any inflow of water into the excavations from the upper surficial granular layers.

Alternatively, this portion of the system can also be supported on concrete caissons socketed into the sound shale bedrock. The design considerations will be similar to those discussed elsewhere in this report.

It should be stressed that the comments given in this report are of a preliminary nature. A complete foundation investigation together with full scale field load and uplift tests will be required, once the system has been finalized and the design details become available.

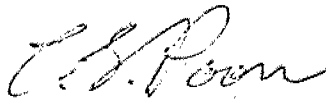
7. MISCELLANEOUS:

The field work was carried out between September 5 and September 14, 1972, under the supervision of Mr. C. S. Poon, Project Foundations Engineer. He was assisted by Messrs. E. C. Ballinger, J. Cortabarría, V. Katic and G. Aubertin, Field Technicians.

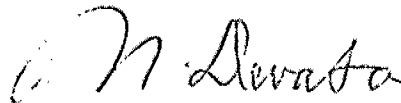
The equipment used was owned and operated by Dominion Soil Investigation Ltd. and Master Soils Investigation Ltd., Toronto.

This report was prepared by Mr. C. S. Poon, Project Foundations Engineer.

This project was under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.



C. S. Poon, P. Eng.



M. Devata, P. Eng.



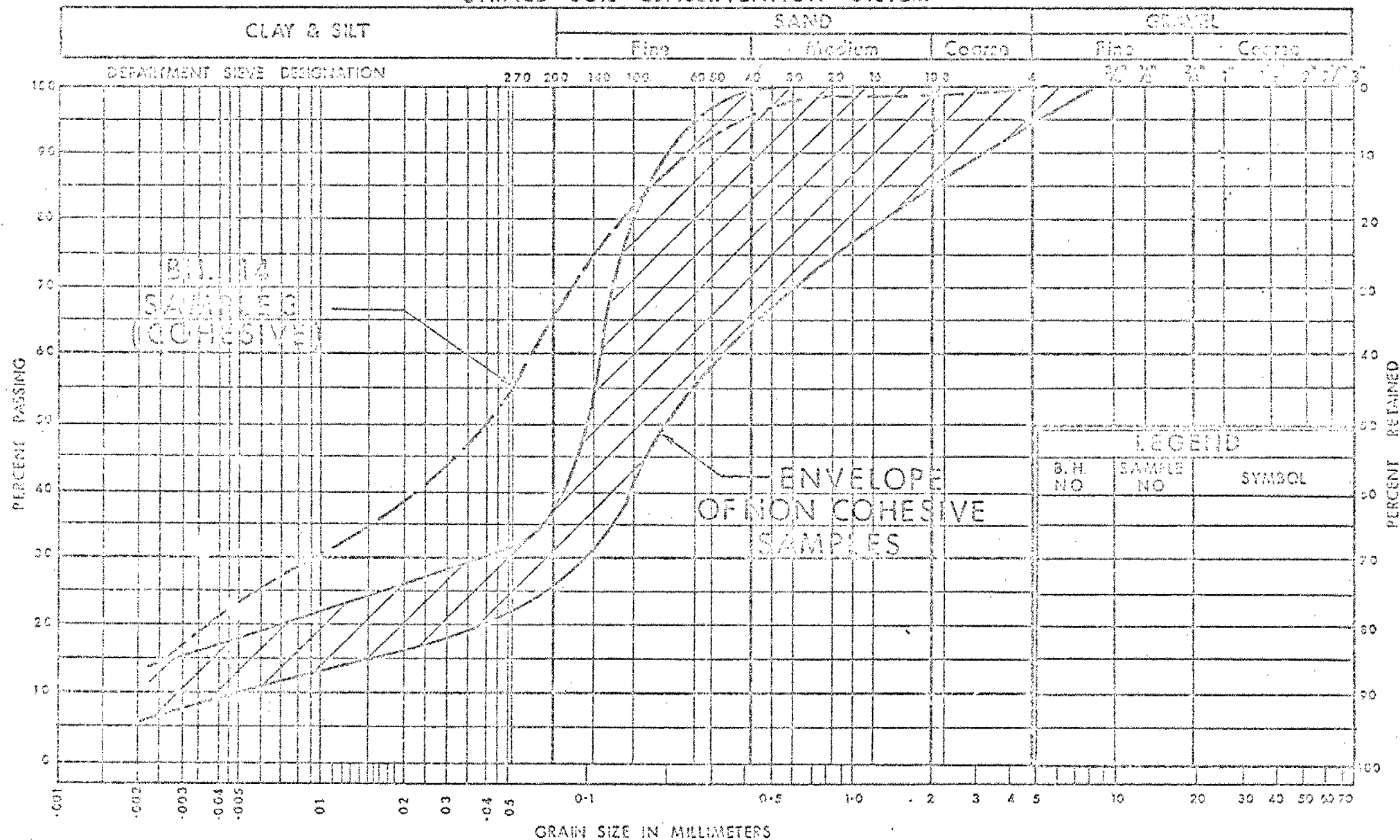
CSP/ao

Sept. 25, 1972.

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## UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS  
DESIGN SERVICES  
BRANCH

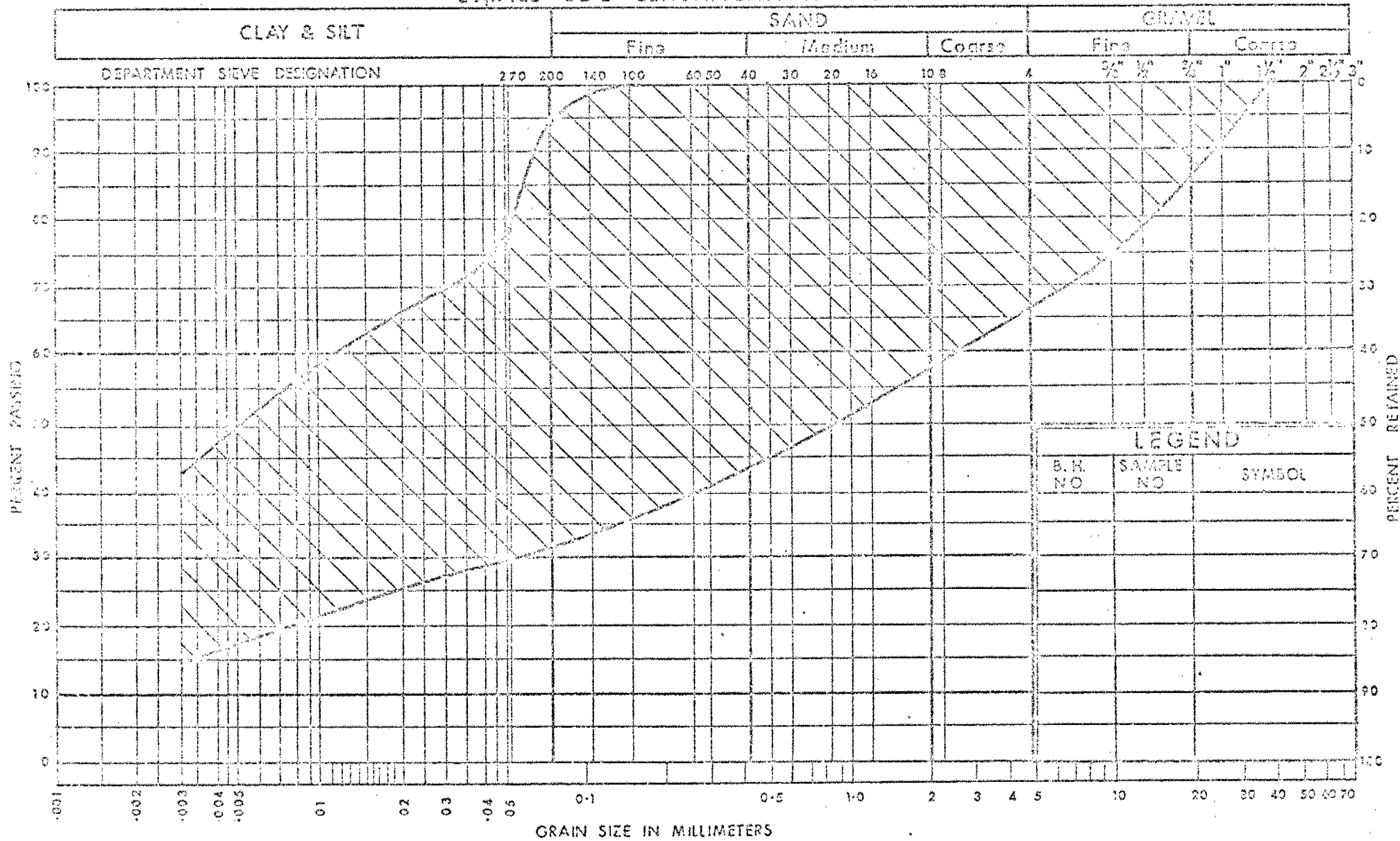
GRAIN SIZE DISTRIBUTION  
FILL MATERIAL

W.F. No. 97-72-01

Doc No. 72-11101

FIG. 1

## UNIFIED SOIL CLASSIFICATION SYSTEM



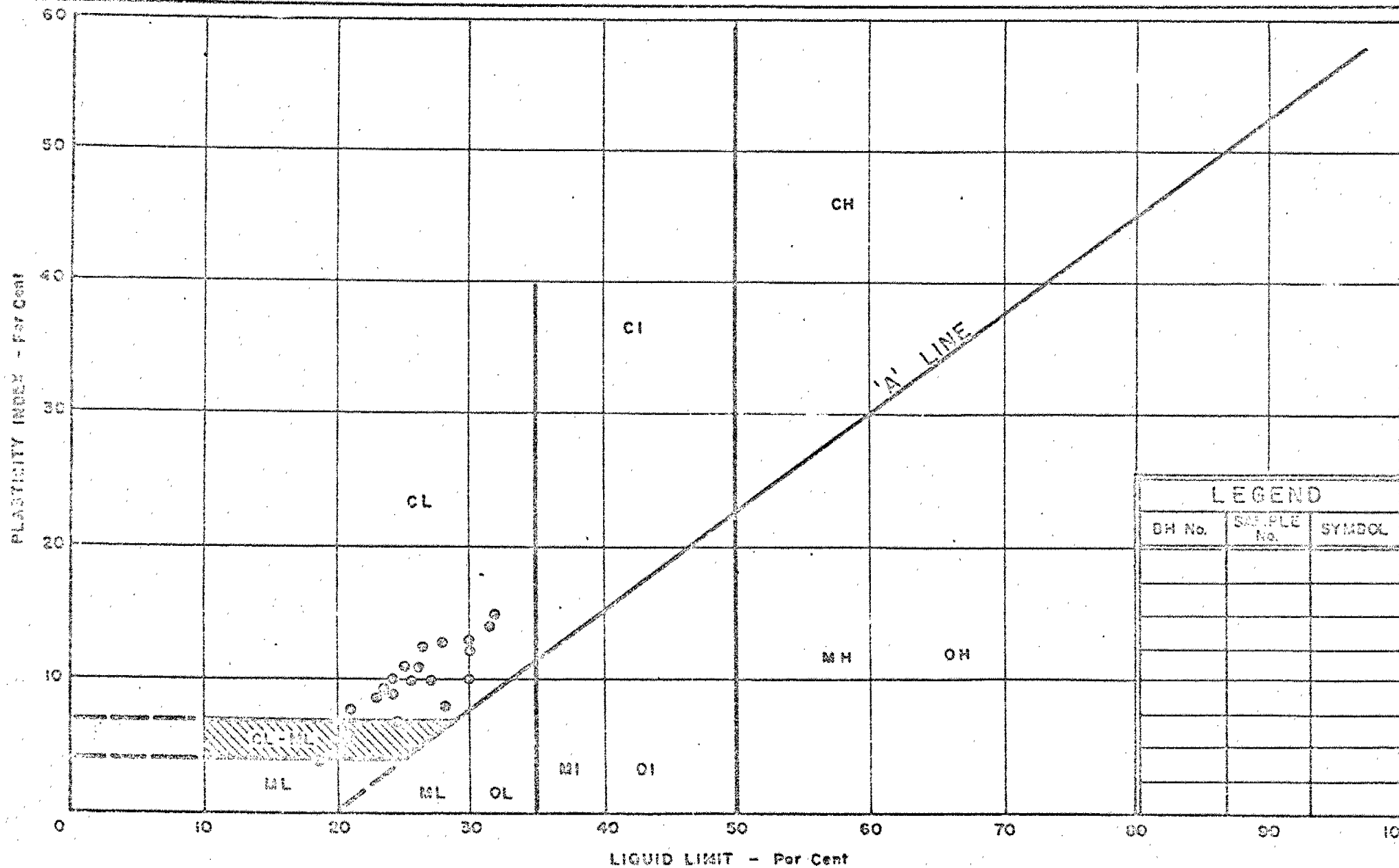
DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS  
DESIGN SERVICES  
DIVISION

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

W.R. No. 97-72-01

LOS No. 72-11101

FIG. No. 2



LEGEND		
DH No.	SAMPLE No.	SYMBOL



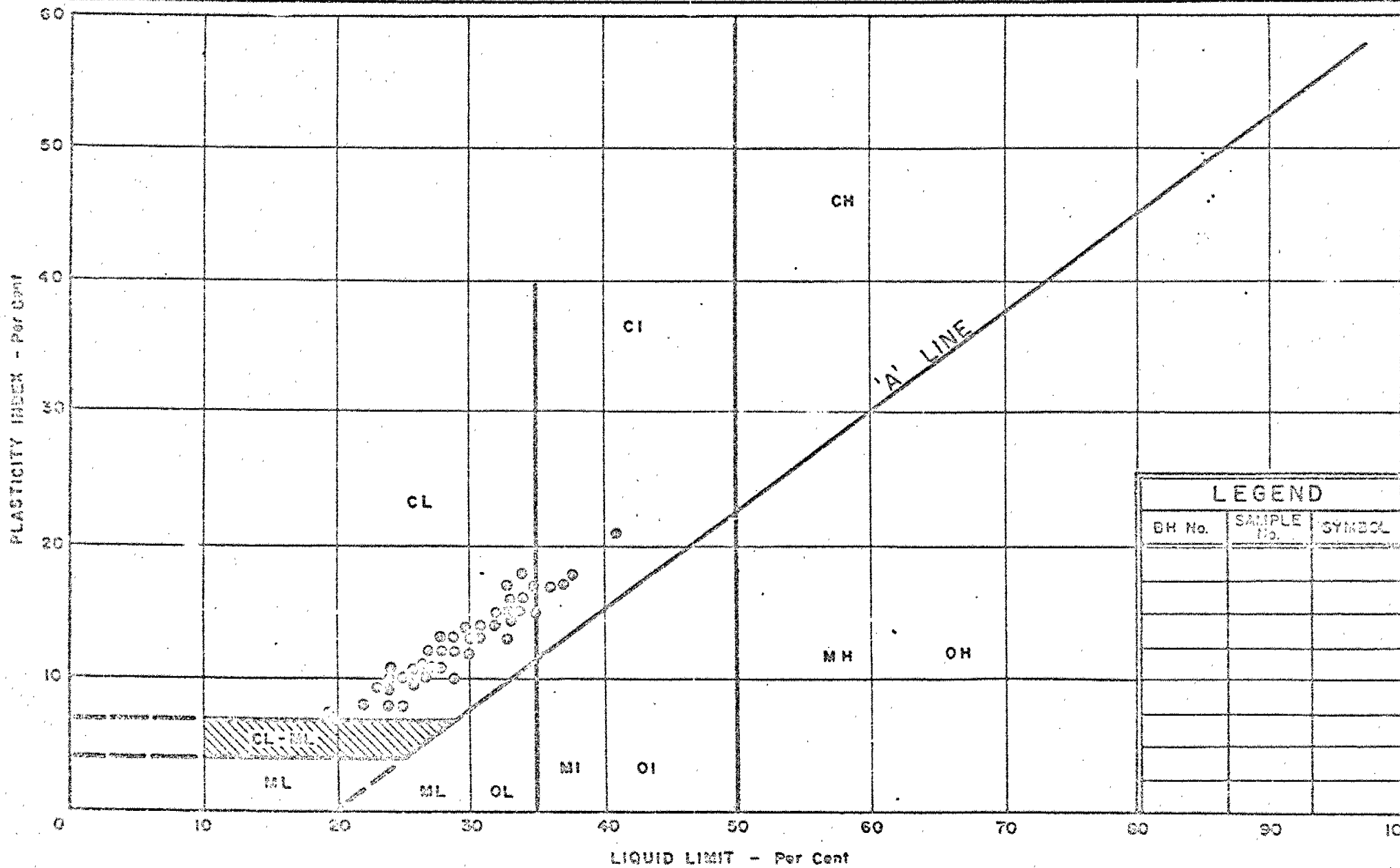
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# PLASTICITY CHART FILL MATERIAL (CLAYEY SILT WITH SAND & GRAVEL)

WR No. 97-72-01

JOB No. 72-11101

FIG. 3



# PLASTICITY CHART

## GLACIAL TILL

(HET. MIXTURE OF CLAYEY SILT, SOME SAND, TRACE OF GRAVEL)

W.R. No. 97-72-01

JDD No. 72-11101

FIG. 4



## DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

## MEMORANDUM

TO: Mr. A. Stermac,  
Pr. Foundation Engineer.

FROM: K. W. Ingham

ATTENTION:

DATE: September 20, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation - 7211101  
Experimental Rapid Transit Line  
C.N.E. Grounds, Toronto

A series of rock cores and soil samples were examined from 29 boreholes out of a total of 67 drilled at the site. The bedrock intersected in each hole was found to be typical of the Dundas formation, which is itself the characteristic bedrock found in subcrop within the Toronto area.

The rock is predominantly a platy bedded dark grey shale with interbeds of silty limestone and limestone ranging in size from 0.05 ft. to 0.5 ft. The latter constitute only 20 percent or less of the formation but may locally form as much as 30 to 40 percent of the section.

Generally the upper layers of the shale are weathered and moderately to badly fragmented and grade through a thin transition zone of shaly till into the overlying till material. The harder bands of silty limestone and limestone are generally moderately fragmented within this zone which is rarely more than 2 to 4 ft. thick. At some locations there is a partially weathered zone overlying the fresh bedrock in which incipient weathering is present along certain layers, however, for foundation purposes this is considered to be the same as the fresh bedrock.

A brief description of each rock core is given below together with the appropriate bedrock elevation.

Hole No. 1

Bedrock at 234.9

15.5 - 18.0

Dark grey shale; weathered.

18.0 - 23.0

Dark grey shale; frequent thin layers of silty limestone and limestone.

Hole No. 3

Bedrock at 232.3

16.0 - 24.2

Dark grey shale; occasional thin beds of silty limestone and limestone, partially weathered layers throughout.

Hole No. 5

Bedrock at 237.9

13.0 - 23.0

Dark grey shale, occasional beds of silty limestone and limestone 0.3 ft. to 0.5 ft. in thickness, partially weathered layers throughout.

Hole No. 9

Bedrock at 235.9

16.1 - 24.0

Dark grey shale; thin limestone bands, weathered.

24.0 - 34.0

Dark grey shale; frequent thin bands of silty limestone and limestone.

Hole No. 11

Bedrock at 234.3

18.0 - 27.0

Dark grey shale; occasional thin beds of silty limestone and limestone, partially weathered sections throughout.

Hole No. 13

Bedrock at 233.3

18.5 - 24.0

Dark grey shale, minor thin beds of limestone and silty limestone, weathered.

24.0 - 29.0

Dark grey shale; occasional beds of silty limestone and limestone 0.2 to 0.6 ft. in thickness.

Hole No. 15

Bedrock at 237.5

15.0 - 15.5

Dark grey shale; weathered.

15.5 - 20.5

Dark grey shale.

Hole No. 17

Bedrock at 239.8

18.5 - 22.0

Dark grey shale; thin beds of limestone, weathered.

22.0 - 29.0

Dark grey shale; minor thin beds of silty limestone and limestone.

Hole No. 19 Bedrock at 241.1

24.0 - 25.0 Dark grey shale; weathered.

25.0 - 30.0 Dark grey shale; occasional thin  
beds of silty limestone and  
limestone.

Hole No. 23 Bedrock at 242.8

31.5 - 36.5 Dark grey shale; minor thin  
limestone beds.

Hole No. 25 Bedrock at 250.4

24.0 - 33.0 Dark grey shale; minor thin  
limestone beds, weathered.

33.0 - 38.0 Dark grey shale; minor thin  
limestone beds.

Hole No. 27 Bedrock at 246.0

28.0 - 33.5 Dark grey shale; occasional  
thin beds of silty limestone  
and limestone, partially  
weathered throughout.

33.5 - 38.5 Dark grey shale; occasional beds  
of silty limestone.

Hole No. 29 Bedrock at 246.6

29.0 - 30.0 Dark grey shale; minor thin  
beds of limestone and silty  
limestone, weathered.

30.0 - 35.2 Dark grey shale; occasional beds  
of silty limestone and limestone  
0.2 ft. to 0.5 ft. in thickness.

Hole No. 31 Bedrock at 252.8

21.0 - 24.0 Dark grey shale; weathered.

24.0 - 29.0 Dark grey shale; occasional thin  
beds of silty limestone and  
limestone.

Hole No. 33

Bedrock at 257.7

18.5 - 20.0

Dark grey shale; weathered.

20.0 - 25.0

Dark grey shale; frequent beds of silty limestone and limestone 0.1 ft. to 0.6 ft. in thickness.

Hole No. 35

Bedrock at 253.7

27.0 - 29.0

Dark grey shale; weathered.

29.0 - 34.0

Dark grey shale; occasional beds of limestone and silty limestone.

Hole No. 37

Bedrock at 256.5

32.0 - 33.7

Dark grey shale; weathered.

33.7 - 38.5

Dark grey shale; frequent beds of silty limestone 0.2 ft. to 0.5 ft. in thickness, minor thin beds of limestone.

Hole No. 39

Bedrock at 257.9

27.0 - 30.0

Dark grey shale; weathered.

30.0 - 35.0

Dark grey shale; occasional thin beds of silty limestone and limestone.

Hole No. 41

Bedrock at 257.4

28.0 - 37.5

Dark grey shale; frequent beds of silty limestone and limestone 0.1 ft. to 0.4 ft. in thickness.

Hole No. 43

Bedrock at 260.3

27.5 - 28.0

Dark grey shale; weathered.

28.0 - 33.2

Dark grey shale; minor thin limestone beds.

Hole No. 45

Bedrock at 259.5

18.5 - 21.0

Dark grey shale; weathered, may include part of transition zone from overlying till.

21.0 - 27.2

Dark grey shale; frequent beds of silty limestone, minor thin beds of limestone.

Hole No. 47

Bedrock at 256.0

15.0 - 18.0

Dark grey shale; weathered.

18.0 - 23.1

Dark grey shale; occasional beds of silty limestone, minor thin beds of limestone.

Hole No. 49

Bedrock at 248.7

16.0 - 18.2

Dark grey shale; minor thin limestone bands, weathered.

18.2 - 19.9

Silty limestone and limestone in beds 0.3 ft. to 0.8 ft. in thickness.

19.9 - 22.4

Dark grey shale; occasional beds of limestone, minor thin beds of silty limestone.

Hole No. 51

Bedrock at 243.3

17.5 - 21.8

Dark grey shale; minor thin beds of limestone and silty limestone, partially weathered throughout.

Hole No. 53

Bedrock at 242.7

18.7 - 21.1

Silty limestone; minor thin beds of limestone and shale.

21.1 - 28.7

Dark grey shale; minor beds of silty limestone and limestone, occasional partially weathered sections.

Hole No. 55

Bedrock at 240.6

19.5 - 26.3

Dark grey shale; occasional beds of silty limestone and limestone, partially weathered throughout.

Hole No. 57

Bedrock at 242.3

9.5 - 12.5

Dark grey shale; minor thin beds of silty limestone and limestone, weathered in the top 2.0 ft. partially weathered in the lower 1.0 ft.

Hole No. 59

Bedrock at 237.4

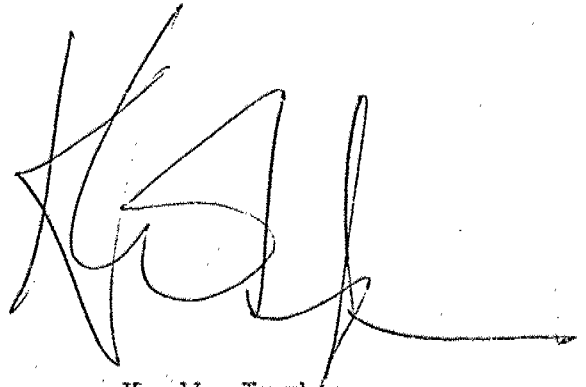
12.6 - 13.6

Dark grey shale; minor beds of  
silty limestone and limestone,  
partially weathered throughout.

13.6 - 17.8

Dark grey shale; minor thin  
beds of limestone.

KWI:mv

A large, stylized handwritten signature in black ink, likely belonging to K. W. Ingham, positioned above the printed name.

K. W. Ingham,  
Geologist.

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 1

JOB 72-11-101 -1

LOCATION Co-ord. 15,852,972 N; 1,021,309 E.  
15,852,972 N; 1,021,309 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXL Rockcore and Cone Test

CHECKED BY S/R

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT $w_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					PLASTIC LIMIT $w_p$				
							20	40	60	80	100 +	WATER CONTENT $w$				
							SHEAR STRENGTH P.S.F.					$w_p$ — $w$ — $w_L$				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT %				
							400	800	1200	1600	2000	10	20	30	P.C.F.	GR SA. SI. CL
250.4	Ground Level					250										
0.0	Fill Material															248.2
	Clayey silt with some sand and gravel, occasional brick pieces.		1	SS	15	245										
			2	SS	6											
			3	SS	5	240										
	Grey Soft to Firm		4	SS	4											
236.4	Fine to medium sand.					235										
14.0	Compact Black		5	SS	100											
235.1	Shale Bedrock															
15.3	Dark Grey Weathered															
232.4	Shale with frequent layers of siltstone and limestone.		6	BXL RC	36% Rec.	230										
18.0	Dark Grey Sound															
227.4	End of Borehole					225										
23.0																

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 2

JOB 72-11101-1 LOCATION Co-ords. 15,852,863 N; 1,021,498 E.  
W.P. 97-72-01 BORING DATE Sept. 14, 1972  
DATUM Geodetic BOREHOLE TYPE Washboring

ORIGINATED BY VK  
COMPILED BY JC  
CHECKED BY [Signature]

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	ELEV. SCALE	20	40	60	80	100	$w_p$	$w$	$w_L$	
248.5 0.0	Ground Level														
	Fill Material					245									
	Clayey silt, sand, gravel, cinders and pieces of wood.		1	SS	13	240									
	Firm Grey		2	SS	6	235									
233.8	Transition Zone		3	SS	60/2'										
14.7	End of Borehole Probable Bedrock					230									



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 3

JOB 72-11101-1

LOCATION

Co-ords.

15,852,948 N; 1,021,671 E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE

Sept. 14, 1972

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE

Washboring & BXL Rock Core

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		SHEAR STRENGTH P.S.F.				$W_P$ $W$ $W_L$ WATER CONTENT %					
							○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE									
248.3	Ground Level															
0.0	Fill Material					245									246.7	
	Sand with gravel and concrete fragments		1	SS	83											
239.3						240										
9.0	Clayey silt with trace of sand & gravel, pieces of decayed wood		2	SS	2											
	Grey-Brown Soft					235										
232.3	Transition Zone		3	SS	97/9"											
16.0	Shale Bedrock with occasional bands of limestone and siltstone, partially weathered throughout		4	BXL RC	98%	230										
			5	BXL RC	70%											
224.1	Dark Grey					225										
24.2	End of Borehole					220										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 4 15,853,057 N; 1,021,837 E

JOB 72-11101-1

LOCATION Co-ords. 852,248 N; 59,270 E

ORIGINATED BY EB

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p \quad w \quad w_L$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
251.1	Ground Level													
0.0	Fill Material					250								
	Sand, trace of gravel, silt, brick, pieces of cinders.		1	SS	25									216.9
			2	SS	8	245								
242.4	Loose to Compact													
9.0	Clayey silt with trace of sand, gravel		3	SS	4									
	brick pieces.					240								
237.9	Soft to Firm		4	SS	5									2 15 59 24
13.5														
	Brown-Grey Loose to Compact		5	SS	27	235								
232.8	Transition Zone		6	SS	100	230								
18.6	End of Borehole Probable Shale Bedrock													

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 5

15,853,128 N; 1,022,024 E.

JOB 72-11101-1

LOCATION

Co-ords. 852,322 N; 59,167 E.

W.P. 97-72-01

BORING DATE

Sept. 6, 1972

DATUM Geodetic

BOREHOLE TYPE

Hollow Stem Auger and BX Rock Core

ORIGINATED BY JC

COMPILED BY SO

CHECKED BY *AR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE						LIQUID LIMIT $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT						PLASTIC LIMIT $w_p$					WATER CONTENT $w$
							SHEAR STRENGTH P.S.F.						WATER CONTENT %					
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						$w_p$ — $w$ — $w_L$					
250.9	Ground Level						100	800	1200	1600	2000	10	20	30	P.C.F.	GR. SA. SI. CL.		
0.0	Fill Material					250										245.9		
	Clayey silt with trace of sand and gravel, and cinders.		1	SS	11													
244.9	Grey Stiff to Very Stiff		2	SS	17	245												
6.0	Sandy silt to silty sand, with trace of clay and cinders		3	SS	10													
			4	SS	6													
			5	SS	8	240												
			6	SS	6													
237.9	Loose Transition Zone		7	SS	50 1/2"											0 36 53 11		
13.0	Shale Bedrock with occasional bands of limestone and siltstone, partially weathered layers throughout.		8	BX RC	25%	235												
	Dark Grey		9	BX RC	45%	230												
227.9																		
23.0	End of Borehole					225												

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 6

JOB 72-11101-1 LOCATION Co-ords. 15,853,165 N; 1,022,219 E. ORIGINATED BY ER  
 W.P. 97-72-01 BORING DATE Sept. 6, 1972 COMPILED BY SO  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY JK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					PLASTIC LIMIT $w_p$					WATER CONTENT $w$
							SHEAR STRENGTH P.S.F.					$w_p$ $w$ $w_L$					
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000					WATER CONTENT % 10 20 30					
250.5	Ground Level																
0.0	Fill Material					250											
247.5	Sand and Gravel																
3.0	Clayey silt with some sand, gravel, brick pieces and cinders.		1	SS	7	245									$\gamma$ 246.0 W. assumed		
			2	SS	7												
			3	SS	9	240											
			4	SS	8												
			5	SS	7												
236.2	Firm to Stiff																
236.0	Weathered Shale		6	SS	79/cm												
14.5	End of Borehole					235											

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 7

JOB 72-11101-1 LOCATION Co-ords. 15,853.196 N; 1,022,382 E.  
 W.P. 97-72-01 BORING DATE Sept. 6, 1972  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger

ORIGINATED BY ED  
 COMPILED BY SO  
 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT ———					PLASTIC LIMIT ——— $w_p$					
							SHEAR STRENGTH P.S.F.					WATER CONTENT — $w$					
							○ UNCONFINED + FIELD VANE					$w_p$ ——— $w$ ——— $w_L$					
							● QUICK TRIAXIAL × LAB VANE					WATER CONTENT %			$\gamma$		
							100	800	1200	1600	2000	10	20	30	P.C.F.	GR SA SI CI	
250.5	Ground Level																
0.0	Fill Material	X				250										248.5	
	Clayey silt with some		1	SS	12												
	sand and gravel,		2	SS	4	245											
	occasional sand		3	SS	4												
	layers.					240											
		X	4	SS	6												
	Grey Firm	X															
235.0		X	5	SS	100	3" 235										35 42 17.6	
15.5	Weathered Shale	X	6	SS	50												
233.4	Dark Grey	X															
17.1	End of Borehole					230											

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 8

15,853,263 N; 1,022,617 E.

JOB 72-11101-1

LOCATION

Co-ords. 852,473 N; 60,057 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Power Auger; Cone Test

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
258.4	Ground Level															
0.0	Fill Material															
	Clayey silt with some sand and gravel & brick pieces		1	SS	30	255										
	changing to sandy silt with depth		2	SS	36	250										
	Brown Hard or Dense		3	SS	39											
244.9			4	SS	52	245										
13.5	Clayey silt with some sand, gravel and cinders		5	SS	10											
	Grey-Brown Stiff		6	SS	11	240										
235.9	Weathered Shale Dark Grey		7	SS	100	235										
23.5	End of Borehole															
						230										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 9

15,853,302 N; 1,022,838 E.

JOB 72-11101-1

LOCATION Co-ords. 15,853,302 N; 1,022,838 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core, Cone Test

CHECKED BY J. H.

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	$W_P$	$W$	$W_L$		
252.0	Ground Level															
0.0	Fill Material															
	Clayey silt with trace of sand and gravel, occasional layers of sand and gravel.		1	SS	16	250										
244.5	Grey Stiff		2	SS	15	245										
7.5	Sandy silt to silty sand with occasional clayey silt layers		3	SS	7											
	organic matter throughout		4	SS	6	240										
235.9	Brown Loose Transition Zone		5	SS	11	7"										
16.1	Shale Bedrock with limestone bands.		6	BXL R.C.	38%	235										
	Weathered Dark Grey		7	BXL R.C.	6%	230										
228.0																
24.0	Shale with bands of limestone and silt-stone.		8	BXL R.C.	100%	225										
	Dark Grey		9	BXL R.C.	100%	220										
218.0	Sound															
34.0	End of Borehole					215										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE No 10

15,853,337 N; 1,022,996 E.

JOB 72-11101-1

LOCATION

Co-ords. 62,551 N; 60,432 E.

W.P. 97-72-01

BORING DATE

Sept. 5, 1972

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger; Cone Test

ORIGINATED BY JC

COMPILED BY SO

CHECKED BY *[Signature]*

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	$w_p$	$w$	$w_L$		
252.6	Ground Level															
0.0	Fill Material															
	Clayey silt with trace of sand and gravel organics.		1	SS	16	250										
			2	SS	6	245										
242.1	Grey Firm		3	SS	7											
10.5	Sandy silt to silty sand with organics.		4	SS	2	240										
			5	SS	2											
	Grey Very Loose					235										
233.5	Transition Zone		6	SS	70/8"											
19.1	End of Borehole Probable Shale Bedrock					230										



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 11

JOB 72-11101-1

LOCATION

Co-ords. 15,853,392 N; 1,023,188 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE

Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, AXT Rock Core & Cone Test

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. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$W_P$	$W$	$W_L$		
252.3	Ground Level															
0.0	Fill Material Clayey silt with trace of sand and gravel, organics		1	SS	14	250										
	Grey-Brown		2	SS	7	245										
243.3	Firm		3	SS	13											
9.0	Sandy silt to silty sand with trace of gravel, clay and organics.		4	SS	1	240										
	Grey		5	SS	3											
234.3	Very Loose to Loose		6	SS	65/4"	235										
18.0	Bedrock Dark grey shale with occasional bands of limestone, partially weathered layers throughout		7	AXT R.C.	50%	230										
			8	AXT R.C.	34%											
225.3																
27.0	End of Borehole					225										



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 13

15,853,607 N; 1,023,525 E.

JOB 72-31101 -1

LOCATION Co-ords. 15,853,607 N; 1,023,525 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, AXT Rock Core &amp; Cone Test

CHECKED BY JTC

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	$W_P$	$W$	$W_L$	
251.8	Ground Level														
0.0	Fill Material					250									
	Clayey silt with trace of sand gravel and organics		1	SS	22										
			2	SS	2	245									
	Very Stiff to Very Soft		3	SS	2										
238.3	Grey-Brown		4	SS	5	240									
13.5	Sand with some silt, trace of gravel		5	SS	9	235									
	Loose														
233.3	Transition-Zone														
18.5	Bedrock		7	AXT R.C.	21%	230									
227.8	Weathered														
24.0	Sound Shale with occasional bands of limestone and siltstone.		8	AXT R.C.	95%	225									
222.8	Dark Grey														
29.0	End of Borehole					220									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>14

15,853,752 N; 1,023,663 E.

JOB 72-11101 -1

LOCATION Co-ords. 852,277 N; 61,093 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 5, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Power Auger and Cone Test

CHECKED BY J.L.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $W_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	PLASTIC LIMIT $W_P$	WATER CONTENT $W$	WATER CONTENT %		
252.3	Ground Level															
0.0	Fill Material															
	Clayey silt with trace of sand and gravel, brick pieces and glass		1	SS	18	250										
	Brown to Grey		2	SS	15	245										
	Firm to Very Stiff		3	SS	9											
239.3	Clayey silt with trace of sand and gravel (Glacial Till)		4	SS	17	240										
236.3	Grey. Very Stiff		5	SS	100/6"											
16.0	Bedrock Shale					235										
	Dark Grey Weathered															
232.3	End of Borehole					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 15

15,853,921 N; 1,023,772 E.

JOB 72-11101-1

LOCATION Co-ords. 853, 160 N, 61, 144 E

ORIGINATED BY G.A.

W.P. 97-72-01

BORING DATE 5 &amp; 6 Sept., 1972

COMPILED BY S.O.

DATUM Geodetic

 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core &  
Dynamic Cone Test

 CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000					$w_p$ $w$ $w_l$ WATER CONTENT % 10 20 30				
252.2	Ground Level															GR SA. SI. CL.
0.0	Fill Material - sandy silt with some gravel & Brick pieces					250										246.1     22-56-21-1
246.2	compact to brown dense		1	SS	32											
6.0	Organic clay, organic silt, brick pieces, sand and gravel		2	SS	9	245										
			3	SS	8											
239.7	Grey Firm		4	SS	14	240										
12.5	Silty sand with some gravel compact															
237.2	Black weathered		5	SS	100	3"										
15.0																
15.5	Bedrock - shale		6	EXL R.C.	78%	235										
231.7	Dark grey sound															
20.5	End of Borehole					230										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 16

JOB 72-11101-1

LOCATION Co-ords. 45,854,049 N; 1,023,830 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Power Auger &amp; Cone Test

CHECKED BY JLF

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	$w_p$	$w$	$w_L$		
252.5	Ground Level															
0.0	Fill Material															
248.5	Clayey silt with trace of sand and gravel. Very Stiff		1	SS	19	250										Hole caved at 246.2
4.0	Sand with trace of silt		2	SS	11	245										AL assumed
	Grey-Brown		3	SS	12											0 89 (11)
239.5	Compact		4	SS	74	240										41 55 (4)
13.0	Gravelly sand															
237.5	Brown Very Dense															
15.0	Bedrock Shale															
234.3	Dark Grey Weathered					235										
18.2	End of Borehole					230										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 17

15,851,462 N; 1,023,910 E.

JOB 72-11101-1

LOCATION Co-ords. 853,001 N, 61,305 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY 50

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Rock Core &amp; C one Test

CHECKED BY JRE

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					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		BLOWS / FOOT 20 40 60 80 100					SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				
												$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30				
258.3	Ground Level														GR SA. SI. CL	
0.0	Fill Material															
	Sand with some gravel and trace of organics		1	SS	16	255									28 53 (19)	
			2	SS	100.6"											
	Grey					250										
248.8	Dense to Very Dense		3	SS	6										Hole Caved 247.5	
9.5															assumed	
	Organic silt, sand, metal pieces and coal		4	SS	15	245									Org. 2.5%	
	Dark Grey to Black		5	SS	3										Org. 13.8%	
	Very Loose to Compact					240										
239.8			6	SS	77.1"											
18.5	Bedrock															
236.3	Weathered		7	BX R.C.	50%											
22.0	Shale with thin bands of limestone and siltstone					235										
	Dark Grey		8	BX R.C.	97%											
229.3	Sound					230										
29.0	End of Borehole					225										





## RECORD OF BOREHOLE No 19

15,850,930 N; 1,023,779 E.

JOB 72-11101-1

LOCATION Co-ords. 15,850,930 N; 1,023,779 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY SO

DATUM Geodetic

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

CHECKED BY *HR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					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		BLOWS / FOOT 20 40 60 80 100					SHEAR STRENGTH P.S.F.					WATER CONTENT % $w_p$ ——— $w$ ——— $w_L$		
							○ UNCONFINED + FIELD VANE ◆ QUICK TRIAXIAL × LAB VANE												
							100 800 1200 1600 2000												
265.1	Ground Level					265													
0.0	Fill Material Clayey silt to silty sand.																		
260.1	Stiff		1	SS	16	260										260.9			
5.0			2	SS	30	260													
			3	SS	30	255										25 h1 3'			
253.1	Brown																		
12.0	Grey Heterogeneous mixture of clayey silt with some sand & gravel (Glacial Till)		4	SS	21	250													
			5	SS	15	250													
	Firm to Stiff		6	TW	PH	245										134			
			7	TW	PH	245										136.5			
241.1																			
24.0	Weathered		8	SS	50/6"	240													
25.0	Bedrock - Shale occasional bands of siltstone and lime- stone.		9	BXL RC	100% Rec														
235.1	Dark Grey Sound																		
30.0	End of Borehole					235													

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 20

15,855,170 N: 1,023,673 E.

JOB 72-11101-1

LOCATION Co-ords. 15,855,170 N: 1,023,673 E.

ORIGINATED BY EB

W.P. 97-72-01

BORING DATE Sept. 6, 1972

COMPILED BY SO

DATUM Geodetic

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

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	$w_p$	$w$	$w_L$		
268.9	Ground Level															
0.0	Fill Material															
	Clayey silt with some sand and gravel, trace of organics.		1	SS	22	265										
	Brown-Grey		2	SS	25											
258.4	Stiff		3	SS	23	260										
10.5	Heterogeneous mixture of clayey silt, some sand and trace of gravel. (Glacial Till)		4	SS	11	255										
			5	SS	9											
			6	SS	13	250										
	Grey		7	SS	16											
	Stiff		8	SS	11	245										
240.9			9	SS	100.5"											
28.0	Bedrock					240										
238.9	Weathered		10	SS	150.4"											
30.0	Shale with occasional thin bands of silt-stone and limestone		11	BXL R.C.	95%	235										
			12	BXL R.C.	95%											
228.9	Dark Grey					230										
	Sound															
40.0	End of Borehole					225										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 21

15,855,275 N; 1,023,610 E.

JOB 72-31101 -1

LOCATION Co-ords. 15,855,275 N; 1,023,610 E.

ORIGINATED BY

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HD

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 100 800 1200 1600 2000			$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
271.8	Ground Level													
0.0	Fill Material					270								
	Sand with silt, trace of organics.		1	SS	7									
265.8	Brown loose					265								
6.0	Heterogeneous Mixture of clayey silt, some sand, trace of gravel (Glacial Till)		2	SS	8									
			3	SS	25									
			4	SS	18	260								
258.3	Brown					255								
13.5	Grey		5	SS	16									
			6	TW	PH									
	stiff to very stiff		7	TW	PH	250								
	with weathered shale fragments below el. 245.		8	TW	PH									
			9	SS	18	245								
			10	SS	12	240								
240.8	Weathered Shale Bed					240								
31.5	End of Borehole													

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 22

15,855,430 N; 1,023,442 E.

JOB 72-11101-1

LOCATION

Co-ords.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE

Sept. 7, 1972

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE

Power Auger and Cone Test

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. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
273.1	Ground Level															
0.0	Fill Material															
	Clayey silt with some sand and gravel, cinders.		1	SS	17	270										270.7
			2	SS	36											
	Brown					265										
262.6	Stiff to Hard		3	SS	34											
10.5	Heterogeneous mixture of clayey silt with some sand and gravel		4	SS	58	260										
	(Glacial Till)		5	SS	12											
			6	SS	13	255										
			7	SS	14											
			8	SS	57	250										
	Grey															
245.1	Stiff to Hard					245										
28.0	Shale Bedrock layers of clayey silt.		9	SS	156											
240.6	Dark Grey. Weathered		10	SS	100											
32.5	End of Borehole					240										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 23

JOB 77-11101 -1

LOCATION

Co-ords. 15,855,541 N; 1,023,285 E.  
44,777 N, 60, 000 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE

Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE

Hollow Stem Auger, BXL Rock Core &amp; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT	BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	PLASTIC LIMIT			WATER CONTENT
274.3	Ground Level						20 40 60 80 100	$w_p$ $w$ $w_L$			
							SHEAR STRENGTH P.S.F.				
							o UNCONFINED + FIELD VANE				
							e QUICK TRIAXIAL x LAB VANE				
								WATER CONTENT %			
								10 20 30			
0.0	Fill Material										
	Sand		1	SS	2/16"	270					
267.3	Brown Very Loose		2A	SS	1/16"						
7.0	Heterogeneous mixture of clayey silt, with trace of sand and gravel		3	SS	19	265					
	(Glacial Till)		4	SS	43						
			5	SS	21	260					
			6	SS	14						
	shale fragments below el. 250.		7	SS	12	255					
			8	SS	60	250					
	cobbles up to 5"		9	BXL RC	Rec 33%						
	Stiff to Hard Grey					245					
242.8	Transition Zone	10	SS	39							
31.5	Shale Bedrock with minor bands of limestone and siltstone.										
	Dark Grey	11	BXL RC	100% Rec	240						
237.8	Sound										
36.5	End of Borehole										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 24

15,855,564 N; 1,023,150 E.

JOB 72-11101

LOCATION

Co-ords.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE

Sept. 13, 1972

COMPILED BY BS

DATUM Geodetic

BOREHOLE TYPE

Hollow Stem 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		SHEAR STRENGTH P.S.F.				$W_p$ $W$ $W_L$				
							O UNCONFINED + FIELD VANE * QUICK TRIAXIAL x LAB VANE				WATER CONTENT % 10 20 30				
274.8	Ground Level														GR SA SI CL
0.0	Fill Material														WL not established
272.8	Sand and Gravel														
2.0	Clayey silt with some sand and gravel.														
269.8	Brown Hard		1	SS	34	270									
5.0	Heterogeneous mixture of clayey silt, trace of sand and gravel (Glacial Till)														
	Hard		2	SS	44	265									
262.8	Brown														
12.0	Grey														
			3	SS	30	260									
	with shale fragments below El. 254.														
	Stiff to Very Hard		4	SS	9	255									
252.8															
22.0	End of Borehole Probable Shale Bedrock					250									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 25

15,855,573 N; 1,022,847 E.

JOB 72-11101-1

LOCATION Co-ords. 15,855,573 N; 1,022,847 E.

ORIGINATED BY JS

W.P. 97-72-01

BORING DATE Sept. 7, 1972

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Rock Core

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				WATER CONTENT % 10 20 30				
271.1	Ground Level														
0.0	Fill Material														
	Sand and gravel to clayey silt, trace of organics. Brown		1	SS	9	270									
269.9	Loose or Stiff														
4.5	Heterogeneous mixture of clayey silt with some sand and gravel (Glacial Till)		2	SS	12										
	Stiff to Hard		3	SS	32	265									
260.9			4	SS	22										
13.5	Brown Grey		5	SS	14	260									
	with shale fragments below el. 253.		6	SS	8										
	Firm to Hard		7	SS	100.5"	255									
250.1															
24.0	Bedrock					250									
	Shale with bands of limestone and siltstone.		9	BX RC	60% Rec.										
	Dark Grey		10	BX RC	18% Rec.	245									
241.1	Weathered														
33.0	Sound		11	BX Rc	98% Rec.	240									
236.1															
38.0	End of borehole					235									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 26

15,855,491 N; 1,022,572 E.

JOB 72-11101-1

LOCATION

Co-ords.

W.P. 77-72-01

BORING DATE

Sept. 7, 1972

DATUM Geodetic

BOREHOLE TYPE Power Auger

ORIGINATED BY VK

COMPILED BY JC

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. PLT.	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				$W_p$ $W$ $W_L$				
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				WATER CONTENT % 10 20 30				
273.8	Ground Level														
0.0	Fill Material Crushed stone and cinders to clayey silt.														
269.3	Loose or Stiff		1	SS	10	270									
4.5	Heterogeneous mixture of clayey silt with trace of sand and gravel (Glacial Till)		2	SS	18	265									
			3	SS	30										
261.8	Brown		4	SS	37	260									
12.0	Grey		5	SS	18										
	with shale fragments below El. 255.		6	SS	108.3"	255									
	Very Stiff to Hard														
250.3			7	SS	100.0"										
23.5	End of Borehole Probable shale bedrock					250									



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 27

15,855,423 N; 1,022,385 E.

JOB 72-11101.1

LOCATION

Co-ords. 851,424 N; 59,776 E.

ORIGINATED BY JO

W.P. 97-72-01

BORING DATE

Sept. 7, 1972

COMPILED BY BS

DATUM Canadian

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE 400 800 1200 1600 2000					$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30				
271.0	Ground Level															
0.0	Fill Material Sand and gravel															
271.0																
3.0	Heterogeneous mixture of clayey silt with trace of sand & gravel (Glacial Till)		1	SS	19	270									269.1	
			2	SS	20											
			3	SS	21	265										
262.0	Brown															
12.0	Grey		4	SS	17	260									15 28 32 25	
			5	SS	9											
	with shale fragments below el. 255.		6	SS	36	255										
			7	SS	100	250										
	Stiff to Hard		8	SS	120											
246.0			9	SS	120											
28.0	Bedrock		10	FX RC	Rec. 50%	245										
240.5	Partially weathered															
33.5	Shale with occasional bands of limestone & siltstone		11	FX RC	Rec. 60%	240										
235.5	Dark Grey Sand															
38.5	End of Borehole					235										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 28

15,855,349 N; 1,022,198 E.

JOB 72-1117-1

LOCATION Co-ords. 15,855,349 N; 1,022,198 E.

ORIGINATED BY VK

W.P. 97-72-01



BORING DATE Sept. 7, 1972

COMPILED BY JS

DATUM Geodetic

BOREHOLE TYPE Power 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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							<input type="radio"/> UNCONFINED <input type="radio"/> QUICK TRIAXIAL	<input type="radio"/> FIELD VANE <input type="radio"/> LAB VANE				$W_P$	$W$		
271.9	Ground Level														
0.0	Fill Material					270									269.1
	Silty sand with gravel and cinders.														
270.1	Dark Brown Compact		1	SS	19										
4.5	Heterogeneous mixture of clayey silt with trace of sand and gravel		2	SS	28										
	(Glacial Till)		3	SS	27	265									
			4	SS	31										
259.9	Brown					260									
15.0	Grey		5	SS	27										
			6	SS	19	255									
	with shale fragments below el. 255														
	Cobbles		7	SS	100.0"										
249.7	Very Stiff to Hard					250									
25.2	End of Borehole					245									
	Probable shale bedrock														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 29

15,855,280 N; 1,022,013 E.

JOB 72-11101-1

LOCATION

Co-ords. 851,172 N, 59,108 E.

ORIGINATED BY GA

W.P. 97-72-01

BORING DATE

Sept. 8, 1972

COMPILED BY VS

DATUM Geodetic

BOREHOLE TYPE

Hollow Stem Auger &amp; BX Rock Core

CHECKED BY *W.C.*

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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE		$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30			
275.6	Ground Level											
0.0	Fill Material Clayey silt with trace of sand and gravel.					275						
270.6	Brown Stiff		1	SS	12							
5.0			2	SS	87	270						
264.6	Brown		3	SS	36	265						
11.0	Grey		4	SS	16							
	Heterogeneous mixture of clayey silt with some sand and gravel  (Glacial Till)		5	SS	15	260						
			6	SS	21							
	with shale fragments below el. 253.		7	SS	22	255						
			8	SS	100	250						
	Stiff to Hard		9	SS	10	245						
246.6	Weathered											
29.0												
30.0	Bedrock Shale with bands of limestone & siltstone		10	BX RC	70% Rec.	240						
	Dark Grey Sound		11	BX RC	58% Rec.							
236.6												
39.0	End of Borehole					235						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 30

15,855,205 N; 1,021,820 E.

JOB 72-11101-1

LOCATION

Co-ords. 15,855,205 N; 1,021,820 E.

W.P. 97-72-01

BORING DATE Sept. 8, 1972

DATUM Geodetic

BOREHOLE TYPE Tower Auger

ORIGINATED BY VK

COMPILED BY HS

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. FOR SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE * QUICK TRIAXIAL x LAB VANE			$W_p$ $W$ $W_L$ WATER CONTENT % 10 20 30				
275.5	Ground Level					275								
0.0	Fill Material Sand and gravel with cinders, brick pieces, changing to clayey silt.		1	SS	18									
269.5	Compact or Very Stiff					270								
6.0	Heterogeneous mixture of clayey silt with trace of sand & gravel (Glacial Till)		2	SS	38									
			3	SS	38	265								
263.5	Brown													
12.0	Grey		4	SS	48									
	with shale and lime- stone fragments below El. 259.		5	SS	27	260								
	Very Stiff to Hard					255								
250.5														
25.0	End of Borehole Refusal to augering probable bedrock					250								

OFFICE REPORT IN SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 31

15,855,121 N. 1,021,643 E.

JOB 72-11101-1

LOCATION

Co-ord.

ORIGINATED BY GA

W.P. 97-72-03

BORING DATE Sept. 8, 1972

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE 100 200 300 400 500					$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30				
273.0	Ground Level															
0.0	Fill Material Clayey silt															
270.4						270										269.6
3.5	Heterogeneous mixture of clayey silt with some sand & gravel (Glacial Till)		1	SS	11											
			2	SS	26											
			3	SS	27	265										
262.9	Brown															
11.0	Grey		4	SS	10	260										26.39 37
			5	SS	32											
	with shale fragments below el. 256.		6	SS	50	255										
	Stiff to Hard															
252.9			7	SS	100											
21.0	Bedrock															
242.2	weathered					250										
24.0	Shale with bands of limestone and silt- stone		8	EX RC	70% Rec											
244.9	Dark Grey Sound					245										
29.0	End of borehole															
						240										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 32

15,855,052 N; 1,021,448 E.

JOB 72-11101-1

LOCATION

Co-ords. 15,855,052 N; 1,021,448 E.

W.P. 97-72-01

BORING DATE Sept. 9, 1972

ORIGINATED BY VR

DATUM Geodetic

BOREHOLE TYPE Power Auger

COMPILED BY HB

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT				
							SHEAR STRENGTH P.S.F.				WATER CONTENT %				
274.7	Ground Level														
0.0	Fill Material														
	Sand and gravel														
	changing to clayey														
	silt.														
268.7	Loose or Stiff					270									
6.0	Heterogeneous mixture														
	of clayey silt, trace														
	of sand and gravel														
	(Glacial Till)					265									
262.7	Brown														
12.0	Grey														
	with shale fragments					260									
	below El. 259.														
256.7	Very Stiff to Hard														
18.0	End of Borehole					255									
	Refusal to augering														
	probable bedrock														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N<sup>o</sup> 33

15,855,003 N; 1,021,312 E.

JOB 72-11101-1

LOCATION Co-ords. 854,180N. 58,711 E.

ORIGINATED BY V.K.

W.P. 92-72-01

BORING DATE Sept. 9/72

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX, Rock Core

CHECKED BY *[Signature]*

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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE O QUICK TRIAXIAL X LAB VANE				$W_p$ — $W$ — $W_L$ WATER CONTENT % 10 20 30				
276.2	Ground Level														
	Fill Material					275									
	Sand and gravel changing to clayey silt														
	Compact or stiff		1	SS	11										
270.2	Brown					270									WL not established
6.0	Heterogeneous Mixture of clayey silt with some sand, trace of gravel (glacial till)		2	SS	40										
			3	SS	44										
265.2	Brown					265									
11.0	Grey (With shale fragments below elev. 259)		4	SS	27										4-25-45-26
			5	SS	82	260									
257.7	Very stiff to hard														
18.5	Bedrock														
256.2	Weathered		6	SS	100/3"										
20.0	Shale with frequent siltstone and limestone bands			BX	Rec.	255									
			7	R.C.	94%										
251.2	dark grey sound														
25.0	End of borehole					250									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 34

15,854,230 N; 1,021,130 E.

JOB 72-11101-1

LOCATION

Co-ords. 15,854,230 N; 1,021,130 E.

W.P. 97-72-01

BORING DATE

Sept. 8, 1972

DATUM Goodelle

BOREHOLE TYPE Hollow Stem Auger

ORIGINATED BY EGB

COMPILED BY MB

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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE			$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30				
273.4	Ground Level													
0.0	Fill Material					275								SL not established
	Sand and gravel													
	changing to clayey silt.		1	SS	6									
	Loose to Firm.													
272.4	Brown													
6.0	Heterogeneous mixture		2	SS	49	270						○		
	of clayey silt with													
	some sand and gravel		3	SS	64									
	(Glacial Till)													
266.4	Brown													
12.0	Grey		4	SS	32	265						○		
	with shale fragments		5	SS	65									
	below El. 257.													
						260								
	Very Stiff to Hard		6	SS	28									
256.4			7	SS	123									
22.0	End of Borehole					255								
	Refusal to augering													
	probable bedrock													



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 35

15,854,867N; 1,020,950 E.

JOB 72-11101-1

LOCATION

Co-ords. 15,854,867 N. 1,020,950 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE

Sept. 9, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE

Hollow Stem Auger &amp; BX Rock Core

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		SHEAR STRENGTH P.S.F.				$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
							○ UNCONFINED		+ FIELD VANE						
						● QUICK TRIAXIAL		x LAB VANE							
280.7	Ground Level														
0.0	Fill Material														
	Clayey silt with trace of sand and gravel														
271.7	Brown Stiff		1	SS	9	275									$\gamma$ 277.3
6.0			2	SS	63										
271.7	Brown Grey		3	SS	36	270									
9.0			4	SS	30										
	Heterogeneous mixture of clayey silt with some sand, trace of gravel		5	SS	51	265									
	(Glacial Till)		6	SS	60										
			7	SS	53	260									
	with shale fragments below El. 257.														
	Hard					255									
253.7	Bedrock														
251.7	Weathered														
29.0	Shale with occasional siltstone and limestone bands.		9	EX RC	90%	250									
246.7	Dark Grey Sound														
34.0	End of Borehole					245									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 36

15,854,800 N; 1,020,757 E.

JOB 72-11171-1

LOCATION Co-ords. 15,854,800 N; 1,020,757 E.

ORIGINATED BY GP

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY VE

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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. GR SA, SI C	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE * QUICK TRIAXIAL x LAB VANE				$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
286.3	Ground Level														
0.0	Fill Material					285									
	Sand with some silt and organics		1	SS	6										
			2	SS	5	280									279.1
	Brown Loose to Very Dense		3	SS	97										
275.3						275									
11.0	Heterogeneous mixture of clayey silt with some sand and gravel (Glacial Till)		4	SS	95										
			5	SS	165	270									
			6	SS	175	10"									
			7	SS	175	11"	265								3h 25 27 3
	sandy silt with shale fragments below El. 259.		8	SS	108										
	Grey Hard		9	SS	155	9"	260								
257.8															
28.5	End of Borehole refusal to augering probable bedrock					255									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>37

15,854,725 N; 1,020,600 E.

JOB 72-11101-1

LOCATION Co-ords. 853,893 N., 58,007 E.

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 9/72

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; EXL Rock Core

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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PROF.	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % $w_p$ ——— $w$ ——— $w_L$ 10 20 30				
288.5	Ground Level													P.C.F.	GR SA SI CL
0.0	Fill Material														
	Sand with some silt		1	SS	8	285									
			2	SS	87										
279.5	Brown Loose to very dense					280									280.4
9.0			3	SS	40										
	Silty Sand		4	SS	60	275									0-66-20-14
			5	SS	63										
	Silty sand to sandy silt		6	SS	108	270									0-30-55-14
	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		7	SS	108/7"	265									P-4 Piez. Tip el. 262.5 26.0
			8	SS	140										
	Hard					260									
	Grey		9	SS	105										
256.5															
32.0	Bedrock					255									
255.0	Weathered														
33.5	Shale with frequent siltstone bands, minor limestone bands		10	EXL RC	96%										
250.0	Dark Grey sound					250									
38.5	End of borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 38

15,854,662 N; 1,020,430 E.

JOB 72-11101-1

LOCATION Co-ords. 753, 200 N; 57,800 W

ORIGINATED BY VE

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE		$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30			
287.8	Ground level											
0.0	Fill Material											
	Sand to silty sand & trace of organics		1	SS	11	285						
	Brown											
279.8	Compact to Very Dense		2	SS	61	280						
8.0	Fine sand with silt.		3	SS	78							
	Grey											
275.8	Very Dense											
12.0			4	SS	71	275						
	Silty Sand		5	SS	76							
			6	SS	89	270						
	clayey silt with trace of sand and gravel (glacial till)		7	SS	115	265						
			8	SS	95							
	Grey Hard					260						
257.1			9	SS	118							
30.7	End of Borehole Refusal to augering probable bedrock					255						

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 39

15,854,009 N; 1,020,294 E.

JOB 72-11101-1

LOCATION Co-ords. 843,770 N; 54,712 E.

ORIGINATED BY VK

W.P. 97-72-02

BORING DATE Sept. 11, 1972

COMPILED BY VS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — W <sub>L</sub>		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT	PLASTIC LIMIT — W <sub>P</sub>	WATER CONTENT — W		
285.0	Ground Level										
0.0	Fill Material										
	Sand, gravel and cinders changing to clayey silt		1	SS	10	280					
	Loose or Stiff										
279.0	Brown										
6.0			2	SS	34						
276.0	Brown										
9.0	Grey		3	SS	60	275					
	Heterogeneous mixture of clayey silt with trace of sand and gravel		4	SS	80						
	(Glacial Till)		5	SS	122	270					
	with silty sand layers throughout		6	SS	140						
			7	SS	150	265					
	Hard		8	SS	112	260					
258.0											
27.0	Bedrock										
255.0	Weathered										
30.0	Shale with occasional bands of siltstone and limestone		10	RC	100%	255					
250.0	Dark Grey Sound					250					
35.0	End of Borehole										
						245					

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 40

15,854,520 N; 1,020,109 E.

JOB 72-11101-1

LOCATION Co-ords. -853,678 N; -57,518 E.

ORIGINATED BY JC

W.P. 97-72-01

BORING DATE Sept. 9, 1972

COMPILED BY VK

DATUM, Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY G. J.

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		SHEAR STRENGTH P.S.F.				$w_p$ $w$ $w_L$					
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				WATER CONTENT % 10 20 30					
284.8	Ground Level														GR. SA SILT	
0.0	Fill Material															
	Sand with silt and trace of organics.															
279.8	Brown Compact		1	SS	16	280										
5.0	Silty sand with some gravel.		2	SS	32										5 h 3b 1	
	Brown-Grey		3	SS	90	275										
273.8	Dense to Very Dense															
11.0	Heterogeneous mixture of clayey silt to silt with some sand and gravel		4	SS	90	270										
	(Glacial Till)		5	SS	82											
			6	SS	75	265									2 20 h 2 3	
			7	SS	76											
			8	SS	180										Hole caved	
			9	SS	205	260									261.7	
	Grey Hard		10	SS	121										WL assumed	
256.1			11	SS	160											
28.4	End of Borehole Refusal probable bedrock					255										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 41

15,854,435 N; 1,019,957 E.

JOB 72-11101-1

LOCATION Co-ords. 853,500 N; 57,370 E.

ORIGINATED BY JO

W.P. 97-72-01

BORING DATE Sept. 9, 1972

COMPILED BY VR

DATUM Geodetic

BOREHOLE TYPE Power Auger &amp; BXL Rock Core

CHECKED BY *off*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE			W <sub>p</sub> ——— W ——— W <sub>L</sub> WATER CONTENT % 10 20 30				
285.4	Ground Level					285								
0.0	Fill Material													
	Clayey silt with some sand and gravel, and trace of organics.		1	SS	18									
	Brown					280								
277.9	Soft to Very Stiff		2	SS	4									
7.5	Silty sand with some gravel		3	SS	160									
	Grey		4	SS	60	275								33 36 18
271.9	Very Dense													
13.5	Heterogeneous mixture of clayey silt to silt with some sand and gravel		5	SS	54									
	(Glacial Till)		6	SS	120									
			7	SS	101	265								265.4
	Grey Hard		8	SS	169	260								P-6 Piez. Tip elev. 259.4
			9	SS	100									
257.4	Bedrock		10	BXL R.C.	100%	255								
28.0	Shale with frequent bands of siltstone and limestone		11	BXL R.C.	100%	250								P-5
	Dark Grey													Piez. Tip el
247.8	Sound													247.
37.6	End of Borehole					245								

OFFICE REPORT / SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE No 42

15,851,310 N; 1,019,820 E.

JOB 72-11191-1

LOCATION Co-ords. 15,851,310 N; 1,019,820 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ○ QUICK TRIAXIAL x LAB VANE				$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30					
287.2	Ground Level															
0.0	Fill Material					285										
	Silty sand with gravel changing to clayey silt with cinders and brick pieces.		1	SS	6											
281.2	Loose or Firm		2	SS	30	280										
6.0			3	SS	28											
275.2			4	SS	29	275										
12.0	Brown Grey		5	SS	33											
	Heterogeneous mixture of clayey silt with trace of sand and gravel (Glacial Till)		6	SS	53	270										
			7	SS	128											
	with weathered shale fragments below El. 260.		8	SS	88	265										
						260										
256.7	Very Stiff to Hard		9	SS	115											
30.5	End of Borehole Probable Bedrock					255										

OFFICE REPORT OF SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE NO 43  
 15,854,233 N; 1,019,565 E.

JOB 72-11101 -1

LOCATION Co-ords. 15,854,233 N; 1,019,565 E.

ORIGINATED BY G.A.

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY H.S.

DATUM GODEFIC

BOREHOLE TYPE Hollow Stem Auger, BXL Back Core &amp; Cone Test

CHECKED BY S.H.

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 Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		25	50	75	100		W <sub>P</sub>	W	W <sub>L</sub>		
282.8	Ground Level															
0.0	Fill Material silty sand with gravel changing to clayey silt					285										
282.8	Compact or V. Stiff Brown		1	SS	19											
5.0	Silty sand with gravel		2	SS	133	280										
	Brown to Grey Very Dense		3	SS	116											
275.3	Heterogeneous Mixture of Clayey silt with trace of sand and gravel (glacial till)		4	SS	100	275										
12.0	(with layers of silty sand)		5	SS	100											
			6	SS	111	270										
			7	SS	100											
			8	SS	115	265										
	Grey Hard															
260.3	Weathered		9	SS	100	260										
28.0	Bedrock - Shale with minor limestone bands		10	BXL R.C.	56%											
251.6	dark grey sand					255										
33.2	End of Borehole															

OFFICE REPORT C SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE NO 44  
 15,854,178 N; 1,019,426 E.

JOB 72-11101-1

LOCATION

Co-ords. 15,854,178 N; 1,019,426 E.

ORIGINATED BY GA

W.P. 97-77-01

BORING DATE Sept. 11, 1972

COMPILED BY VZ

DATUM Canadian

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY J. J. J.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — $w_L$			BULK DENSITY	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT — $w_p$						
							SHEAR STRENGTH P.S.F.				$w_p$ — $w$ — $w_L$						
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				WATER CONTENT %						
												10	20	30			
287.1	Ground Level																
0.0	Fill Material					285											
	Clayey silt changing to sand.																
	Compact to Dense		1	SS	10												
	Brown		2	SS	51	280											
279.1																	
8.0			3	SS	60												
	Heterogeneous mixture of clayey silt with traces of sand and gravel		4	SS	54	275											
	(Glacial Till)		5	SS	47												
			6	SS	34	270											
	with silty sand layers throughout.		7	SS	150	265											
			8	SS	117												
	Grey Hard		9	SS	79												
259.3			10	SS	173	260											
27.8	End of Borehole																
	Refusal to augering probable bedrock					255											

OFFICE REPORT C-1 SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 45

JOB 72-11101 -1

LOCATION Co-ords. 15,854,054 N; 1,019,277 E.

ORIGINATED BY C.P.

W.P. 97-72-01

BORING DATE Sept. 11, 1972

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Power Auger &amp; BXL Rock Core

CHECKED BY J.K.

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		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							O UNCONFINED + FIELD VANE Q QUICK TRIAXIAL X LAB VANE				$w_p$ $w$ $w_L$				
278.0	Ground Level														
0.0	Fill Material - Sand														
276.0															
2.0	Heterogeneous Mixture of clayey silt to silt with trace of sand and gravel (glacial till)		1	SS	34	275									
			2	SS	41										
						270									
	sandy silt		3	SS	79										0.43 42.15
			4	SS	72	265									265.0
			5	SS	118/9"										
259.5	grey hard		6	SS	80/6"	260									
18.5	bedrock														
257.0	weathered														
21.0	Shale with frequent siltstone and limestone bands		7	BXL R.C.	86%	255									
			8	BXL RC	75%										
250.8	dark grey sound		9	BXL RC	99%										
27.2	End of borehole					250									

OFFICE REPORT C-1 SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 46

15,853,875 N: 1,019,188 E.

JOB 72-11101-1

LOCATION CO-ORDS. 15,853,875 N: 1,019,188 E.

ORIGINATED BY VK

W.P. 72-72-01

BORING DATE 11/72

COMPILED BY NO

DATUM GEOIDETIC

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT $w_L$				BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT				PLASTIC LIMIT $w_p$					
							SHEAR STRENGTH P.S.F.				WATER CONTENT $w$					
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				WATER CONTENT % 10 20 30					
275.1	Ground Level															
0.0	Fill Material - Clayey silt trace of sand and gravel		1	SS	10	270										
269.1	Brown Stiff															
6.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	52											
			3	SS	11	265										
	Very Stiff to Hard		4	SS	28											
260.0	Brown															
15.0	Grey		5	SS	30	260										
257.1																
17.0	Weathered Shale Bed-		6	SS	12	255										
19.0	End of Borehole															

OFFICE REPORT C SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 47

15,853,757 N; 1,019,152 E.

JOB 72-11101 -1

LOCATION CO-ORDS 45° 30' 00" N, 76° 55' 00" W

ORIGINATED BY 60

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY 113

DATUM GROUND

BOREHOLE TYPE Hollow Stem Auger BXL Rock Core &amp; Comp Test

CHECKED BY 113

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>		
271.0	Ground Level															
0.0	Fill Material - Clayey silt trace of sand and gravel					270										
266.5	Brown Hard		1	SS	53											
4.5	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	55	265										
261.0	Brown		3	SS	100	3"										
10.0	Grey		4	SS	100	5"										
256.0	Hard		5	SS	100	3"										
15.0	Bedrock					255										
253.0	Weathered															
18.0	Shale with occ. bands of silty limestone and minor limestone seams		6	BXL RC	88%	250										
247.2	dark grey Sound															
23.8	End of Borehole					245										

OFFICE REPORT / SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 48

15,853,603 N; 1,019,170 E.

JOB 72-11101 - 1

LOCATION CO-ORDS. 15,853,603 N; 1,019,170 E.

ORIGINATED BY

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY

DATUM GEODETIC

BOREHOLE TYPE Power 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. 65 SA SI CL	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ⊙ QUICK TRIAXIAL x LAB VANE				$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30				
267.4	Ground Level														
0.0	Fill Material - Clayey silt with trace of sand, gravel - & organics					265									
262.9	brown Hard		1	SS	40								○ ———		
4.5	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	157	260									
			3	SS	72								○ ———		
	Brown-grey Hard		4	SS	180	255									
	(with shale fragments below elev. 255)		5	SS	120	250									
250.4			6	SS	130	245									
17.0	End of borehole probably bedrock			Refusal											

Note Caved at 252.9  
W.L. assumed

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 49

15,853,431 N; 1,019,253 E.

JOB 72-11101 -1

LOCATION CO-ORDS. 870, 475, 103E

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 11/72

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; PYL Rock Cone

CHECKED BY JH

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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE O QUICK TRIAXIAL X LAB VANE			$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30				
201.7	Ground Level													
201.7	0.0 Till Material - clayey silt with trace of sand and gravel (brown)													
201.7	3.0 Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		1	SS	38	200								
255.7	Brown		2	SS	37									
255.7	Grey		3	SS	37	255								
255.7	(with shale fragments below elev. 250)		4	SS	38									
255.7	Hard		5	SS	300	250								
16.0	Bedrock - Shale and Limestone													
216.5	Weathered Limestone and sand													
216.5	shale													
216.5	with bands of limestone		6	BXL RC	90%	215								
216.5	Dark-Grey sound													
23.0	End of borehole					240								

P-8  
Piez. Tip  
at 216.5  
16.5

 P-8  
Piez. Tip  
at 216.5  
16.5

 P-8  
Piez. Tip  
at 216.5  
16.5

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>50

15,853,350 N; 1,019,372 E.

JOB 72-11101 - 1

LOCATION CO-ORDS.

ORIGINATED BY WK

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY HS

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem 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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
266.5	Ground Level														
0.0	Fill Material - clayey silt with trace of sand, gravel & organice					265									
260.5	brown stiff		1	SS	12										
6.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	14	260									
			3	SS	34										
			4	SS	50	255									
	Brown Hard		5	SS	85	250									
248.5	Weathered shale		6	SS	12	248.5									
247.5	bedrock														Hole Caved Bl. 248.8 V.W.I. Assumed
19.0	End of Borehole					245									

 Hole Caved  
 El. 248.8  
 W.I.  
 Assumed



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 51

15,853,239 N; 1,019,530 E.

JOB 72-11101-1

LOCATION

Co-ords. 852,380 N; 96,970 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE

Sept. 12, 1972

COMPILED BY J.D.

DATUM Geodetic

BOREHOLE TYPE

Power Auger, BXL Rock Core, Cone Test

CHECKED BY J.C.

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	$w_p$	$w$	$w_L$	
260.8	Ground Level														
0.0	Fill Material					260									
	Clayey silt with some sand, gravel, wood chips & organics.		1	SS	9	255									
	Brown-Grey		2	SS	21										
250.3	Soft to Very Stiff		3	SS	3	250									Hole caved
10.5	Organic silt with sand wood chips and glass.		4	SS	5	245									$\gamma$ 247.8 NL assumed
	Black Loose		5	SS	5										
243.3	Shale Bedrock with minor bands of limestone & siltstone Dark Grey Partially weathered		6	BXL MC	65%	240									
239.0															
21.8	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 52

15,853,192 N; 1,019,648 E.

JOB 72-111-01-1

LOCATION CO-ORDS. 44° 33'N, 47° 03'W

ORIGINATED BY DA

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY JO

DATUM GEODESIC

BOREHOLE TYPE Hollow Stem 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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
261.2	Ground Level															
0.0	Fill Material -					260										
	Clayey silt with organics		1	SS	14											
	(with sand to silty sand layers)		2	SS	17	255										
	Firm to Very Stiff		3	SS	8	250										
			4	SS	25											
246.2																
15.0	Organic silt with sand, wood chips and brick pieces		5	SS	3	245										
242.7	Loose black															
241.2	Weathered Shale		6	SS	100	240										
19.5	End of hole															

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE NO 53  
 15,853,150 N; 1,019,861 E.

JOB 72-11101 -1

LOCATION Co-ords. 15,853,150 N; 1,019,861 E.

ORIGINATED BY C.P.

W.P. 97-72-01

BORING DATE Sept. 12, 1972

COMPILED BY JO

DATUM Geodetic

BOREHOLE TYPE Power Auger, B.L. Rock Core &amp; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— $W_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS/FOOT	20 40 60 80 100	PLASTIC LIMIT ——— $W_P$	WATER CONTENT ——— $W$	WATER CONTENT %		
261.1	Ground Level												
0.0	Fill Material												
	Clayey silt with trace of sand and gravel, brick pieces and organics.		1	SS	10	260							
			2	SS	9	255							
251.9	Brown-Grey Stiff		3	SS	4	250							
9.5	Organic sand, silt, wood chips and cinder		4	SS	7	250							
	Black Loose		5	SS	4	245							
242.7	Bedrock												
18.7	Silty limestone												
240.3	Shale, minor bands of siltstone and limestone with partially weathered section (2" - 6" thick)		6	BXL R.C.	94%	240							
21.1	Dark Grey Sound					235							
232.7	End of Borehole					230							
28.7													

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 54

15,853,170 N; 1,020,065 E.

JOB 72-11101-1

LOCATION Co-ords. 852, 322 N; 57, 503 E

ORIGINATED BY C.A.

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; Dynamic Cone Test

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE		$w_p$ $w$ $w_L$ WATER CONTENT % 10 20 30			
261.7	Ground Level											GP SA SL CL
0.0	Fill Material clayey silt with trace of sand and gravel		1	SS	24	260						
	Very stiff to hard		2	SS	20	255						
	brown-grey		3	SS	60	250.7						
11.0	Organic sand, silt & cinders		4	SS	5	250						
	dark grey		5	SS	5	245						
243.7	loose		6	SS	20	243.7						
18.0	End of borehole Probable shale bedrock					230						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>55

15853,191 N; 1,020,222 E.

JOB 72-11101-1

LOCATION Co-ords. 452, 348 N, 57, 661 E

ORIGINATED BY C.P.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Power Auger EXL Rock Core &amp; Cone Test

CHECKED BY S. J.

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30			
260.1	Ground Level					260						P.C.F. GR SA SI CL
0.0	Fill Material Clayey silt with some sand, gravel & organics  Firm to stiff		1	SS	13	255						
251.1	Brown-Grey		2	SS	6							
9.0	Sand and Gravel changing to organic silt with sand		3	SS	54	250						
			4	SS	2							
			5	SS	3	245						
	Dark grey loose											
240.6	Transition Zone		6	SS	100	240						
19.5	Bedrock											
	Shale with bands of siltstone and limestone, with partially weathered sections throughout		7	BXL RC	73%							
233.8	Dark grey		8	BEL RC	85%	235						
26.3	End of Borehole					230						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 56

15,853,033 N; 1,020,445 E.

JOB 72-11101-1

LOCATION CO. 0000. 055, 1 000, 151, 0000

ORIGINATED BY VE

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY

DATUM GEODETIC

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT $W_L$				BULK DENSITY	REMARKS
FLEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT $W_P$					
251.6	Ground Level						SHEAR STRENGTH P.S.F.				WATER CONTENT %					
0.0	Fill Material						O UNCONFINED + FIELD VANE				$W_P$ $W$ $W_L$					
	Sand and gravel with pockets of clayey silt, brick pieces and cinders		1	SS	6	250	O QUICK TRIAXIAL X LAB VANE									
			2	SS	10	245										
	brown loose		3	SS	128											
240.6	Transition Zone															
11.0	End of borehole					240										
	Probable bedrock Shale															

240.6  
C-67-21-13

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N<sup>o</sup>57

15,853,049 N; 1,020,563 E.

JOB 72-11101-1

LOCATION Co-ords. 853, 230 N, 58, 000 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; BX Rock Core

CHECKED BY

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				W <sub>P</sub> — W — W <sub>L</sub> WATER CONTENT %					
251.8	Ground Level														P.C. 62 SA SI.CI	
0.0	Fill Material - silty sand, gravel brick pieces & cinders		1	SS	24	250									247.8	
245.8	Brown Compact															
6.0	Fine sand, some silt		2	SS	2/18"	245									0, 86 14	
242.3	Grey very loose															
9.5	Bedrock - dark grey shale with minor bands of limestone & siltstone					240										
239.3	2" weathered		3	SS	100/4"											
12.5	Dark grey shale with occasional siltstone bands		4	BX RC	88%	235										
234.7																
17.1	End of Borehole					230										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 58

15,853,072 N; 1,020,795 E.

JOB 72-11101

LOCATION Co-ords. 852,242 N; 58,230 E.

ORIGINATED BY VK

W.P. 97-72-71

BORING DATE Sept. 12, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY C/L

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		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				$w_p$ ——— $w$ ——— $w_L$ 10 20 30				
250.4	Ground Level					250									GR SA, SL, CL
0.0	Fill Material														
	Sand, gravel, cinders and brick pieces.		1	SS	14										246.4
244.4	Brown Compact					245									
6.0	Silty sand, some gravel and organics		2	SS	2/18"										14 40 30 16
	Grey		3	SS	7										
239.4	Very Loose to Loose					240									
11.0	End of Borehole Refusal to augering probable shale bedrock					235									



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 59

15,853,093 N; 1,021,003 E.

JOB 72-11101-1

LOCATION

Co. Ords. 852, 264 N, 58, 445 E

W.P. 97-72-01

BORING DATE

Sept. 12/72

DATUM Geodetic



BOREHOLE TYPE

Hollow Stem Auger &amp; BX Rock Core

ORIGINATED BY V.E.

COMPILED BY J.C.

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				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. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ⊗ QUICK TRIAXIAL x LAB VANE								
250.0	Ground Level														
0.0	Fill Material Sand & Gravel with cinders					250									246.0  2.70, 17.11.
			1	SS	14		245								
244.0	Compact														
6.0	Sand with some silt & occasional clay pockets, & organics		2	SS	2/18"										
	Very loose to compact	3	SS	13		240									
237.5	Grey Black		4	SS	150/3"										
12.5	Bedrock Weathered														
236.4															
13.6	Shale, minor thin bands of limestone		5	BXL RC	68%		235								
232.2	Dark Grey Sound														
17.8	End of Borehole					230									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 60

15,853,985 N; 1,022,998 E.

JOB 72-11101 -1

LOCATION

Co-ords. 15,853,985 N; 1,022,998 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Sept. 12, 1972

COMPILED BY JC

DATUM Guelphic

BOREHOLE TYPE Hollow Stem 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.	REMARK
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				$w_p$ $w$ $w_L$ WATER CONTENT % 10 20 30				
261.0	Ground Level														
0.0	Fill Material														
	Clayey silt with pockets of sand and bricks.		1	SS	7	260									Not established
258.0	Brown Firm														
6.0			2	SS	42										
						255									
			3	SS	33										
252.0	Brown														
12.0	Grey		4	SS	22	250									
	Heterogeneous mixture of clayey silt with trace of sand and gravel														
	(Glacial Till)		5	SS	33										
	Very Stiff to Hard (with shale fragments below El. 244)					245									
243.0			6	SS	34										
21.0	End of Borehole Probable Shale Bedrock					240									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 61

15,854,533 N; 1,022,820 E.

JOB 72-11101-1

LOCATION Co-ords. 453,752 N, 60,233 E

ORIGINATED BY V.E.

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY J.C.

DATUM Coadetic

BOREHOLE TYPE Hollow Stem 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.T. GR. S.A. S.C.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				$W_P$ — $W$ — $W_L$ WATER CONTENT % 10 20 30					
266.9	Ground Level															
0.0	Fill Material - sand and gravel					265										
264.9	Brown															
2.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		1	SS	36											
			2	SS	58	260										
			3	SS	28											
254.9	Brown					255										
12.0	Grey		4	SS	21										253.5	
	Very stiff to hard		5	SS	29	250										
			6	SS	18											
245.9			7	SS	118											
21.0	End of borehole Probable shale bedrock					245										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 62 15,854,971 N; 1,022,639 E.

JOB 72-11101-1

LOCATION Co-ords. 854, 170 N, 60, 044 E

ORIGINATED BY V.K.

W.P. 97-72-01

BORING DATE Sept. 12/72

COMPILED BY J.C.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Augers

CHECKED BY J.C.

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. GR SA, SI, CL	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				$W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30				
270.2	Ground Level														
0.0	Fill material					270									
	Sandy silt with trace of clay & wood		1	SS	22										
264.2	Compact					265									264.3
6.0	Heterogeneous mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	9										
			3	SS	27	260									
			4	SS	19										
255.2	Brown					255									
15.0	Grey		5	SS	20										
			6	SS	13	250									
248.9	Stiff to Very Stiff					248.9									
			7	SS	100/4"										
21.3	End of Borehole probable shale bedrock					245									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 63

15,853,628 N; 1,021,730 E.

JOB 72-11101-1

LOCATION CO-ORDS. 87° 11' 15" W, 49° 14' 30" N

ORIGINATED BY J.E.

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY J.E.

DATUM GEOIDAL

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY J.E.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			PLASTIC LIMIT $w_p$				WATER CONTENT $w$
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE			$w_p$ — $w$ — $w_L$			WATER CONTENT % 10 20 30	
264.3	Ground level													
0.0	Fill Material - sand and gravel	X												NOT ESTABLISHED
262.3														
2.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)					260								
			1	SS	58									
						255								
			2	SS	68									
251.2	brown					250								
13.0	grey													
	hard (with shale fragments below elev. 247)													
246.3			3	SS	71									
18.0	End of borehole Probable shale bedrock					245								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE N264

15,854,473 N; 1,021,505 E.

JOB 72-11101-1

LOCATION GO-CRDS. 85, 62, 58, 917

ORIGINATED BY VI

W.P. 97-72-01

BORING DATE Sept. 13/72

COMPILED BY JC

DATUM CHADWICK

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		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. OR SA.S.L.CI	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE					
272.4	Ground level											
0.0	Fill Material -											
270.4	Sand and Gravel					270						Wt. not established
2.0	Clayey silt with trace of gravel											
265.4	dark brown soft		1	SS	h	265						
7.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	50	260						
257.4	Brown Grey		3	SS	h3	255						
15.0	Hard		h	SS	6h	250						
250.4	End of borehole Probable shale bedrock											
22.0												

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 65

JOB 72-11101-1

LOCATION

CO-ORDS.

15,853,155 N; 1,019,772 E.

ORIGINATED BY JC

W.P. 97-77-01

BORING DATE

Sept. 13, 72

COMPILED BY JC

DATUM GEODETIC

BOREHOLE TYPE

Lower Auger & Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_l$			REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	60	80	100		PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$		
270.1	Ground Level														
0.0	Fill Material sand & silt with organics		1	SS	2	265									
262.1	grey to black very loose														
8.0	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)		2	SS	80	260									
			3	SS	15	255									
252.6	Brown-Gray Hard														
17.5	End of Borehole Probable shale bedrock					250									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 66

15,853,820 N; 1,019,680 E.

JOB 72-11101-1

LOCATION CO-ORDS. 44° 27' 00" N, 77° 12' 00" W

ORIGINATED BY           

W.P. 07-72-01

BORING DATE Sept. 13/72

COMPILED BY           

DATUM GEOIDAL

BOREHOLE TYPE Power Auger & Core Test

CHECKED BY           

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20 40 60 80 100	PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$		
							SHEAR STRENGTH P.S.F.		$w_p$ — $w$ — $w_L$			
							○ UNCONFINED + FIELD VANE					
							● QUICK TRIAXIAL x LAB VANE					
271.8	Ground Level											
0.0	Fill Material - Clayey silt with trace of sand and gravel & organics					270						
266.3	Brown Hard		1	SS	35							
5.5	Heterogeneous Mixture of clayey silt with trace of sand and gravel (glacial till)					265						
			2	SS	117							
	(with shale fragments below elev. 256)					260						
			3	SS	81 7/8"							
						255						
	Brown - Grey Hard											
251.5			4	SS	60 7/8"							
20.3	End of borehole probable shale bedrock					250						



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 129

JOB 72-11101-1

LOCATION Co-ords. 15,852,900 N; 1,021,418 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE March 5-6, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Pressuremeter Test and

CHECKED BY

NXL Rock Core

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT $W_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT $W_p$				
248.5	Ground Level						SHEAR STRENGTH P.S.F.			WATER CONTENT $W$				
							○ UNCONFINED + FIELD VANE			$W_p$ — $W$ — $W_L$				
							● QUICK TRIAXIAL x LAB VANE			10 20 30				
0.0	Asphalt & crushed stone (3/4")		1	SS	6/60	240								GR SA. SI. CL.
	Fill Material													▽246.5
	Clayey silt, sand, gravel & brick pieces		2	SS	5									
	Brown Soft													
232.5	Bedrock weathered sound		3	SS	75/90	230								
16.0	Shale with occ. thin bands of limestone		4	RC NXL	90%									
223.0	Dark Grey		5	RC NXL	93%									
25.5	End of Borehole					220								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 131

JOB 72-11101-1

LOCATION Co-ords. 15,853,490 N; 1,023,469 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F.				WATER CONTENT %					
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				$W_P$ $W$ $W_L$ 10 20 30					
252.1	Ground Level															
0.0	Fill Material					250										
247.1	Silty sand		1	SS	58										246.1	
5.0	Clayey silt with some sand and gravel. Grey		2	SS	14											
			3	SS	6											
238.1	Soft to Firm		4	SS	30	240										
14.0	Silty sand with traces of clay.		5	SS	12										0 54 35 12	
284.1	Shale Bedrock Weathered		6	SS	125/6"											
18.5	End of Borehole					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 132

JOB 72-11101 -1

LOCATION Co-ords. 15,853,589 N; 1,023,668 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT $W_L$				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT $W_p$					
							SHEAR STRENGTH P.S.F.				WATER CONTENT $W$					
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				WATER CONTENT %					
252.6	Ground Level															
0.0	Fill Material					250									246.6	
	Clayey silt, sand, gravel, brick pieces and wood chips.		1	SS	23											
	Grey		2	SS	54											
238.6	Soft to Firm		3	SS	50 7/8"											
234.6	Sand with some silt.		4	SS	4	240										
233.2	Grey Very Loose		5	SS	1 1/8"											
233.2	Transition Zone		6	SS	101											
19.4	Bedrock		7	RC	33%	230										
	weathered sound		8	NXL	100%											
	Shale with limestone layers (max. 8" thick)	9	NXL	92%	220											
219.6	Dark Grey															
33.0	End of Borehole					210										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 133

JOB 72-11101-1

LOCATION Co-ords. 15,853,721 N; 1,023,797 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
252.5	Ground Level													
0.0	Fill Material					250								
	Clayey silt, sand, gravel, brick pieces and wood chips.		1	SS	36									
	Grey		2	SS	20									
241.5	Soft to Firm		3	SS	7									
11.0	Silty sand, gravel and brick pieces.		4	SS	11	240								
231.5	Loose		5	SS	11									
18.0	Bedrock-shale weathered		6	SS	80/9"									
18.8	End of Borehole					230								

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 134

JOB 72-11101 -1

LOCATION Co-ords. 15,853,905 N; 1,023,896 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Cone Test & NXI Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$ WATER CONTENT % 10 20 30			BULK DENSITY $\gamma$ P.C.F. GR SA. SI CL	REMARK
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
252.8	Ground Level													
0.0	Fill Material					250								
	Clayey silt, sand and gravel.		1	SS	50/7"									
	Brown-Grey		2	SS	38									
241.8	Soft to Firm		3	SS	4									
11.0	Sand, gravel		4	SS	4	240								2 29 49 20
	Loose		5	SS	7									2 93 ( 5 )
235.3	Bedrock weathered sound		6	SS	60/6"									
17.5	Shale with occ. thin bands of limestone. Dark Gray		7	RC NXL	90%	230								
229.3														
23.5	End of Borehole													
						220								

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 135

JOB 72-11101-1

LOCATION Co-ords. 15,854,087 N; 1,023,950 E.

ORIGINATED BY OP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				$W_p$ $W$ $W_L$ WATER CONTENT % 10 20 30				
253.4	Ground Level														
0.0	Fill Material Clayey silt, sand and gravel.		1	SS	52	250									▽247.3  0 65 (35)
244.4	Brown-Grey Soft to Firm		2	SS	50/4										
9.0	sand, silt, trace of gravel.		3	SS	7										
	Grey		4	SS	7	240									
235.4	Loose		5	SS	51/4										
18.0	End of Borehole Probable Bedrock		6	AS	-										
						230									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 136

JOB 72-11101-1

LOCATION Co-ords. 15,854,274 N; 1,023,988 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — W <sub>L</sub>			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	PLASTIC LIMIT — W <sub>P</sub>	WATER CONTENT — W	W <sub>P</sub>	W		
255.0	Ground Level												
0.0	Fill Material												
	sand, gravel with		1	SS	6	250							
	occ. pockets of		2	SS	8								
	clayey silt		3	SS	11								
243.0			4	SS	2								
12.0	Silt with some sand					240							
238.9	Very Loose		5	SS	12/11								
16.1	End of Borehole												
	Probable Bedrock												
						230							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 137

JOB 72-11101-1

LOCATION Co-ords. 15,854,949 N; 1,023,757 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY JB

DATUM Goodetic

BOREHOLE TYPE Hollow Stem Auger &amp; NXL Rock Core

CHECKED BY *Jo*

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. GR. SA. SI. CL.	REMARK
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE		$w_p$ $w$ $w_L$ WATER CONTENT % 10 20 30			
266.6	Ground Level											
0.0	Topsoil											
1.5	(Glacial Till) Het. mix. of clayey silt, sand & gravel.		1	SS	18	260						
			2	SS	34							
			3	SS	20							
			4	SS	19							
	Brown Grey		5	SS	10	250						
	Stiff to Hard		6	SS	11							
			7	SS	14							
243.6												
23.0	Bedrock - shale with occ. thin limestone bands, Dark Grey, Sound		8	RC NXL	90%	240						
237.6												
29.0	End of Borehole					230						

OFFICE REPORT SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 139

JOB 72-11101-1

LOCATION Co-ords. 15,855,032 N; 1,023,720 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Feb. 23 - 26, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Pressuremeter Test and

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT ——— $w_p$					
											WATER CONTENT — $w$					
							SHEAR STRENGTH P.S.F.				$w_p$ ——— $w$ ——— $w_L$			WATER CONTENT %		
							○ UNCONFINED + FIELD VANE							10 20 30		
							● QUICK TRIAXIAL x LAB VANE									
														P.C.F.		
267.8	Ground Level														GR. SA. SI. CL	
0.0	Topsoil															
1.0	Het. mix. of clayey silt, some sand & gravel (Glacial Till)		1	SS	110	260									261.8	
			2	SS	145											
	Brown Grey		3	SS	15	250										
	Stiff to Hard		4	SS	17											
240.8			5	SS	31										18 26 41 15	
27.0	Bedrock					240										
	weathered sand		6	RC NXL	60%											
	Shale with occ. thin layers of limestone.		7	RC NXL	96%	230										
227.8	Dark Grey															
40.0	End of Borehole					220										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 140

JOB 72-11101 -1

LOCATION Co-ords. 15,855,048 N; 1,023,755 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F.				WATER CONTENT %					
							O UNCONFINED		+ FIELD VANE		$w_p$ $w$ $w_L$		10 20 30			
267.6	Ground Level															
0.0	Topsoil															
1.0	Het. mix. of clayey silt with some sand and gravel		1	SS	38	260										
			2	SS	44											
			3	SS	41											
	Brown Grey  (Glacial Till)		4	SS	22	250										
			5	SS	18											
			6	SS	16											
	Stiff to Very Stiff		7	SS	12	240										
			8	SS	27											
			9	SS	26											
239.6						240										
28.0	End of Borehole Probable Bedrock					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 141

JOB 72-11101-1

LOCATION Co-ords. 15,855,189 N; 1,023,698 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 22, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

 CHECKED BY 10

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		SHEAR STRENGTH P.S.F.			$W_p$ $W$ $W_L$				
269.1	Ground Level													
0.0	Topsoil													
1.5	Het. mix. of clayey silt with some sand & gravel (Glacial Till)		1	SS	30	260								264.2
			2	SS	36									
			3	SS	24									
	Brown Grey		4	SS	9									
			5	SS	9									
	Stiff to Very Stiff		6	SS	7	250								
			7	SS	9									
244.3	Weathered Shale Bedrock		8	SS	50/ft									
24.8	End of Borehole					240								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 143

JOB 72-11101-1

LOCATION Co-ords. 15,853,116 N; 1,019,283 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE March 1 - 2, 1973

COMPILED BY CP

DATUM Geodetic

 BOREHOLE TYPE Hollow Stem Auger, Pressuremeter Test and  
NXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— $w_L$				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT ——— $w_p$					
							SHEAR STRENGTH P.S.F.				WATER CONTENT ——— $w$					
256.6	Ground Level															
0.0	Fill Material															
	Clayey silt, some grav & brick pieces.															
	Brown		1	SS	13	250										
	Soft to Firm															
240.4	sand, gravel with traces of silt. Grey		2	SS	115											
16.2	Bedrock weathered sound					240										
	shale with occ. thin layers of limestone		3	RC NXL	97%											
	Dark Grey		4	RC NXL	97%	230										
228.6																
28.0	End of Borehole					220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 144

JOB 72-11101-1

LOCATION Co-ords. 15,855,081 N; 1,021,484 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 23, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Cores

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		SHEAR STRENGTH P.S.F.			$W_P$ $W$ $W_L$				
274.6	Ground Level													
0.0	Rich material Asphalt, sand & gravel													
268.6	clayey silt with some sand & gravel.		1	SS	20	270								
6.0	Het. mix. of clayey silt, with some sand and gravel.		2	SS	12									
			3	SS	16									
	Brown (Glacial Till)		4	SS	51	260								
256.6	Stiff to Very Stiff		5	SS	31									
18.0			6	SS	50									
	weathered sound				triconed	250								
	Bedrock - shale with occ. thin limestone layers.		7	RC NXL	90%									
242.1			8	RC NXL	94%									
32.5	End of Borehole					240								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 145

JOB 72-11101-1

LOCATION Co-ords. 15,855,022 N; 1,021,395 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 23, 1973

COMPILED BY CP

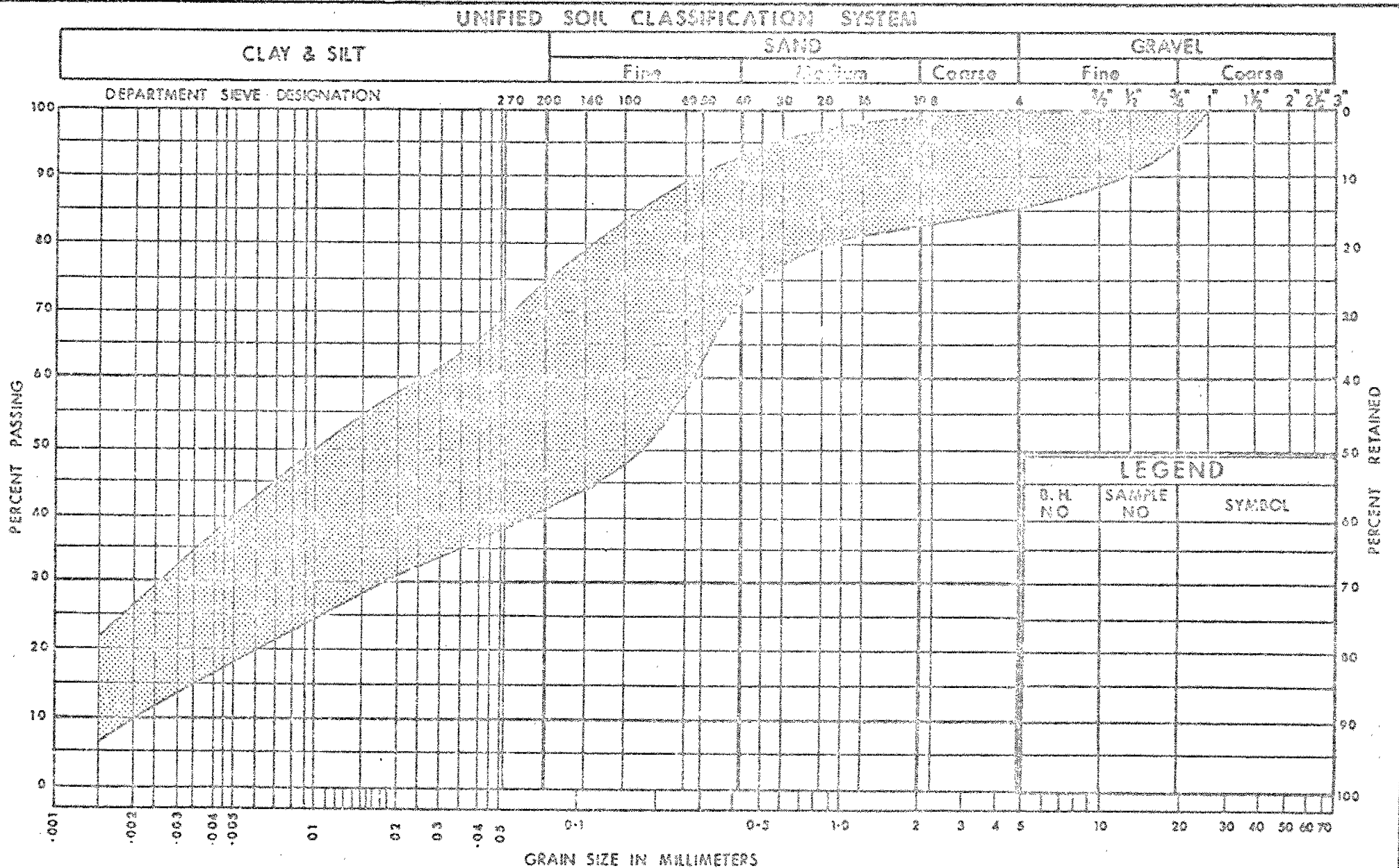
DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Core

CHECKED BY 10

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT			PLASTIC LIMIT — $w_p$				
							SHEAR STRENGTH P.S.F.			WATER CONTENT — $w$				
							○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE	$w_p$			$w$
274.6	Ground Level													
0.0	Fill Material													
271.6	Asphalt, sand & gravel													
3.0	clayey silt with some sand & gravel		1	SS	12	270								
268.6	Set. mix. of clayey silt, with some sand & gravel.		2	SS	12									
6.0	Brown Grey (Glacial Till)		3	SS	19									
	Stiff to Very Stiff		4	SS	35	260								
256.6	Bedrock		5	SS	24									
18.0	weathered sand shale with occ. thin limestone layers.		6	SS	50.4"									
248.3			7	SS	53.4"									
26.3	End of Borehole		8	NXL	100%	250								
						240								

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES  
BRANCH

## GRAIN SIZE DISTRIBUTION

FILL MATERIAL  
CLAYEY SILT, WITH SOME SAND & GRAVEL

97 - 72 - 01

JOB No. 72-11101-1

FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Fine

Medium

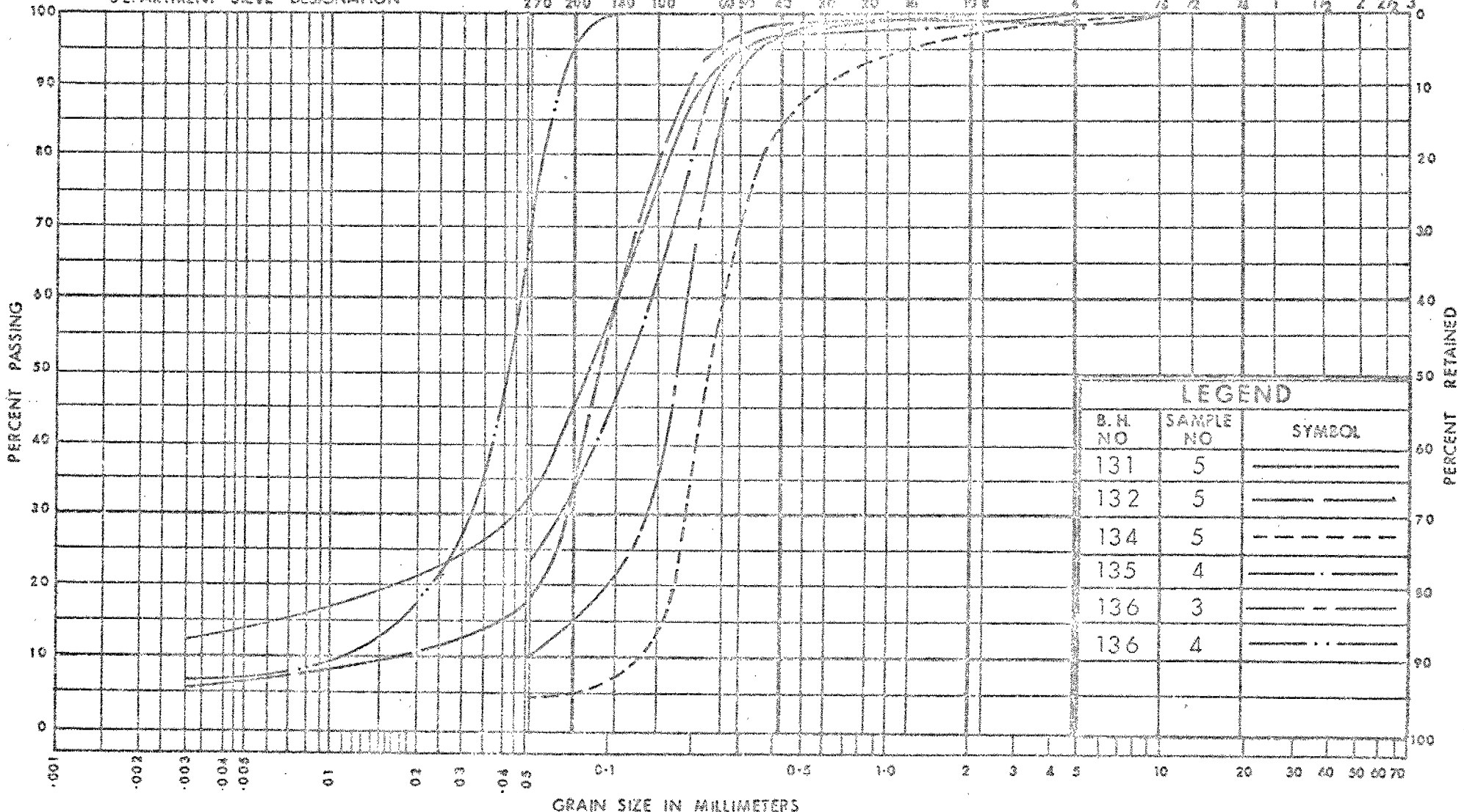
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 43 30 20 36 10 4 3/8 1/2 3/4 1 1 1/2 2 2 1/2 3"



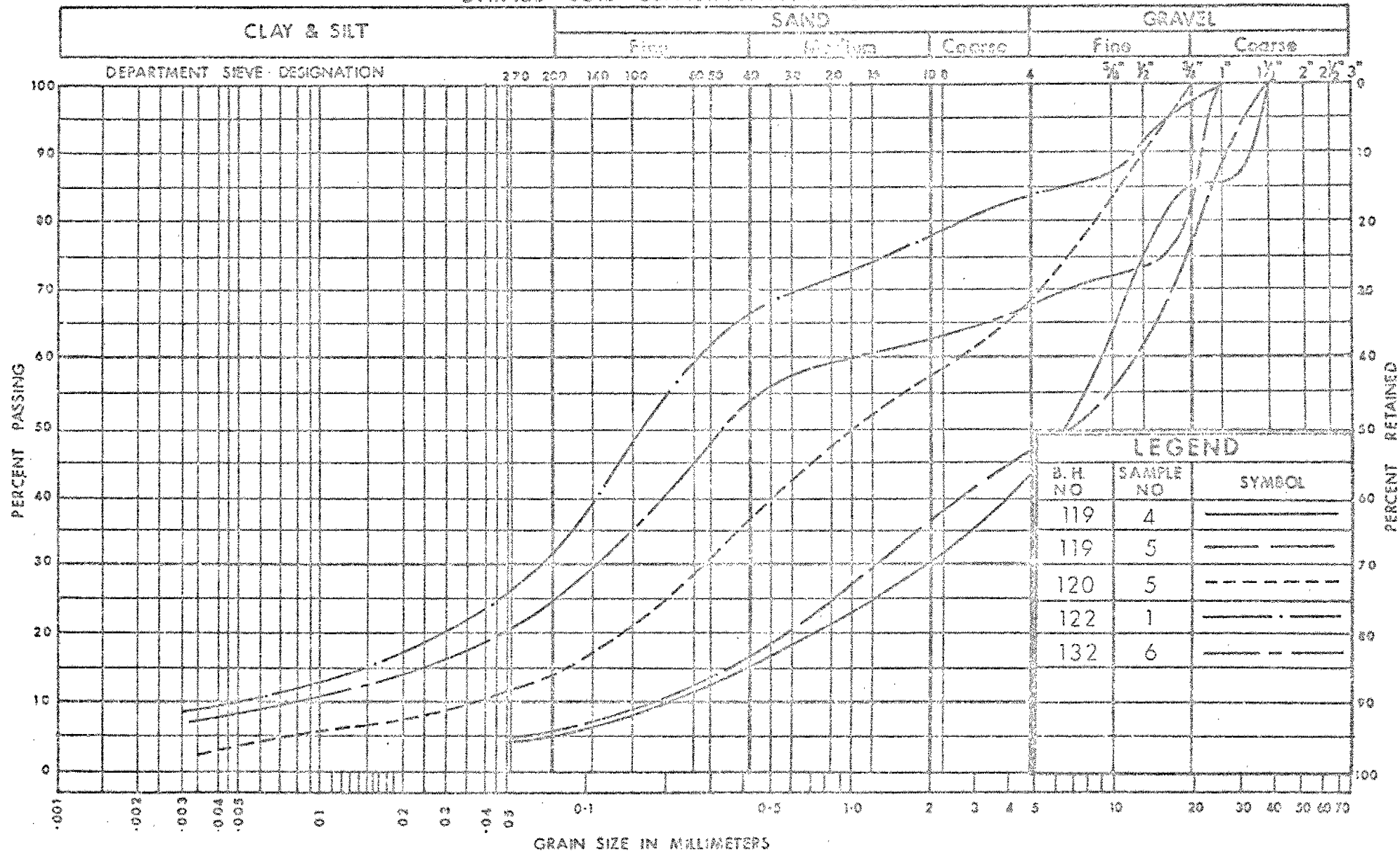
DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS  
  
DESIGN SERVICES  
BRANCH

GRAIN SIZE DISTRIBUTION  
FILL MATERIAL  
SAND WITH SOME GRAVEL

W.P. No. 97-72-01  
JOB No. 72-11101-1  
FIG. 2



# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES  
BRANCH

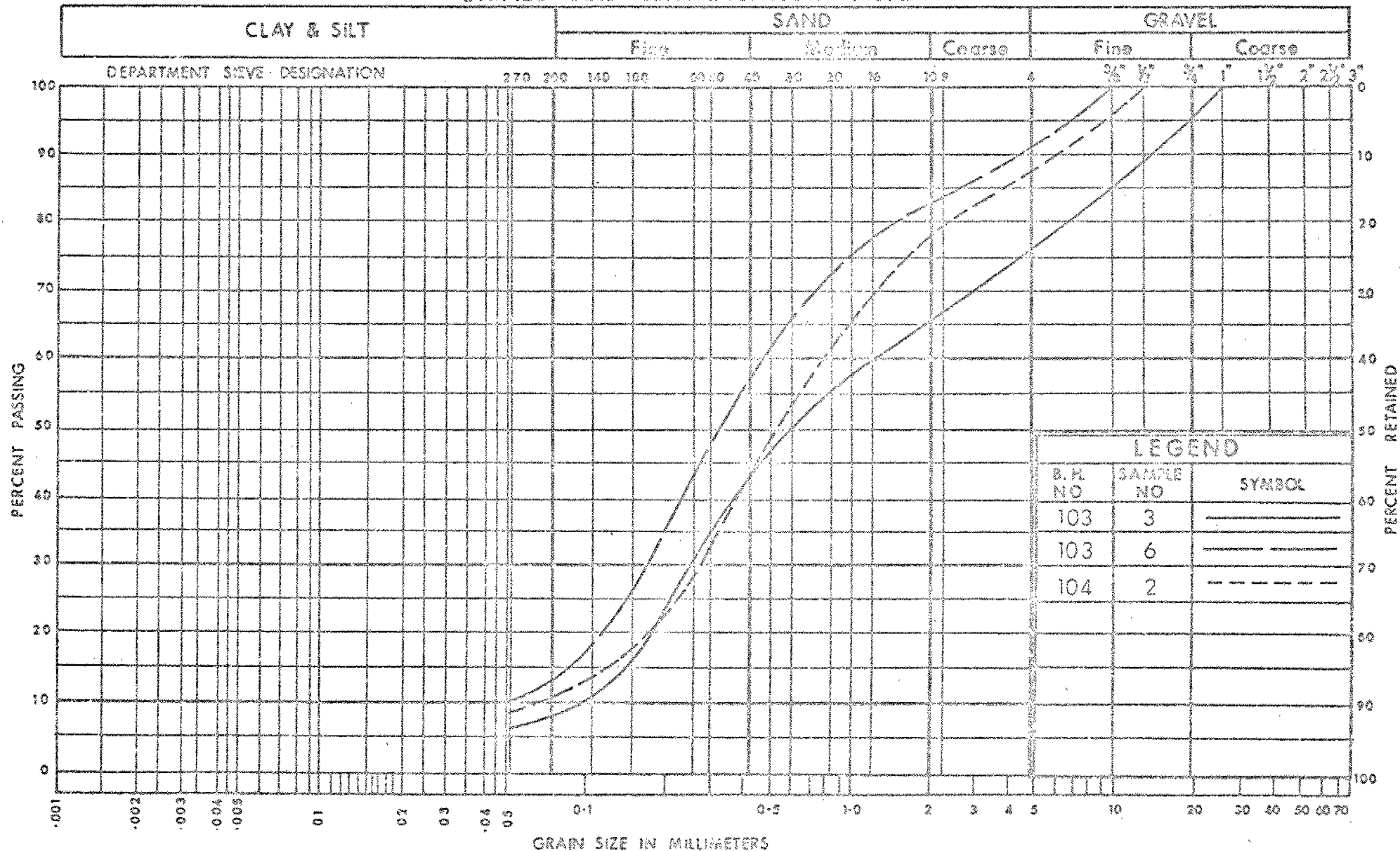
## GRAIN SIZE DISTRIBUTION FILL MATERIAL SAND & GRAVEL

W.P. No. 97-72-01

JOB No. 72-11101-1

FIG. 3

# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS



DESIGN SERVICES  
BRANCH

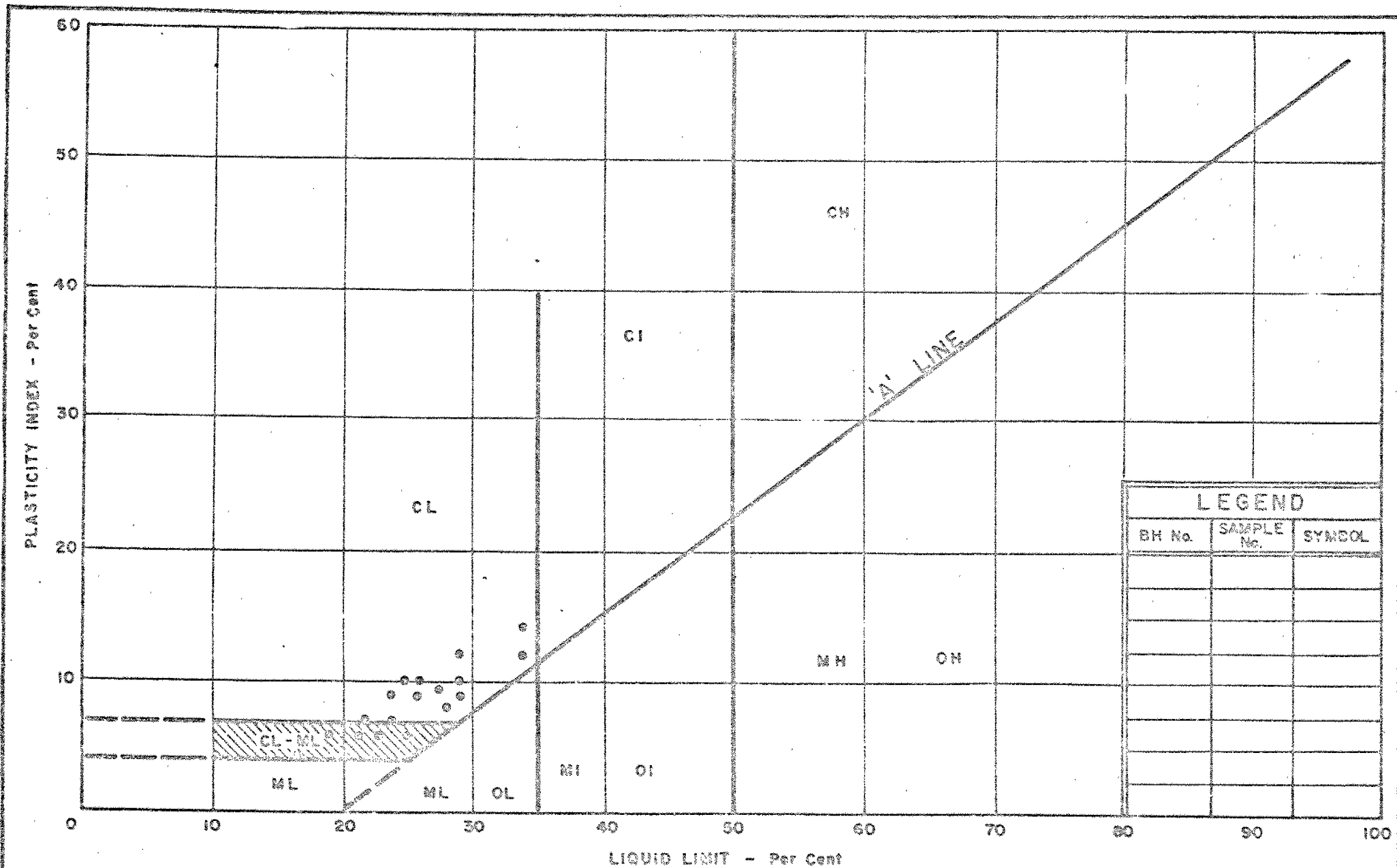
## GRAIN SIZE DISTRIBUTION

BACKFILL MATERIAL BEHIND EXISTING RETAINING WALL  
(GARDINER EXPRESSWAY) SAND, SOME GRAVEL

W.P. No. 97-72-01

JOB No. 72-11101-1

FIG. 4



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

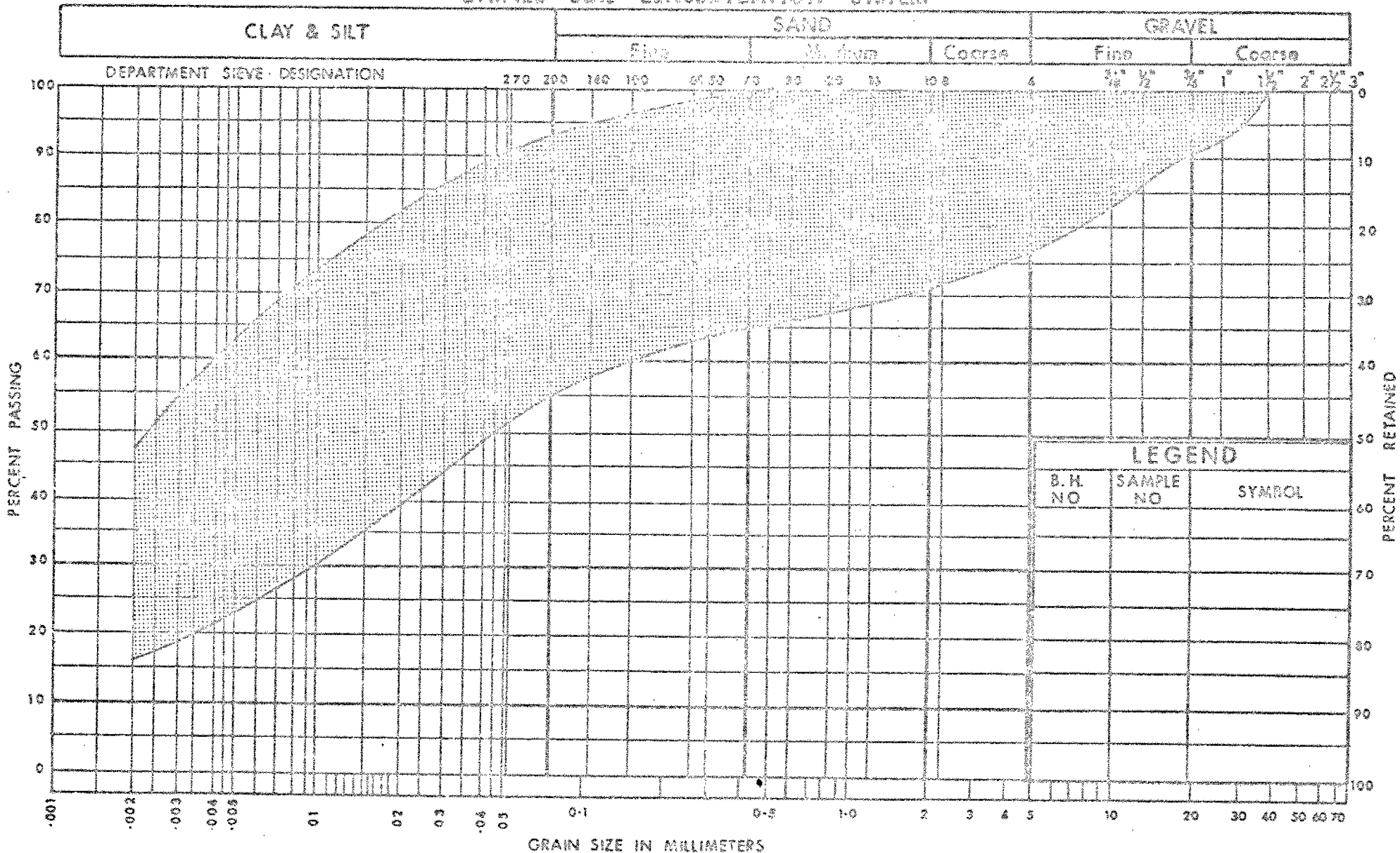
**PLASTICITY CHART**  
**FILL MATERIAL**  
CLAYEY SILT, WITH SOME SAND & GRAVEL  
(RECLAIMED AREA)

WR No. 97-72-01

JOB No. 72-11101-1

FIG. 5

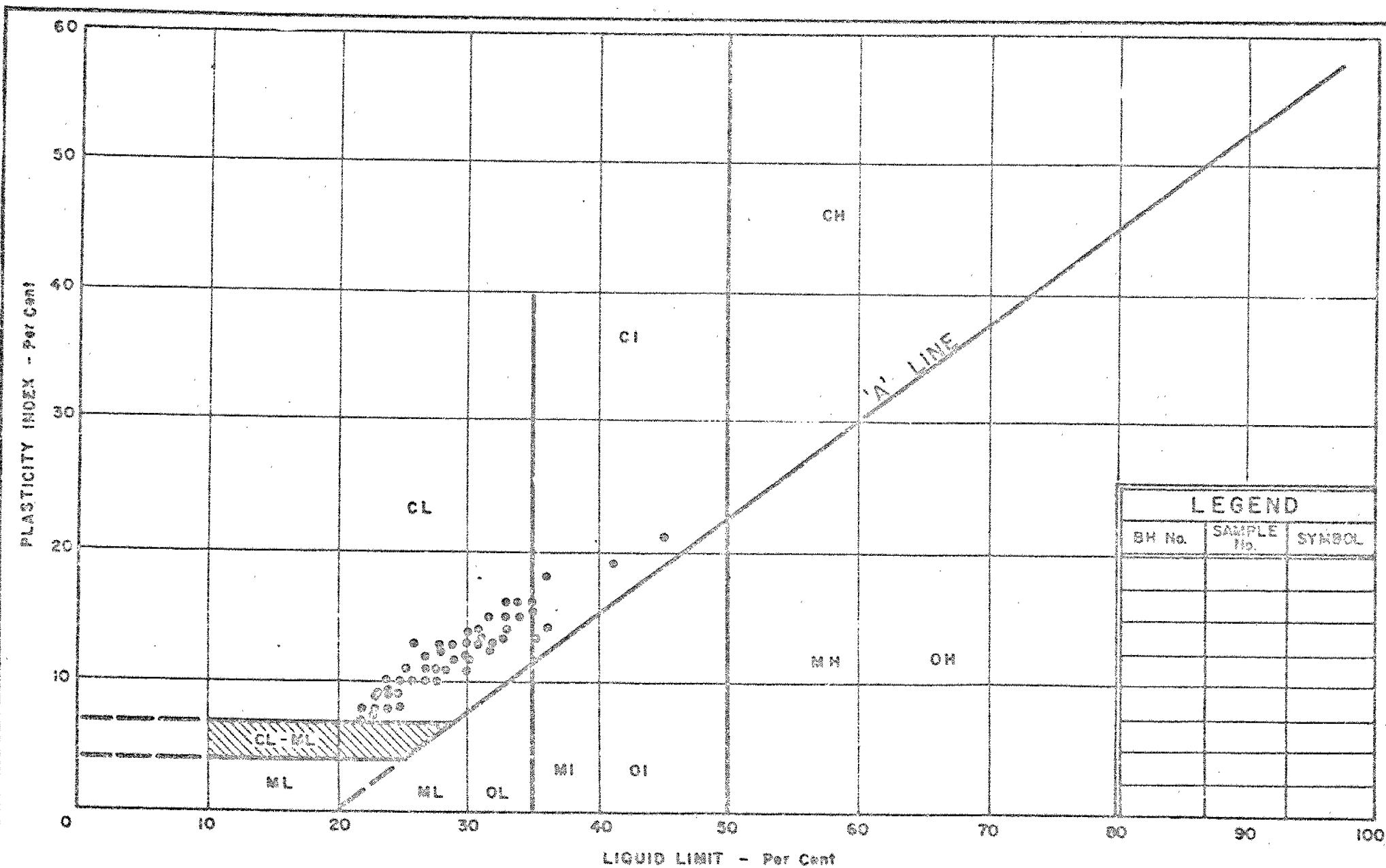
# UNIFIED SOIL CLASSIFICATION SYSTEM



**GRAIN SIZE DISTRIBUTION**  
**GLACIAL TILL**  
 HET. MIXTURE OF CLAYEY SILT, SOME SAND  
 & TRACES OF GRAVEL

DEPARTMENT  
OF  
TRANSPORTATION AND COMMUNICATIONS  
**DESIGN SERVICES  
BRANCH**

W.P. No. 97-72-01  
 JOB No. 72-11101-1  
**FIG. 6**



LEGEND		
BH No.	SAMPLE No.	SYMBOL



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

PLASTICITY CHART  
GLACIAL TILL  
HET. MIXTURE OF CLAYEY SILT, SOME SAND  
& TRACES OF GRAVEL

WP No. 97-72-01  
JOB No. 72-11101-1  
FIG. 7

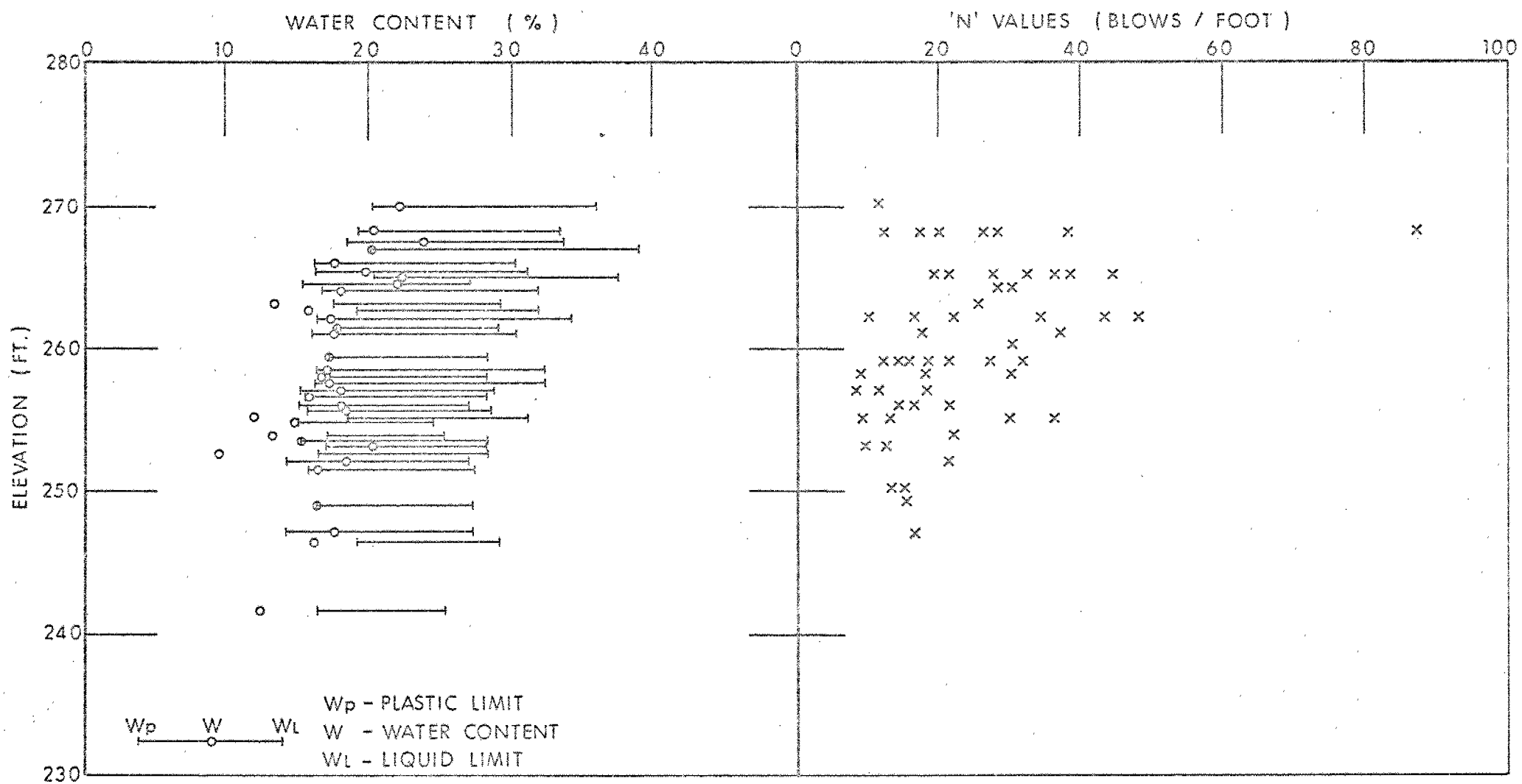


FIG. 8 - SUMMARIZED PROPERTIES OF GLACIAL TILL  
(BORE HOLES 19 TO 31 & 137 TO 145)

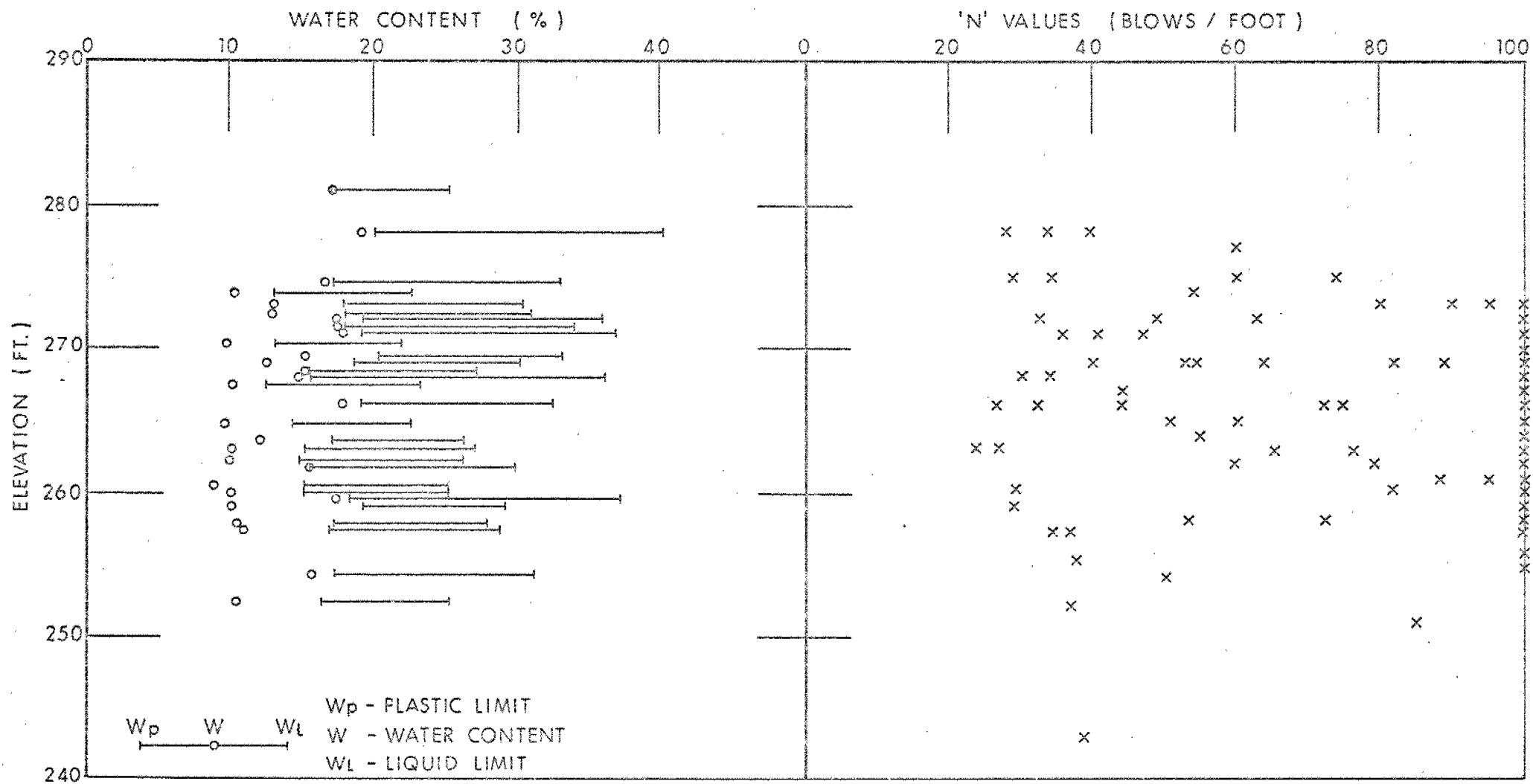


FIG. 9 - SUMMARIZED PROPERTIES OF GLACIAL TILL  
(BORE HOLES 32 TO 50 & 102 TO 111)

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. M. Devata,  
Sup. Foundation Engineer.

FROM: K. W. Ingham

ATTENTION:

DATE: April 11, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT:

Foundation Investigation 72-11101;  
Experimental Rapid Transit Line,  
C.N.E. Grounds, Toronto.

The present study arises from a previous investigation (Sept. 20, 1972) which was a preliminary study of the general subsurface conditions at this site. The general geology of the bedrock outlined in that report is equally applicable to this investigation. The poor core recovery experienced in the former case prompted further drilling to obtain larger diameter core (NXL) for more precise description, and to provide specimens to evaluate the compressive strength of the shale.

A lithological description of each core is attached together with the approximate elevation of the bedrock surface. A primary purpose of the investigation was to delineate fairly accurately the rock surface and various zones of weathering which contributed to poor core recovery in the preliminary investigation. Unfortunately in 7 of the 22 rock cores described in this report, a portion of the upper badly weathered zone of rock was not cored and, therefore, a maximum and minimum elevation for the rock surface is given in these cases. The lower boundary of the badly weathered and generally fractured bedrock has been ascertained and also the depth below which the rock does not show any appreciable signs of weathering.

Specimens selected for strength testing were prepared by machining the ends plane and normal to the core axis and they were then subjected to unconfined uniaxial compression. The compressive strength and sample size for each specimen is given in Table 1. It was found impossible to maintain the cores in their pristine state so at the best the results are representative only of moderately disturbed samples. To obtain a sample with the height equal to approximately twice the diameter after machining required the selection of a section of core approximately 5 inches in length. The relative



difficulty experienced delineating sections of core of this length is a good indication of the interbedded nature of the formation. Examination of the samples after testing indicated that only 4 out of 7 were more or less pure shale.

Available evidence indicates that the maximum difference in strength between specimens with the height twice the diameter and those of approximately equal dimensions is of the order of 25 to 30 percent. Interpolation between these extremes for the samples in Table 1 would produce relatively little change for most of the results and the discrepancies would certainly be within the limits of experimental error. The major difference would be in sample S3 where the corrected value would be approximately 8000 p.s.i. as opposed to the recorded ultimate strength of 9,440 p.s.i.

A brief description of each sample and the nature of failure is given below for the purpose of comparison.

Sample S1

Shaly limestone generally homogeneous with minor laminated sections. Failed by shearing along smooth gently curving planes at approximately 80° to the base of the specimen.

Sample S2

Upper half interbedded shale and shaly limestone with irregular lenses and nodules of limestone. Lower half shaly limestone - separated from the upper portion before testing. The upper section failed first along smooth shear planes at approximately 70 to 80°.

Sample S3

Interbedded shaly limestone and shale. Failed partly by shearing and partly by crushing and more or less fragmented. Shear planes initiating failure very irregular and step-like at approximately 60°.

Sample S4

Shale interlaminated with calcareous shale. Shale laminae 1 mm. or less in thickness. Shale with higher calcium carbonate content generally 1 to 3 mm. in thickness. Initial failure smooth gently curving shear planes in the upper portion of specimen changing to irregular step-like fractures in the

lower portion. Failures vary from  $80^{\circ}$  near the top to  $50^{\circ}$  near the bottom but do not intersect the lower surface of the specimen. Failure primarily shearing with minor crushing.

Sample S5

Similar to sample S4. Failure planes very irregular intersecting both end surfaces of the specimen. Failure partly due to shearing and partly to crushing.

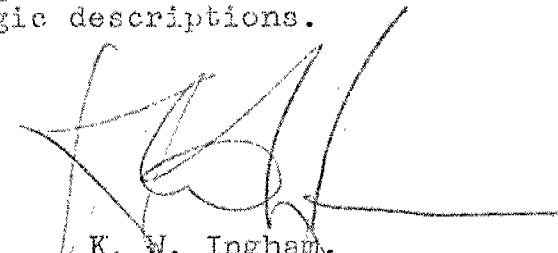
Sample S6

Shale with minor slightly silty or more calcareous layers. Laminae generally 1 mm. or less in thickness. Conspicuous desiccation cracks in some layers in a 5 to 10 mm. polygonal pattern, now infilled with calcite. These are more common in the silty layers and the trace of the failure planes on the basal surfaces frequently follows these cracks. They may indicate small planes of weakness along which failure is initiated in specimens of the size tested. Numerous irregular failure planes developed in the upper half of the specimen, approximate inclination  $50$  to  $60^{\circ}$ .

Sample S7

Shale similar to S6. Main fracture planes irregular approximately  $70$  to  $80^{\circ}$  do not intersect either basal surface. Failure mainly shearing some minor crushing.

Most studies indicate an average shear strength for shale of approximately 5000 p.s.i. Although sample S4 is reasonably close to this value the other three shale samples S5, S6 and S7 are less than 2000 p.s.i. The results may in part be due to the testing technique, as it was found impossible to prevent a certain amount of separation along bedding planes before testing. Probably thereby introducing undue differential pressures and premature failure. However, since the same conditions are probably encountered in the weathered or fractured layers of rock, we can probably equate these low values to such zones in the accompanying lithologic descriptions.



K. W. Ingham,  
Geologist.

KWI:mv

Table 1

The Unconfined Compressive Strength  
Results of Selected Core Samples

Sample No.	Dimensions of Specimen Inches	Ratio of Core Diameter to Length of Specimen	Unconfined Compressive Strength p.s.i.
S1	2-1/8 x 3-1/2	1 : 1.7	11,550
S2	2-1/8 x 4-1/4	1 : 2.0	10,140
S3	2-1/8 x 2-7/8	1 : 1.4	9,440
S4	2-1/8 x 3-5/8	1 : 1.7	5,980
S5	2-1/8 x 4-1/8	1 : 1.9	1,160
S6	2-1/8 x 3-7/8	1 : 1.8	1,340
S7	2-1/8 x 3-7/8	1 : 1.8	1,900

Hole No. 101

Bedrock at 238.7

- |             |   |
|-------------|---|
| 15.5 - 16.0 | Shale; badly weathered, minor thin limestone bands.   |
| 16.0 - 16.3 | Limestone; medium grey, fine grained.   |
| 16.3 - 17.0 | Shale; dark grey, thin bedded, occasional moderately weathered and fractured layers throughout, occasional thin limestone layers. |
| 17.0 - 17.5 | Shale; dark grey, thin bedded, minor thin limestone layers.   |
| 17.5 - 18.0 | Limestone; medium grey, fine grained, thin to medium bedded, slightly silty.  |
| 18.5 - 25.5 | Shale; dark grey, thin to medium bedded, occasional limestone layers 0.1 to 0.2 ft. in thickness, minor thin silty layers.        |
| Note 1.     | Sample S5 19.3 to 20.0 ft.  |
| Note 2.     | Fresh bedrock below 17.0 ft.  |

Hole No. 102

Bedrock 257.2

- 23.5 - 25.0 Shale; badly weathered, occasional limestone layers 0.05 to 0.1 ft. in thickness.
- 25.0 - 27.0 Shale; dark greenish grey, thin bedded to platy, frequent thin limestone interbeds, moderately weathered throughout.
- 27.0 - 27.7 Shale; dark grey, thin bedded, moderately weathered in the lower 0.2 ft.
- 27.7 - 28.1 Limestone, medium grey, fine grained.
- 28.1 - 28.7 Shale; dark grey, thin bedded, frequent thin limestone interbeds.
- 28.7 - 29.1 Limestone; medium grey, fine grained, slightly silty.
- 29.1 - 30.0 Shale; dark grey, thin to medium bedded, minor thin limestone layers.
- Note 1. Fresh bedrock below 27.7 ft.

Hole No. 101

Bedrock between 257.6 and 261.6

- 26.0 - 30.0      No recovery; probably badly weathered shale with minor thin limestone layers.
- 30.0 - 31.0      Shale; dark greenish grey, thin to platy bedded, minor thin limestone bands, slightly weathered.
- 31.0 - 31.4      Limestone; medium grey, fine grained.
- 31.4 - 35.1      Shale; dark grey, thin bedded, minor thin limestone layers.
- 35.1 - 35.4      Limestone; medium grey, fine grained, slightly silty.
- 35.4 - 36.3      Shale; dark grey, thin to medium bedded, occasional thin limestone layers.
- 36.3 - 36.7      Limestone; medium grey.
- 36.7 - 37.1      Shale; dark grey, thin bedded.
- 37.1 - 37.6      Limestone; medium grey, fine grained, thin bedded.
- 37.6 - 39.1      Shale; dark grey, thin to medium bedded, minor thin limestone layers.

Note 1.      Fresh bedrock below 31.0 ft.

Hole No. 106

Bedrock at 258.2

- |             |   |
|-------------|---|
| 18.2 - 20.5 | Shale; dark greenish grey, badly weathered, generally thin to platy bedded.   |
| 20.5 - 20.9 | Limestone; medium grey, fine grained, moderately weathered in the upper 0.05 ft.  |
| 20.9 - 21.3 | Shale; dark grey, thin bedded, occasional thin limestone layers.  |
| 21.3 - 22.1 | Limestone; medium grey, fine grained, slightly silty, thin to medium bedded.  |
| 22.1 - 25.0 | Shale; dark grey, thin to medium bedded, occasional limestone layers 0.1 to 0.2 ft. in thickness, some weathering along bedding planes. |

Note 1. Fresh bedrock below 20.6 ft.

Hole No. 109

Bedrock between 257.7 - 259.7

15.0 - 17.0	No recovery; probably badly weathered shale in part.
17.0 - 17.8	Limestone; medium grey, fine grained, silty, thin to medium bedded.
17.8 - 18.1	Shale; dark grey, thin bedded, slightly weathered.
18.1 - 18.5	Limestone; medium grey, fine grained.
18.5 - 21.0	Shale; dark grey, thin to platy bedded, occasional limestone layers 0.1 to 0.2 ft. in thickness, some weathering along bedding planes.
21.0 - 21.5	Shale; dark grey, thin to medium bedded.
21.5 - 22.0	Limestone; medium grey, fine grained, thin to medium bedded,
22.0 - 25.5	Shale; dark grey, minor thin limestone layers, considerable ground core throughout).

Note 1. Fresh bedrock below 21.0.



Hole No. 111

Bedrock at 246.2

17.3 - 18.5	Shale; dark greenish grey, platy bedded, badly weathered.
18.5 - 19.1	Shale; dark grey, platy bedded, moderately weathered and fractured throughout.
19.1 - 19.6	Limestone; medium grey, fine grained, thin bedded, fractured in the upper 0.2 ft.
19.6 - 19.9	Shale; dark grey, slightly weathered.
19.9 - 20.2	Limestone; medium grey, fine grained, slightly silty.
20.2 - 20.5	Shale; dark grey, moderately weathered.
20.5 - 20.9	Interbedded shale and limestone in thin layers; moderately weathered throughout.
20.9 - 21.1	Limestone; medium grey, fine grained.
21.1 - 21.7	Shale; dark grey, thin bedded, weathered in the upper 0.2 ft.
21.7 - 22.0	Limestone; medium grey, fine grained.
22.0 - 22.3	Limestone; dark grey, fine grained, shaly.
22.3 - 22.5	Limestone; medium grey, fine grained.
22.5 - 22.9	Shale; dark grey, slightly to moderately weathered.
22.9 - 23.2	Limestone; medium grey, fine grained.
23.2 - 23.3	Shale; dark grey, slightly to moderately weathered.
23.3 - 23.7	Limestone; medium grey, fine grained.
23.7 - 27.0	Shale; dark grey, occasional to frequent thin limestone layers, some weathering along bedding planes.

Note 1. Sample S3 26.4 to 26.7 ft.

Note 2. Generally fresh bedrock below 21.3 ft., however, evidence of slight weathering to the bottom of the hole.

Hole No. 112

Bedrock between 256.8 - 259.3

22.5 - 25.0	No recovery; badly weathered shale in part.
25.0 - 26.0	Limestone; medium grey, fine grained, thin shale layer 0.1 ft. from the top.
26.0 - 30.0	Shale; dark grey, thin to medium bedded, minor limestone layers 0.1 to 0.2 ft. in thickness, slightly weathered in the upper 2.0 ft.

Note 1. Fresh bedrock below 28.0 ft.

Hole No. 113

Bedrock at 256.5

22.0 - 22.9

Limestone; medium grey,  
fine grained.

22.9 - 27.3

Shale; dark grey, generally  
medium bedded, some thin to  
platy bedded sections, minor limestone  
layers 0.1 to 0.2 ft. in thickness.

Hole No. 115

Bedrock at 257.1

- |             |  |
|-------------|--|
| 19.3 - 19.8 | Clayey silt till with gravel size shale fragments.   |
| 19.8 - 20.8 | Limestone; medium grey, fine grained, silty, thin bedded, prominent vertical fracture.   |
| 20.8 - 22.3 | Shale; dark grey, generally thin bedded, some platy sections, occasional thin limestone layers, slightly weathered throughout. |
| 22.3 - 23.0 | Limestone; medium grey, fine grained, medium bedded.   |
| 23.0 - 23.5 | Shale; dark grey, platy bedded.  |
| 23.5 - 26.5 | Interbedded dark grey shale, shaly limestone and layers of limestone 0.05 to 0.2 ft. in thickness.                             |

Hole No. 117

Bedrock at 256.8

21.0 - 21.7	Shale; dark greenish grey, platy bedded, badly weathered.
21.7 - 21.8	Limestone; medium grey, fine grained, moderately weathered and fractured.
21.8 - 22.3	Shale; dark grey, platy bedded, badly weathered.
22.3 - 22.4	Limestone; medium grey, fine grained.
22.4 - 22.7	Limestone; dark grey, fine grained, shaly, prominent vertical fracture.
22.7 - 23.0	Limestone; medium grey, fine grained.
23.0 - 23.5	Shale; dark grey, platy bedded, moderately weathered.
23.5 - 24.2	Limestone; medium grey, fine grained, slightly silty.
24.2 - 25.0	Shale; dark grey, thin bedded.
25.0 - 25.4	Limestone; dark grey, shaly.
25.4 - 25.5	Shale; dark grey.
25.5 - 25.7	Limestone; medium grey, fine grained.
25.7 - 25.8	Shale; dark grey.
25.8 - 26.0	Limestone; medium grey, fine grained.
26.0 - 26.5	Limestone, dark grey, shaly.

Note 1. Generally fresh bedrock below 23.5, however, evidence of slight weathering to the bottom of the hole.

Hole No. 120

Bedrock at 238.2

18.0 - 18.4	Clayey silt till with gravel size fragments of limestone and shale.
18.4 - 18.9	Limestone; light grey, fine grained, silty.
18.9 - 19.4	Shale; medium to dark grey, thin to medium bedded, slightly weathered.
19.4 - 19.9	Limestone; light grey, fine grained, silty.
19.9 - 23.0	Shale; dark grey, thin to medium bedded, thin bands of silty limestone 20.3 - 20.7, thin bands of fossiliferous calcareous shale 21.0 - 22.8.

Note 1. Fresh bedrock below 19.4 ft.

Hole No. 122

Bedrock at 237.0

15.0 - 15.9	Shale; dark greenish grey, platy bedded, fissile, 0.1 ft. bed of limestone at the top, generally badly weathered throughout.
15.9 - 16.8	Limestone; medium grey, thin to medium bedded, thin bands of moderately weathered shale at 16.2 and 16.5.
16.8 - 17.1	Shale; dark grey, moderately weathered.
17.1 - 17.2	Limestone; medium grey, fine grained.
17.2 - 17.4	Shale; dark grey, slightly weathered.
17.4 - 17.6	Limestone; medium grey, fine grained.
17.6 - 19.1	Shale; dark grey, medium bedded.
19.1 - 19.3	Limestone; medium grey, fine grained, slightly silty.
19.3 - 23.0	Shale, dark grey, medium bedded, occasional thin limestone beds.

Note 1. Fresh bedrock below 17.4 ft.

Hole No. 124

Bedrock Between 232.5 - 236.5

15.0 - 19.0	No recovery; probably badly weathered shale in part.
19.0 - 19.3	Limestone; light grey, thin bedded, moderately fractured.
19.3 - 24.0	Shale; dark grey, occasional thin limestone layers.

Note 1. Fresh bedrock below 19.3 ft.

Note 2. Sample S4 20.1 - 20.5 ft.



Hole No. 126

Bedrock at 235.6

15.0 - 15.4	Limestone; medium grey, slightly silty.
15.4 - 15.8	Limestone; medium grey, frequent thin shale interbeds, moderately fractured.
15.8 - 16.5	Shale; medium to dark grey, thin bedded, weathered along the bedding planes.
16.5 - 16.7	Limestone; medium grey, fine grained.
16.7 - 18.0	Shale; dark grey, thin to medium bedded, minor thin limestone bands, moderately weathered throughout, badly weathered and fragmented 17.0 - 17.4 ft. and 17.6 - 18.0 ft.
18.0 - 21.0	Shale; dark grey, thin to medium bedded, moderately weathered and badly fragmented sections.
21.0 - 21.8	Shale; dark grey, thin to medium bedded, moderately weathered.
21.8 - 21.9	Limestone; medium grey, fine grained.
21.9 - 22.0	Shale; dark grey, thin bedded.

Note 1. Fresh bedrock below 21.8 ft.

Hole No. 129

Bedrock at 232.5

- 16.0 - 16.4 Shale; badly weathered.
- 16.4 - 16.8 Shale; dark greenish grey, thin to platy bedded, moderately weathered and fractured.
- 16.8 - 19.4 Shale; dark grey, thin to medium bedded with some platy sections, minor thin limestone layers, slightly weathered.
- 19.4 - 20.0 Interbedded dark grey shale and medium grey limestone; thin bedded, slightly weathered and fractured.
- 20.0 - 21.0 Shale; dark grey, thin bedded, minor thin limestone layers, occasional slightly weathered and fractured layers throughout.
- 21.0 - 21.5 Shale; dark grey, thin to medium bedded.
- 21.5 - 22.0 Limestone; medium grey, fine grained, thin to medium bedded.
- 22.0 - 25.5 Shale; dark grey, thin bedded, minor thin limestone layers.

Note 1.

Fresh bedrock below 21.0 ft.

Hole No. 132

Bedrock at 233.2

19.0 - 19.4	Clayey silt till with sand and gravel size shale fragments.
19.4 - 24.0	Shale; dark grey, thin to medium bedded, moderately to badly weathered, occasional limestone layers 0.05 - 0.2 ft. in thickness.
24.0 - 24.3	Limestone; medium grey, fine grained, silty.
24.3 - 24.8	Shale; dark grey, medium bedded.
24.8 - 25.5	Limestone; medium grey, fine grained, prominent vertical fracture.
25.5 - 28.3	Shale; dark grey, thin to medium bedded, frequent limestone layers 0.1 to 0.2 ft. in thickness.
28.3 - 28.7	Limestone; medium grey, fine grained.
28.7 - 30.3	Shale; dark grey, thin to medium bedded, occasional thin limestone bands.
30.3 - 30.5	Limestone; medium grey, fine grained.
30.5 - 33.0	Shale; dark grey, thin to medium bedded, occasional to frequent thin limestone layers.

Note 1. Fresh bedrock below 24.0 ft.

Note 2. Sample S2 30.8 - 31.3 ft.

Hole No. 134

Bedrock at 235.3

17.5 - 18.3	Shale; dark grey, thin bedded, badly weathered.
18.3 - 19.1	Shale; dark grey, thin to medium bedded, moderately weathered throughout.
19.1 - 19.5	Limestone; light grey, fine grained, thin bedded, silty.
19.5 - 19.9	Shale; dark grey, thin bedded, slightly weathered.
19.9 - 20.3	Shale; dark grey, frequent thin bands of shaly limestone.
20.3 - 22.8	Shale; dark grey, thin to medium bedded, occasional to frequent limestone layers 0.05 to 0.1 ft. in thickness.
22.8 - 23.2	Limestone; medium grey, fine grained, slightly silty.
23.2 - 23.5	Shale; dark grey.

Note 1. Fresh bedrock below 19.9 ft.

Hole No. 137

Bedrock at 243.6

23.0 - 29.0

Shale; thin to medium bedded,  
occasional thin limestone  
layers, slight weathering  
along bedding plane at 23.8 ft.

Note 1. Fresh bedrock below 23.8 ft.

Hole No. 139

Bedrock between 235.8 - 240.8

- 27.0 - 32.0      No recovery; weathered shale in part.
- 32.0 - 33.1      Shale; dark grey, thin bedded, minor  
limestone bands up to 0.1 ft. in  
thickness.
- 33.1 - 33.3      Limestone; medium grey, fine grained.
- 33.3 - 36.3      Shale; dark grey, thin to medium bedded,  
occasional silty layers, minor limestone  
layers up to 0.1 ft. in thickness.
- 36.3 - 36.6      Limestone; medium grey, fine grained.
- 36.6 - 38.8      Shale; dark grey, thin to medium bedded,  
occasional limestone layers 0.05 to 0.1 ft.  
in thickness.
- 38.8 - 40.0      Limestone; medium grey, thin bedded, thin  
shale bands between beds.

Note 1.      Fresh bedrock below 32.0 ft.

Hole No. 143

Bedrock between 238.6 and 240.4

- |             |  |
|-------------|--|
| 16.2 - 18.0 | No recovery; badly weathered shale in part.  |
| 18.0 - 19.0 | Shale; dark greenish grey, thin bedded, moderately weathered throughout.   |
| 19.0 - 19.2 | Limestone; medium grey, fine grained.  |
| 19.2 - 22.5 | Shale; dark grey thin to medium bedded, occasional thin limestone bands 0.05 to 0.1 ft. in thickness, weathering along the bedding planes in the upper 2.3 ft. |
| 22.5 - 23.0 | Limestone; medium grey, fine grained.  |
| 23.0 - 24.1 | Shale; dark grey, medium bedded.   |
| 24.1 - 26.1 | Shale; dark grey, medium bedded, minor thin limestone layers.  |
| 26.1 - 26.5 | Limestone, medium grey, fine grained.  |
| 26.5 - 28.0 | Shale; dark grey, thin bedded, frequent limestone layers 0.1 to 0.2 ft. in thickness.  |
| Note 1.     | Fresh bedrock below 21.5 ft.   |
| Note 2.     | Sample S6 23.0 - 23.5 ft., sample S7 23.5 - 24.1 ft.   |

Hole No. 144

Bedrock between 256.6 - 260.1

- 18.0 - 23.5 No recovery; badly weathered shale in part.
- 23.5 - 24.9 Limestone; medium grey, fine grained, thin to medium bedded, silty, minor thin shale layers, prominent vertical fracture 24.0 - 24.9 ft.
- 24.9 - 27.5 Shale; dark grey, generally thin to platy bedded, occasional thin limestone layers 0.1 to 0.2 ft. in thickness, prominent vertical fracture 24.9 - 27.5 ft.
- 27.5 - 27.9 Shale; dark grey, platy bedded, fissile, moderately weathered.
- 27.9 - 28.9 Limestone; medium grey, fine grained, slightly silty.
- 28.9 - 29.9 Limestone; dark grey, shaly, minor thin shale seams.
- 29.9 - 32.6 Shale; dark grey, thin to medium bedded.

Note 1. Fresh bedrock below 27.9 ft.

Note 2. Sample S1 29.2 - 29.6 ft.



Hole No. 145

Bedrock between 256.6 - 259.6

18.0 - 21.0	No recovery; badly weathered shale in part.
21.0 - 21.3	Shale; dark greenish grey, platy bedded, fissile, badly weathered.
21.3 - 21.5	Shale; dark grey, moderately weathered.
21.5 - 22.2	Limestone; medium grey, fine grained, silty, fractured in the lower 0.2 ft.
22.2 - 22.5	Shale; dark grey, platy bedded, slightly weathered sections.
22.5 - 22.9	Limestone; medium grey, fine grained, slightly silty.
22.9 - 23.1	Shale; dark grey, thin bedded, slightly weathered.
23.1 - 23.2	Limestone; medium grey, fine grained.
23.2 - 25.5	Shale; dark grey, generally thin to platy bedded, fissile sections, occasional layers of limestone 0.1 to 0.2 ft. in thickness, slightly weathered throughout.
25.5 - 26.3	Limestone; medium grey, fine grained.

Note 1. Fresh bedrock below 25.5 ft.

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

TERMS TO BE USED IN DESCRIBING SOILS :-

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

TYPE OF SAMPLE

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

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

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

# ABBREVIATIONS & SYMBOLS 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
$w_s$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

## GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF $\sigma$
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF $\sigma$ 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

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 108

JOB 72-11101-1

LOCATION Co-ords. 15,853,782 N; 1,019,035 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$ $w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30		BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
272.2	Ground Level											
0.0	Fill Material	◆				270						
270.2	gravelly sand											
2.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)	⋄	1	SS	76					○	—	
		⋄	2	SS	55							
		⋄	3	SS	72	260				○	—	
	Hard	⋄	4	SS	61					○	—	
257.2		⋄										
256.9	Weathered shale bedrock	⋄	5	SS	75							
15.3	End of Borehole											
						250						

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 109

JOB 72-11101-1

LOCATION Co-ords. 15,853,788 N; 1,018,996 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; NXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$ $w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								
272.7	Ground Level														
0.0	Fill Material-sa. & gr.	X													
1.5	(Glacial Till)		1	SS	59	270									
	Het. mix. of clayey sil		2	SS	73										
	sand and gravel.		3	SS	113										
	Hard		4	SS	37	260									
257.7	Brown		5	SS	75										
15.0	Bedrock shale with weathered sound		6	RC	73%										
251.7	occ. thin layers of limestone. Dark Grey			NXL											
21.0	End of Borehole					250									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 110

JOB 72-11101 - 1

LOCATION Co-ords. 15,853,543 N; 1,019,005 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$ $w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 10 20 30				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
264.2	Ground Level															
0.0	Fill Material-clayey silt, sand, gravel and organics.					260										
260.7			1	SS	26											
3.5	Het. mix. of clayey silt, sand & gravel (Glac. Till)		2	SS	32											
	— Brown Grey		3	SS	56											
	Very Stiff to Hard		4	SS	48	250										
247.7			5	SS	75											
16.5	End of Borehole Probable Bedrock					240										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 111

JOB 72-11101 - 1

LOCATION Co-ords. 15,853,390 N; 1,019,091 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL ROCK CORE

 CHECKED BY *Lo*

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		SHEAR STRENGTH P.S.F.			WATER CONTENT %				
							$w_p$	$w$	$w_L$	10	20	30		
263.5	Ground Level													
0.0	Topsoil													
1.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)		1	SS	29	260								
			2	SS	52									
			3	SS	10									
	--- Brown Grey		4	SS	32	250								
	Stiff to Hard		5	SS	17									
246.2			6	SS	100	240								
17.3	Bedrock shale with weathered sound		7	RC	86%									
	occ. thin layers of limestone		8	NXL	92%									
236.5	Dark Grey													
27.0	End of Borehole					230								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 112

JOB 72-11101-1

LOCATION Co-ords. 15,854,038 N; 1,018,937 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JR

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Core

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			WATER CONTENT %				
							$W_P$	$W$	$W_L$	$W_P$	$W$	$W_L$		
281.8	Ground level													
0.0	Fill material, sand & gravel					280								
2.0	(Glacial till)		1	SS	42									
			2	SS	69									
			3	SS	57									
			4	SS	19	270								
			5	SS	42									
			6	SS	48									
259.3			7	SS	57	260								
22.5	Bedrock													
	Shale with weathered occ. thin layers of limestone			Triconed NXL RC	80%									
251.8	dark grey													
30.0	End of borehole					250								

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 113

JOB 72-11101-1

LOCATION Co-ords. 15,853,912 N; 1,018,849 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Core

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 $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				$W_P$ $W$ $W_L$					
278.5	Ground level															
0.0	Fill materials, e.g.,															
1.0	(Glacial till)															
	Het. mix. of clayey silt, sand & gravel		1	SS	60	270										
			2	SS	59											
			3	SS	25											
	brown grey		4	SS	22											
	Stiff to hard		5	SS	60/2	260										
			6	SS	13											
			7	SS	80											
256.5	Limestone															
22.0	Bedrock - Shale with occ. thin layers of limestone		8	NXL RC	100% Rec.											
251.2	dark grey sand															
27.3	End of Borehole					250										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 114

JOB 72-11101-1 LOCATION Co-ords. 15,853,820 N; 1,018,835 E. ORIGINATED BY CP  
 W.P. 97-72-01 BORING DATE Feb. 20, 1973 COMPILED BY JB  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — $w_L$			BULK DENSITY	REMARK
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			WATER CONTENT — $w$				
275.8	Ground level						SHEAR STRENGTH P.S.F.			$w_p$ — $w$ — $w_L$				
0.0	Gravel & brick pieces						○ UNCONFINED + FIELD VANE			WATER CONTENT %				
272.8	(Glacial till)		1	SS	68	270	● QUICK TRIAXIAL × LAB VANE			15 30 45			$\gamma$	P.C.F. GR.SA.SI.C.
3.0	Het. mixture of clayey silt, sand & gravel		2	SS	122									
	Hard		3	SS	50									
			4	SS	45									
			5	SS	40	260								
257.5	End of Borehole		6	SS	100	3"								0,7,49,44
18.3	Probable bedrock													
						250								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 115

JOB 72-11101-1

LOCATION Co-ords. 15,853,861 N; 1,018,782 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JR

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
276.9	Ground level															
0.0	Fill material sa. & gravel															
2.0	(Glacial till)		1	SS	30	270									▽ 272.8	
			2	SS	50											
			3	SS	40											
			4	SS	30											
	brown-grey Het. mix. of clayey silt, sand & gravel Hard		5	SS	24	260										
257.1	Transition zone--		6	SS	80/3"											
19.8	Limestone shale bedrock with layers of limestone		7	NXL RC	85% Rec.											
			8	NXL RC	100% Rec.											
250.4	dark grey sand					250										
26.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 116

JOB 72-11101-1

LOCATION Co-ords. 15,853,670 N; 1,018,890 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY Lo

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
270.2	Ground level					270								
0.0	Gravel													
1.5	(Glacial till)													
	Het. mix. of clayey silt, sand & gravel		1	SS	32									
			2	SS	37									
			3	SS	86	260								
	brown grey		4	SS	38									
254.5	Hard		5	SS	108	8"								
15.7	Transition zone -- End of borehole													
	Probable bedrock													
						250								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 117

JOB 72-11101-1

LOCATION Co-ords. 15,853,944 N; 1,018,696 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and NXL Rock Core

CHECKED BY 10

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		SHEAR STRENGTH P.S.F.			$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
277.8	Ground Level													
0.0	Fill Material-sa. & gravel													
1.5	(Glacial Till) Het. mix. of clayey silt, sand & gravel.		1	SS	20	270								▼ 271.6
			2	SS	31									
			3	SS	36									
	Brown Grey		4	SS	30	260								
			5	SS	14									
	Very Stiff to Hard		6	SS	29									
256.8			7	SS	50 7/8"									
21.0	Bedrock weathered shale with sound occ. thin layers of Limestone		8	NXL RC	88%									
251.3	Dark Grey		9	NXL	86%									
26.5	End of Borehole					250								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 118

JOB 72-11101-1

LOCATION Co-ords. 15,853,820 N; 1,018,645 E.

ORIGINATED BY GP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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. GR. SA. SI. C.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE			$W_P$ $W$ $W_L$ WATER CONTENT % 10    20    30				
273.5	Ground Level													
0.0	Fill Material-sa. & st.													
1.5	(Glacial Till) Het. mix. of clayey silt, sand & gravel.		1	SS	11	270								
			2	SS	60									
	Brown Grey		3	SS	61									
	Stiff to Hard		4	SS	16	260								
			5	SS	37									
255.5	Redrock Shale-weathered		6	SS	75/6"									632 45 17 256.5
18.0	End of Borehole													
18.5						250								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 119

JOB 72-11101-1

LOCATION Co-ords. 15,853,212 N; 1,019,213 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and Cone Test

 CHECKED BY Jo

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	$W_P$	$W$	$W_L$		
259.2	Ground Level															
0.0	Clayey silt with some sand & gravel.		1	SS	15											
254.2	Brown Firm		2	SS	12											
5.0	Fill Material		3	SS	2	250										
	Sand, gravel, brick pieces & organics.		4	SS	7											
	Loose to Compact		5	SS	75											
241.0			6	SS	50/75											
18.2	End of Borehole					240										
	Probable Bedrock															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 120

JOB 72-11101-1

LOCATION Co-ords. 15,853,093 N; 1,019,368 E.

ORIGINATED BY GP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Cone Test &amp; NXL Rock Core

 CHECKED BY JP

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	$W_P$	$W$	$W_L$		
256.6	Ground Level															P.C.F. GR. SA. SI. CI.
0.0	Fill Material															
	Clayey silt, sand, gravel, brick pieces and organics.		1	SS	10											
			2	SS	7											
			3	SS	8											
	Firm		4	SS	5 1/2											
242.6			5	SS	60/70											
15.0	Sand and gravel															
239.1																
238.2	Transition Zone															
18.1	Bedrock - shale with thin bands of silty limestone.		6	NXL	100%											
233.6	Dark Grey Sand															
23.0	End of Borehole															



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 121

JOB 72-11101-1

LOCATION Co-ords. 15,853,034 N: 1,019,543 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Goodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

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 P.C.F.	REMARK
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				w <sub>p</sub> — w — w <sub>L</sub> WATER CONTENT % 10 20 30					
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
254.1	Ground Level															
0.0	Clayey silt, organics, sand and gravel.		1	SS	13	250									247.2	
242.3	Firm		2	SS	6											
5.0	Fill Material- sand, gravel, brick pieces, and organics		3	SS	3											
	(with cobbles below 81.242.7)		4	SS	50/1"	240										
238.6	Black Loose		5	SS	27/6											
15.5	End of Borehole Probable Bedrock					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 122

JOB 72-11101 - 1

LOCATION Co-ords. 15,852,997 N; 1,019,796 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21/73

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Cone Test &amp; NXL Rock Core

CHECKED BY

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. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
252.0	Ground Level															
0.0	Fill Material - sand, gravel, brick pieces, with occ. clayey silt pockets. (with cobbles below el. 240.)		1	SS	27	250										16 52 24 8
			2	SS	3											246.5
			3	SS	8											
			4	SS	50/2"	240										
237.0	Loose to Compact		5	NXL	10%											
15.0	Bedrock weathered sound		6	NXL	95%											
	Shale with occ. thin layers of limestone		7	NXL	90%	230										
229.0																
23.0	End of Borehole															
						220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 123

JOB 72-11101 -1

LOCATION Co-ords. 15,853,015 N; 1,019,993 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				Wp — W — WL 10 20 30					
252.2	Ground Level															
0.0	Fill Material sand with some silt		1	SS	18	250									246.1 14 21 45 20	
244.2	Grey Compact		2	SS	14											
8.0	Clayey silt with sand & gravel.		3	SS	4											
240.2	Grey. Soft to Firm					240										
12.0	End of Borehole															

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 124

JOB 72-11101-1

LOCATION Co-ords. 15,853,032 N; 1,020,186 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Goodetic

BOREHOLE TYPE Hollow Stem Auger, Cone Test & NXL Rock Core

CHECKED BY *LB*

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	$W_P$	$W$	$W_L$		
251.5	Ground Level															
0.0	Fill Material - Clayey silt, sand, gravel and brick pieces.		1	SS	11	250										
	Sand Black		2	SS	11											
	with cobbles below el. 239.		3	SS	25											
234.5	Soft		4	SS	50/2	240										
17.0	Bedrock weathered shale with sound thin limestone bands		5	NXL	12%											
227.5	Dark Grey		6	NXL	80%	230										
24.0	End of Borehole					220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 124

JOB 72-11101-1

LOCATION Co-ords. 15,853,032 N; 1,020,186 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 21, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Cone Test & NXL Rock Core

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. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$W_P$	$W$	$W_L$		
251.5	Ground Level															
0.0	Fill Material - Clayey silt, sand, gravel and brick pieces.		1	SS	1	250										
	Sand Black		2	SS	1											
	with cobbles below el. 239.		3	SS	25											
234.5	Soft		4	SS	50/2"	240										
			5	NXL	12%											
17.0	Bedrock weathered shale with sound thin limestone bands		6	NXL	80%	230										
227.5	Dark Grey															
24.0	End of Borehole					220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE No 126

JOB 72-11101-1 LOCATION Co-ords. 15,853,035 N; 1,021,270 E.  
 W.P. 97-72-01 BORING DATE Feb. 26, 1973  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & NXL Rock Core

ORIGINATED BY CP  
 COMPILED BY CP  
 CHECKED BY CP

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$ $w_p$ ——— $w$ ——— $w_L$ WATER CONTENT %				BULK DENSITY $\gamma$ P.C.F. GR. SA. SI. C.	REMARK
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
250.6	Ground Level															
0.0	Fill material - sand, gravel, brick pieces with occ. pockets of clayey silt. Loose		1	SS	6	250										248.1
242.6			2	SS	3											
8.0	Clayey silt, some sand, brick pieces & wood		3	SS	6	240										
235.6			4	SS	75.5"											
15.0	Bedrock - shale with occ. thin layers of limestone.		5	RC NXL	80%											
228.4	Dark Grey. Weathered		6	RC NXL	50%	230										
22.0	End of Borehole					220										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 128

JOB 72-11101 -1

LOCATION: Co-ords. 15,852,979 N; 1,021,360 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 26, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				$W_P$ — $W$ — $W_L$ WATER CONTENT %					
250.5	Ground Level															
0.0	Fill Material		1	SS	7	250										
	Clayey silt, some sand and brick pieces.		2	SS	12											
	Grey Soft to Firm		3	SS	7	240										
			4	SS	5											
232.5	Weathered Shale Bedrock		5	SS	72/2"											
18.2	End of Borehole					230										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 67 (R.H. 2, 72-11059)

15,853,083 N; 1,021,173 E.

JOB 72-11001-1

LOCATION Co-ords. 15,853,083 N; 1,021,173 E.

ORIGINATED BY C.S.P.

W.P. 97-72-01

BORING DATE May 9, 1972

COMPILED BY T.B.

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY J.L.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE					$W_P$ $W$ $W_L$ WATER CONTENT %				
250.8	Ground Level															
250.7	Black loam soil		1	SS	55/2"	250									V. 250.8	
0.7	Grey sand & gravel, broken bricks		2	SS	56										May 10/72	
247.8																
3.0	Fill		3	SS	30											
	Clayey silt with some sand & gravel, occasional organic pockets, brick pieces		4	SS	14	245										
			5	SS	14											
			6	SS	13											
	Firm to Stiff		7	SS	14	240										
239.8			8	SS	60/2"											
11.0			9	SS	50/2"											
236.8	Weathered Sound		10	SS	15/3"											
14.0			11	HX RC	80% Rec	235										
	Grey shale bedrock															
			12	BX RC	80% Rec	230										
226.8																
24.0	End of Borehole					225										

OFFICE REPORT SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 101

JOB 72-11101-1 LOCATION Co-ords. 15,854,240 N; 1,023,989 E.  
 W.P. 97-72-01 BORING DATE March 6-7, 1973  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, Pressuremeter Test and

ORIGINATED BY VK  
 COMPILED BY CP  
 CHECKED BY [Signature]

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			$w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30				
254.2	Ground Level													
0.0	Fill Material clayey silt, sand, gravel & concrete pieces.		1	SS	5	250								248.2
244.2	Brown Soft		2	SS	6									
10.0	Silty sand													
238.7	Black Loose		3	SS	60	240								
15.5	Bedrock weathered sound shale with occ. thin layers of limestone		4	NXL RC	100%									
228.7	Dark Grey		5	NXL RC	100%	230								
25.5	End of Borehole					220								

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 102

JOB 72-11101 -1

LOCATION Co-ords. 15,854,853 N; 1,020,930 E.

ORIGINATED BY VK

W.P. 97-72-01

BORING DATE Feb. 27-28, 1973

COMPILED BY CP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Pressuremeter Test and

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT					
280.7	Ground Level						SHEAR STRENGTH P.S.F.				WATER CONTENT %					
0.0	Topsoil						○ UNCONFINED + FIELD VANE				Wp — W — Wl					
1.0	Het. mix. of clayey silt, sand & gravel.		1	SS	56	280									▼ 277.2	
	Glacial Till		2	SS	69	270										
	Brown Grey		3	SS	57	260										
	Hard		4	SS	387.9"											
257.2	Bedrock		5	RC												
23.5	Shale with weathered occ. lime- sound stone layers.			NXL	93%											
250.7	Dark Grey															
30.0	End of Borehole					250										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 103

JOB 72-11101-1

LOCATION Co-ords. 15,854,268 N; 1,019,417 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1972

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem 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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE		WATER CONTENT % $w_p$ $w$ $w_L$					
288.8	Ground Level													
0.0	Fill Material		1	SS	55	280						23 69 ( 8		
	Sand and Gravel		2	SS	39									
	Brown		3	SS	27									
	Very Loose to Very		4	SS	29									
	Dense		5	SS	27									
			6	SS	20		270						9 78 (13) 266.3	
			7	SS	12									
			8	SS	1									
260.8			9	SS	100.1"	260								
28.0	End of Borehole Probable Bedrock													

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 104

JOB 72-11101-1 LOCATION Co-ords. 15,854,192 N; 1,019,256 E.

ORIGINATED BY VK

W.P. 97-72-01 BORING DATE Feb. 21-22, 1973

COMPILED BY CP

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, Pressuremeter Test and

CHECKED BY 22

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— $w_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT ——— $w_p$				
							SHEAR STRENGTH P.S.F.			WATER CONTENT ——— $w$				
287.6	Ground Level													
0.0	Fill Material													
	Clayey silt		1	SS	11									
	Brown Firm		2	SS	2									
	sand, gravel with some silt.		3	SS	19	280								
	Brown Loose													
272.1			4	SS	67									
15.5	Het. mix. of clayey silt, some sand and gravel.		5	SS	138	270								
	(Glacial Till)													
262.6	Grey Hard		6	SS	130.9"									
25.0	Bedrock					260								
	weathered sound			Triconed										
	shale with occ. layers of limestone		7	RC NXL	100%									
	Dark Grey		8	RC NXL	100%	250								
248.5														
39.1	End of Borehole					240								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 105

JOB 72-11101-1 LOCATION Co-ords. 15,854,063 N; 1,019,098E. ORIGINATED BY GP  
W.P. 97-72-01 BORING DATE Feb. 20, 1973 COMPILED BY JB  
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY Jo

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		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				$W_P$	$W$	$W_L$		
283.4	Ground Level														
0.0	Fill Material sandy silt to silty sand with some gravel		1	SS	22	280									9 16 54 21 ▼ 277.4 3' 56 31 10 1 31 56 12
275.4	Compact		2	SS	22										
8.0	Glacial Till Brown Grey		3	SS	52										
	Het. mix. of clayey silt, sand & gravel		4	SS	30	270									
			5	SS	32										
			6	SS	52										
	Very Stiff to Hard		7	SS	111										
259.9			8	SS	87	260									
23.5	End of Borehole Probable Bedrock					250									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 106

JOB 72-11101-1

LOCATION Co-ords. 15,853,880 N; 1,019,057 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger &amp; NXL Rock Core

CHECKED BY *JB*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — $w_L$				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT — $w_p$					
							SHEAR STRENGTH P.S.F.				WATER CONTENT — $w$					
							○ UNCONFINED + FIELD VANE				$w_p$ — $w$ — $w_L$					
							● QUICK TRIAXIAL × LAB VANE				WATER CONTENT %					
											10 20 30					
276.4	Ground Level															
274.4	Fill Material-clayey silty with some sand & gravel															
2.0	(Glacial Till)		1	SS	17											0 22 53 25
	Het. mix. of clayey silty sand and gravel.		2	SS	78	270										271.2
	Brown		3	SS	32											
	Grey		4	SS	35											
	Very Stiff to Hard		5	SS	48	260										
258.2			6	SS	50/3"											
18.2	Bedrock weathered shale with sound			RC												
251.4	occ. thin layers of Limestone. Dark Grey		7	NXL	90%											
25.0	End of Borehole					250										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 107

JOB 72-11101-1

LOCATION Co-ords. 15,853,890N; 1,019,020 E.

ORIGINATED BY CP

W.P. 97-72-01

BORING DATE Feb. 20, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

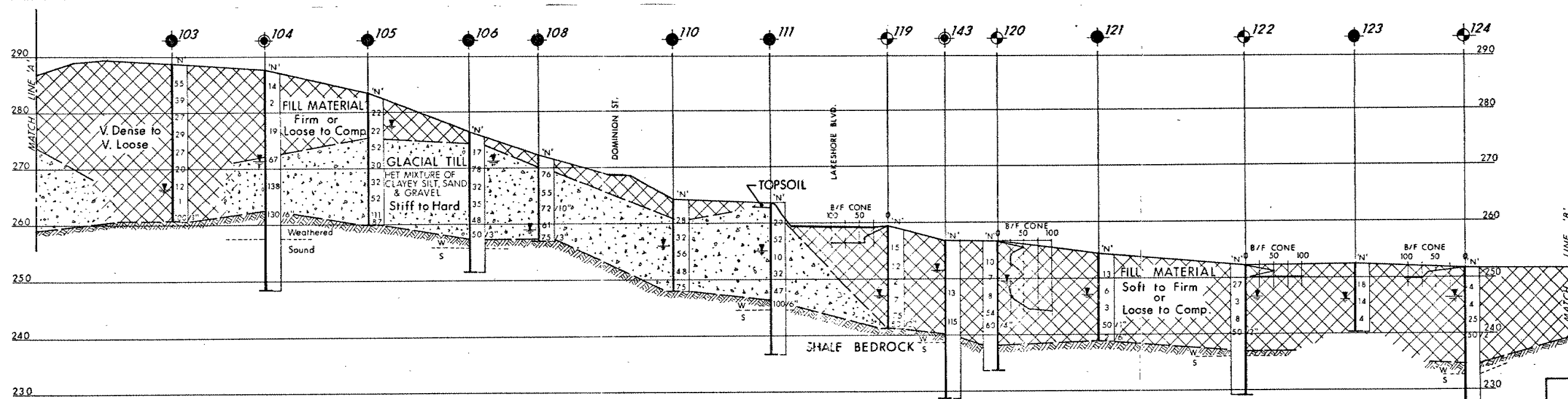
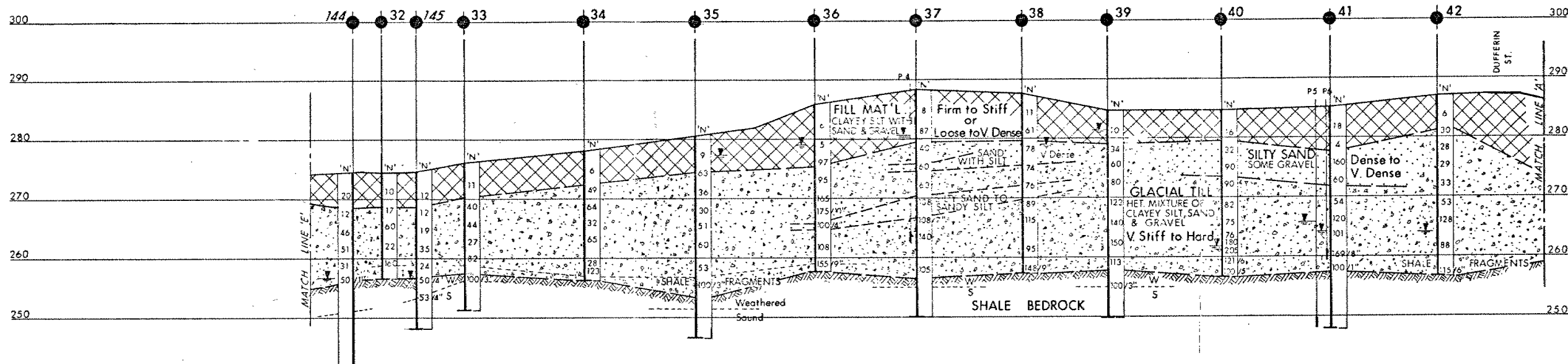
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
278.1	Ground Level													
0.0	Fill Material sand, gravel, clayey silt & brick pieces.		1	SS	50/21									
270.1	Loose		2	SS	11	270								
8.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)		3	SS	15									
	Hard		4	SS	31									
	Brown		5	SS	19									
259.1	Grey		6	SS	75/21	260								
258.0	Weathered shale bedrock													
19.2	End of Borehole					250								

OFFICE REPORT SOIL EXPLORATION

# OVERSIZE DRAWING

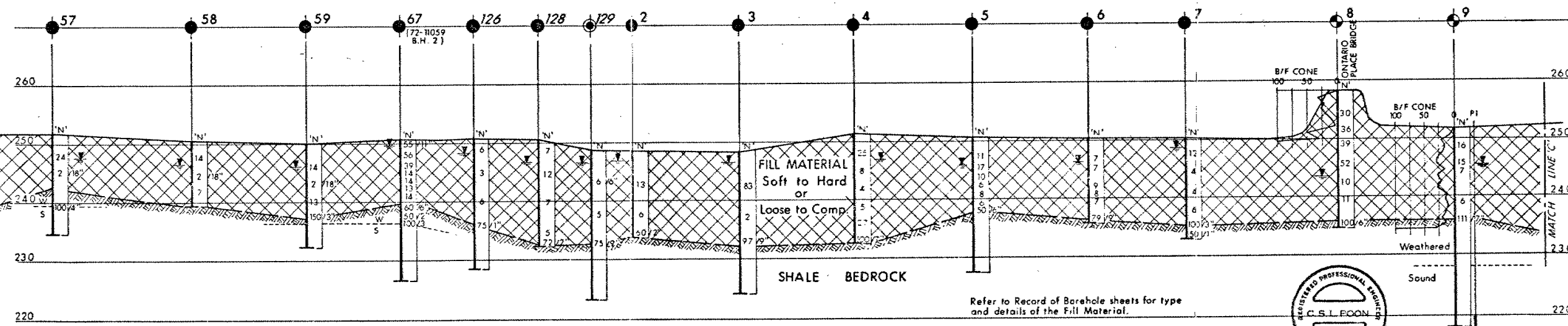


NOTE: Water Levels in Bore Holes 32, 33 & 34 not established



LEGEND	
	Bore Hole
	Bore Hole with Pressure Meter Test
	Bore Hole & Cone Test
	Water Levels established at time of field investigation, SEPT. 1972 & FEB. & MAR. 1973
	Water Levels assumed
	Piezometer
NO.	ELEVATION

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



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

Refer to Record of Borehole sheets for type and details of the Fill Material.



REVISIONS	DATE	BY	DESCRIPTION

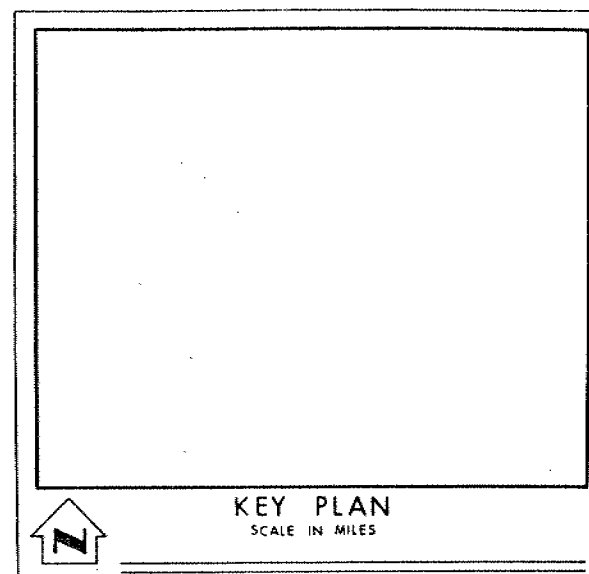
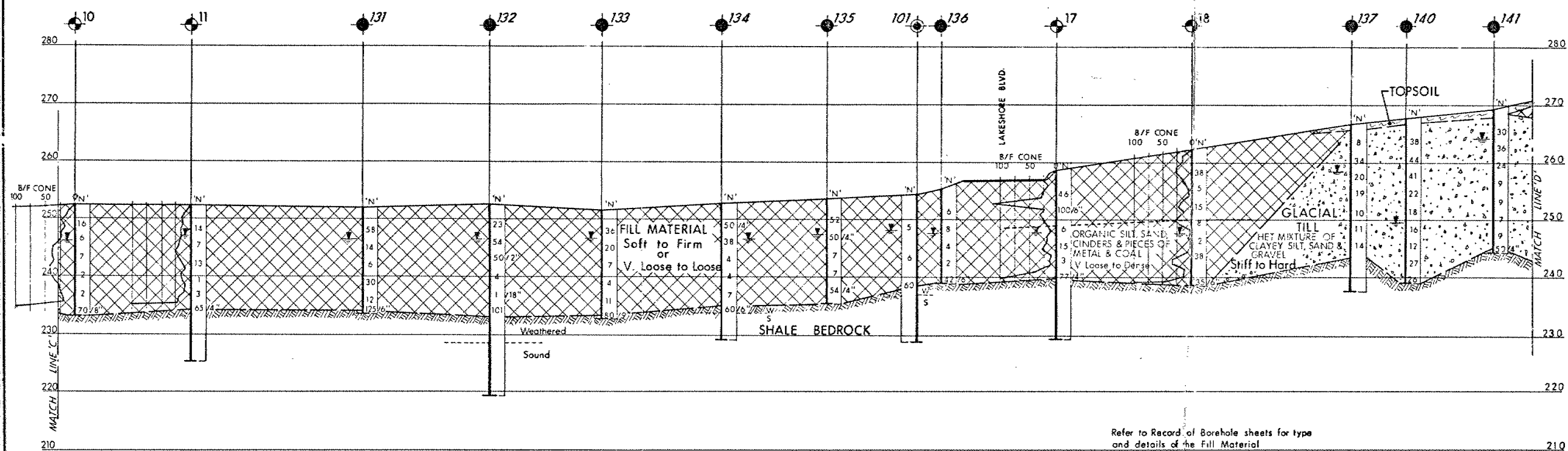
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

PROPOSED ELEVATED RAPID TRANSIT SYSTEM  
(INTERMEDIATE CAPACITY)

HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
TWP. \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

PROFILE & SOIL STRATA

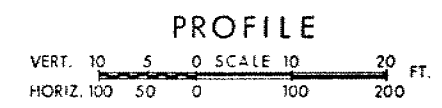
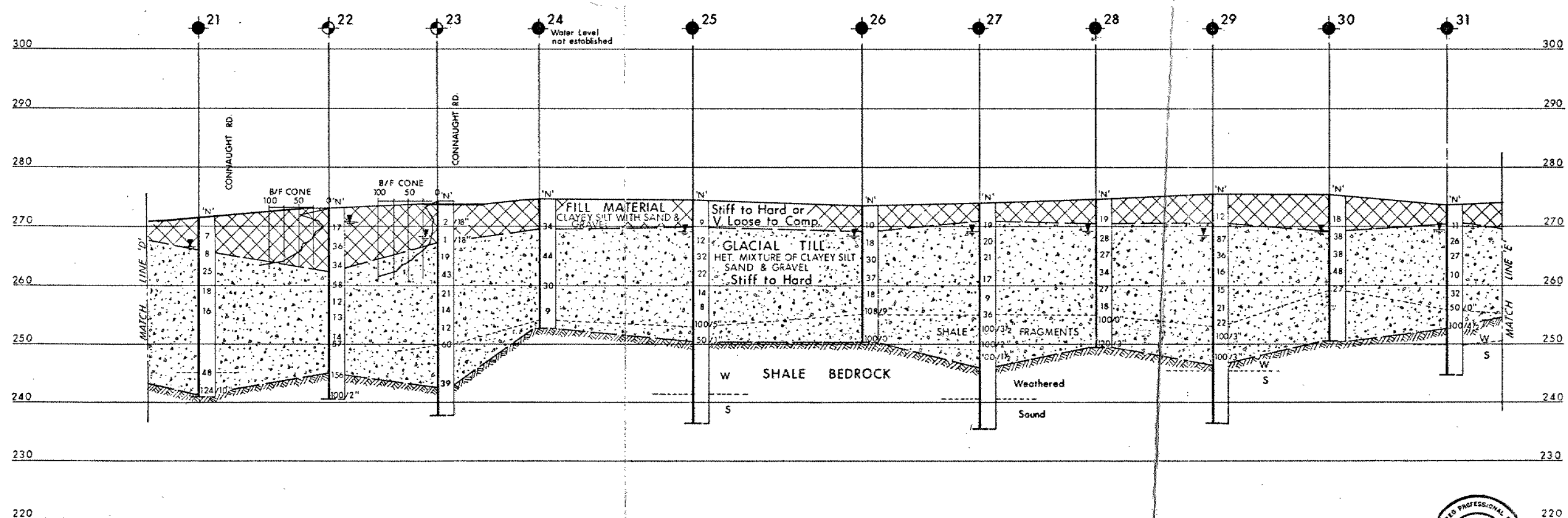
SUBMD. <input checked="" type="checkbox"/> P	CHECKED <input checked="" type="checkbox"/>	WP NO. 97-72-01	DRAWING NO. <b>72-11101-1B</b>
DRAWN <input checked="" type="checkbox"/> SO	CHECKED <input checked="" type="checkbox"/>	WO NO. 72-11101-1	BRIDGE DRAWING NO. _____
DATE 12 MAR 1973	SITE NO. _____	CONT. NO. _____	
APPROVED <i>[Signature]</i>	PRINCIPAL FOUNDATION ENGINEER		



- LEGEND**
- Bore Hole
  - ⊙ Bore Hole with Pressure Meter Test
  - ⊙ Bore Hole & Cone Test
  - ⊙ Water Levels established at time of field investigation, SEPT. 1972 & FEB. 1973
  - ⊙ Water Levels assumed

NO.	ELEVATION		

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



REVISIONS	DATE	BY	DESCRIPTION

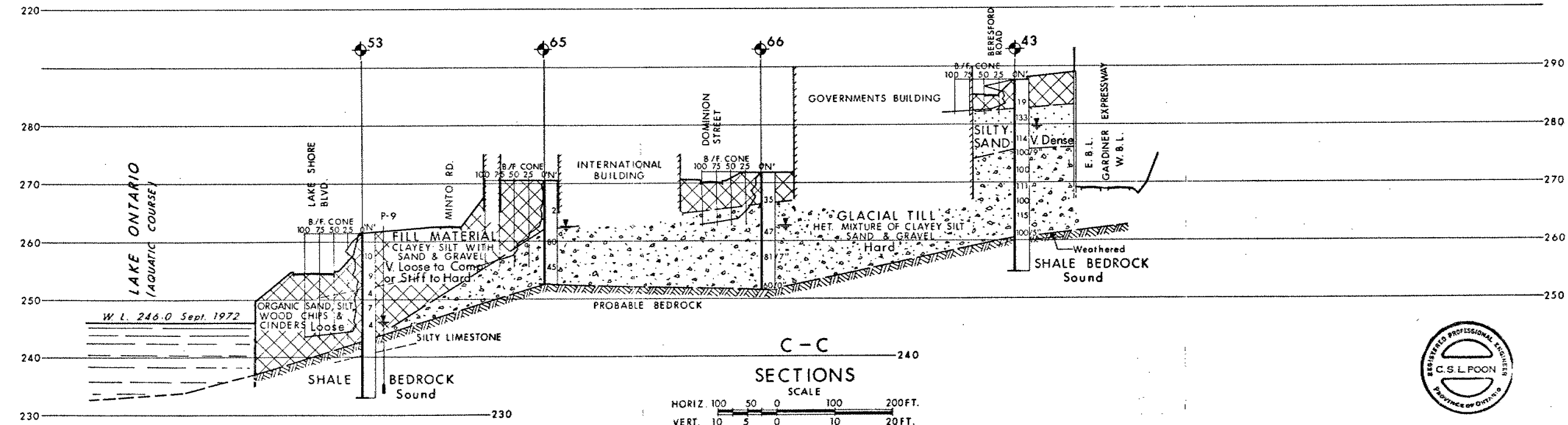
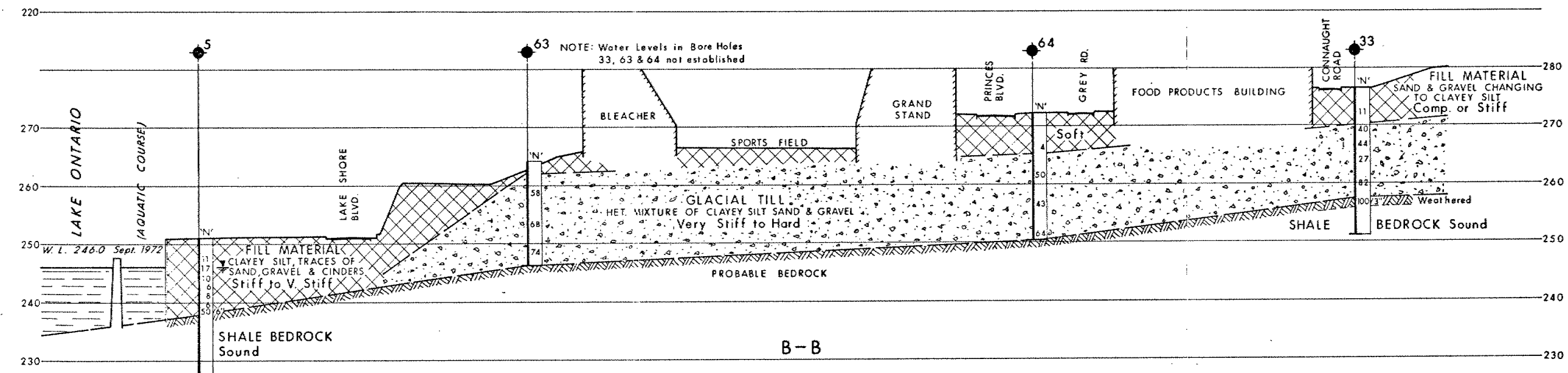
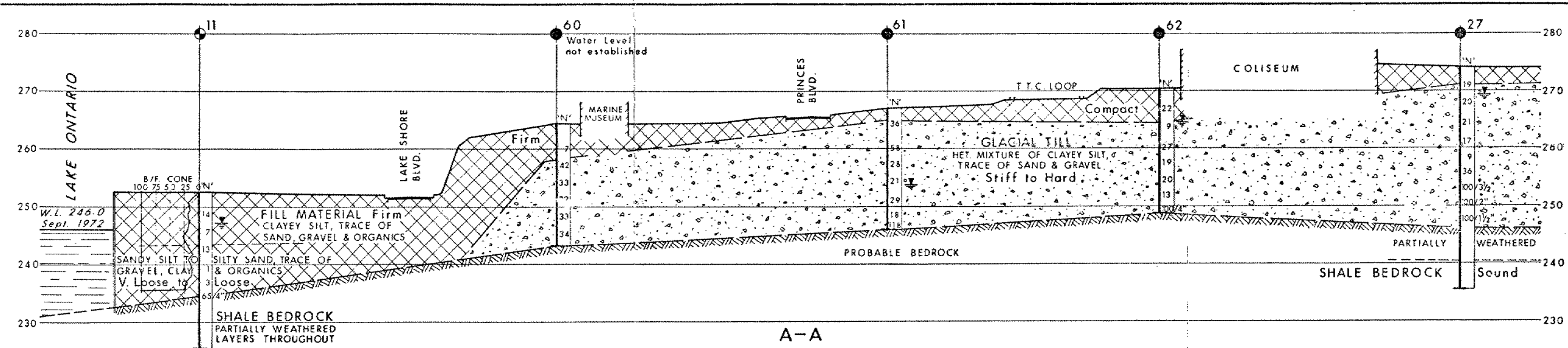
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

**PROPOSED ELEVATED RAPID TRANSIT SYSTEM (INTERMEDIATE CAPACITY)**

HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
TWP. \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

**PROFILE & SOIL STRATA**

SUBMD C.P. CHECKED <input checked="" type="checkbox"/>	W.P. NO. 97-72-01	DRAWING NO. <b>72-11101-1C</b>
DRAWN S.O. CHECKED <input checked="" type="checkbox"/>	W.O. NO. 72-11101-1	BRIDGE DRAWING NO. _____
DATE 22 MAR 1973	SITE NO. _____	CONT. NO. _____
APPROVED <i>Altmann</i>	PRINCIPAL FOUNDATION ENGINEER	



SEE DRAWING NO. 72-11101A

KEY PLAN  
SCALE IN MILES

### LEGEND

- Bore Hole
- ⊕ Cone Penetration Test
- ⊕ Bore Hole & Cone Test
- ⊕ Water Levels established at time of field investigation, SEPT. 1972
- ⊕ Piezometer

NO.	ELEVATION		

### NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

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

PROPOSED ELEVATED RAPID TRANSIT SYSTEM  
(INTERMEDIATE CAPACITY)

HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
TWP. \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

### SECTIONS & SOIL STRATA

SUBWD C.P.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 97-72-01	DRAWING NO. 72-11101-1D
DRAWN <input checked="" type="checkbox"/>	CHECKED <input checked="" type="checkbox"/>	W.O. NO. 72-11101-1	BRIDGE DRAWING NO.
DATE Sept. 22, 1972	SITE NO.	CONT. NO.	
APPROVED <input checked="" type="checkbox"/>	PRINCIPAL FOUNDATION ENGINEER		



Mr. G.E. Boggis,  
Construction Manager,  
Intermediate Capacity T.D.S.,  
C.N.E. GROUNDS, Toronto.

Mr. L. Lennox.

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

June 14th, 1974.

Additional Borings between Stn. 137 & 151,  
Intermediate Capacity T.D.S.,  
C.N.E. Grounds, Toronto,  
Krauss-Maffei Contract #0263-00-041,  
W.P. 97-72-01, W.O. 72-11101.

---

Piers # P-49 to # P-62 inclusive, for the abovementioned T.D.S. Project are to be supported on drilled caissons. The choice of caisson type foundation was made, based on the subsoil information obtained from our preliminary foundation investigation. At that time, the borings were put down some 10 to 45 feet south of centreline of the Guideway, due to the existence of the various underground utilities and the wood bleachers.

Available geological information suggests that the bedrock surface in this area dips gently in a southerly direction, and therefore, the bedrock surface at the pier locations may be at a higher elevation than that obtained in the previous investigation. This being the case, the designed top elevation of the caissons will only be a few feet above the bedrock surface and it may be advantageous to change the caisson support to spread footings founded on bedrock at these locations. The foregoing was discussed in a meeting between Messrs. G. Boggis, L. Lennox and M. Devata, held on June 5th, 1974. In order to assist the project team in evaluating this alternate proposal, Mr. Devata suggested that the Soil Mechanics Section carry out borings at the pier locations to accurately determine the bedrock elevation.

As a result of this, this Section put down 13 borings at the pier locations between June 6th and 7th, 1974. The borings revealed that the overburden is a heterogeneous fill material which has been dumped to reclaim the land from Lake Ontario. The fill material is underlain by interbedded shale and limestone bedrock. The bedrock elevation and the other relevant information were given to Mr. L. Lennox immediately after the completion of the field work. They are also presented in the Drawing No. 72-11101-1E and summarized as follows:

June 14th, 1974.

Mr. G.E. Boggs - W.P. 97-72-01, W.O. 72-11101.

<u>P.E.S.</u>	<u>Ground Elev.</u>	<u>Location</u>	<u>Bedrock Elev.</u>	<u>Groundwater Level</u>
151	253.6	P-51	239.9	247.6
152	255.8	P-53	239.8	247.6
155	253.4	P-55	239.9	247.4
156	252.4	P-56	240.6	247.9
157	251.7	P-57	240.8	248.2
157A	251.7	P-57	240.2	248.2
158	251.9	P-58	240.7	248.0
159	251.6	P-59	241.4	247.7
160	251.6	P-60	241.4	248.4
161	251.8	P-61	240.5	248.0
162	251.5	P-62	240.0	247.2
165	251.6	P-65	239.6	247.8
166	251.3	P-66	239.8	247.4

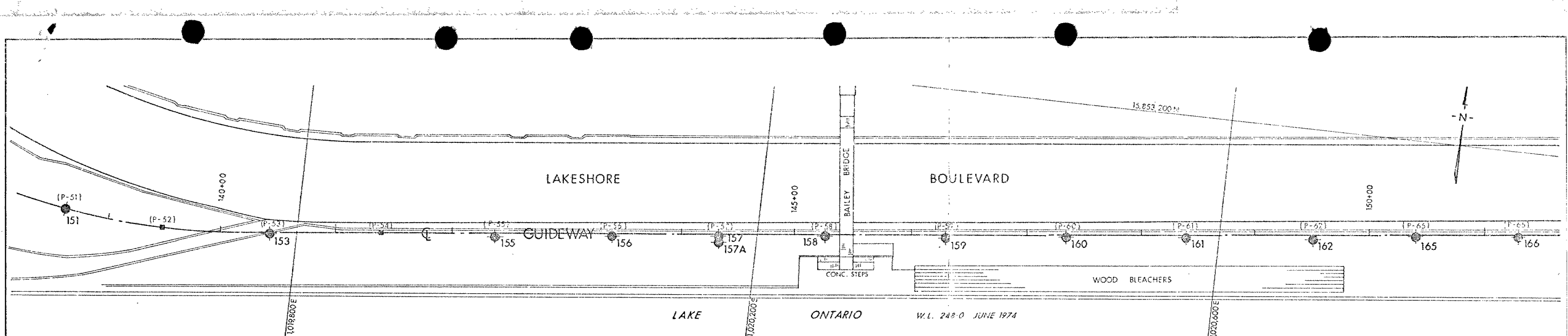
By comparing the established bedrock elevation to the designed caisson cut-off elevation, we suggest that P-56 to P-62 inclusive, may be supported on spread footings founded on the bedrock using an allowable bearing pressure of up to 10 t.s.f. The fill material is pervious, therefore, a dewatering scheme will be required during the construction of the spread footings.

Should you require further information, please feel free to contact this office.

C.S. Poon  
Project Engineer  
For:  
M. Devata  
Supervising Engineer

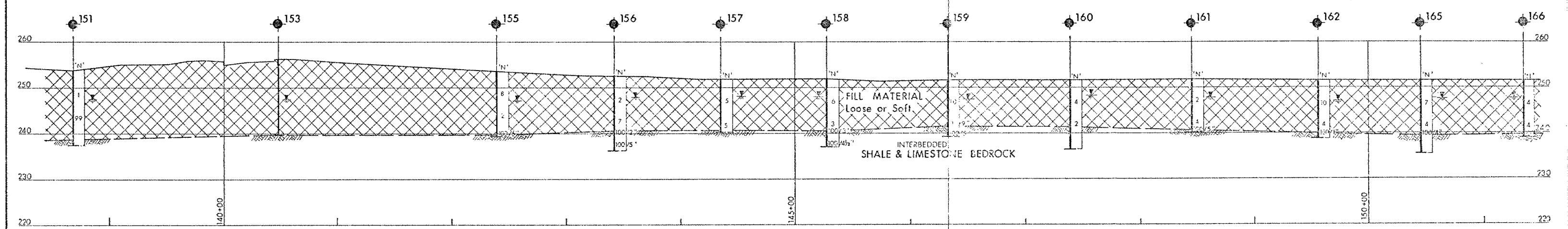
CSP/mj  
c.c. B.R. Davis  
D.E. Thrasher  
R.A. Dorton





PLAN

40 20 0 SCALE 40 80 FT.



PROFILE

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

LEGEND			
	Bore Hole		
	Water Levels established at time of field investigation, JUNE 1974		
	Pier with number		
NO	ELEVATION	CO-ORDINATES	
		NORTH	EAST
151	253.6	15,853,011	1,019,554
153	255.8	15,853,006	1,019,773
155	253.4	15,853,027	1,019,974
156	252.4	15,853,038	1,020,075
157	251.7	15,853,049	1,020,167
157A	251.7	15,853,044	1,020,168
158	251.9	15,853,060	1,020,260
159	251.6	15,853,070	1,020,364
160	251.6	15,853,082	1,020,468
161	251.8	15,853,091	1,020,573
162	251.5	15,853,104	1,020,677
165	251.6	15,853,117	1,020,771
166	251.3	15,853,126	1,020,860

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  
SEE DRAWING NO. 72-11101-1A FOR KEY PLAN

NOTE FOR CONTRACT DOCUMENTS  
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview and at the \_\_\_\_\_ District Office.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE			
C.N.E. INTERMEDIATE CAPACITY TRANSIT DEMONSTRATION SYSTEM			
HIGHWAY NO. _____	DIST. NO. 6		
CO. _____	METROPOLITAN TORONTO		
TWP. _____	LOT _____	CON _____	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBNO. C-1 CHECKED	W.F. NO. 97-72-01	DRAWING NO.	
DRAWN S.D. CHECKED	W.F. NO. 72-11101-1A	72-11101-1E	
DATE 14 JUL 1974	DRAWN	APPROVED	
APPROVED	CONF. NO.		



Mr. M. Devata,  
Sup. Foundation Engineer.

K. W. Ingham

April 11, 1973

Foundation Investigation 72-11101;  
Experimental Rapid Transit Line,  
C.N.E. Grounds, Toronto.

WP 97-72-1

The present study arises from a previous investigation (Sept. 20, 1972) which was a preliminary study of the general subsurface conditions at this site. The general geology of the bedrock outlined in that report is equally applicable to this investigation. The poor core recovery experienced in the former case prompted further drilling to obtain larger diameter core (NXL) for more precise description, and to provide specimens to evaluate the compressive strength of the shale.

A lithological description of each core is attached together with the approximate elevation of the bedrock surface. A primary purpose of the investigation was to delineate fairly accurately the rock surface and various zones of weathering which contributed to poor core recovery in the preliminary investigation. Unfortunately in 7 of the 22 rock cores described in this report, a portion of the upper badly weathered zone of rock was not cored and, therefore, a maximum and minimum elevation for the rock surface is given in these cases. The lower boundary of the badly weathered and generally fractured bedrock has been ascertained and also the depth below which the rock does not show any appreciable signs of weathering.

Specimens selected for strength testing were prepared by machining the ends plane and normal to the core axis and they were then subjected to unconfined uniaxial compression. The compressive strength and sample size for each specimen is given in Table 1. It was found impossible to maintain the cores in their pristine state so at the best the results are representative only of moderately disturbed samples. To obtain a sample with the height equal to approximately twice the diameter after machining required the selection of a section of core approximately 5 inches in length. The relative

OK  
H.

difficulty experienced delineating sections of core of this length is a good indication of the interbedded nature of the formation. Examination of the samples after testing indicated that only 4 out of 7 were more or less pure shale.

Available evidence indicates that the maximum difference in strength between specimens with the height twice the diameter and those of approximately equal dimensions is of the order of 25 to 30 percent. Interpolation between these extremes for the samples in Table 1 would produce relatively little change for most of the results and the discrepancies would certainly be within the limits of experimental error. The major difference would be in sample S3 where the corrected value would be approximately 8000 p.s.i. as opposed to the recorded ultimate strength of 9,440 p.s.i.

A brief description of each sample and the nature of failure is given below for the purpose of comparison.

#### Sample S1

Shaly limestone generally homogeneous with minor laminated sections. Failed by shearing along smooth gently curving planes at approximately 80° to the base of the specimen.

#### Sample S2

Upper half interbedded shale and shaly limestone with irregular lenses and nodules of limestone. Lower half shaly limestone - separated from the upper portion before testing. The upper section failed first along smooth shear planes at approximately 70 to 80°.

#### Sample S3

Interbedded shaly limestone and shale. Failed partly by shearing and partly by crushing and more or less fragmented. Shear planes initiating failure very irregular and step-like at approximately 60°.

#### Sample S4

Shale interlaminated with calcareous shale. Shale laminae 1 mm. or less in thickness. Shale with higher calcium carbonate content generally 1 to 3 mm. in thickness. Initial failure smooth gently curving shear planes in the upper portion of specimen changing to irregular step-like fractures in the



lower portion. Failures vary from  $80^{\circ}$  near the top to  $50^{\circ}$  near the bottom but do not intersect the lower surface of the specimen. Failure primarily shearing with minor crushing.

Sample S5

Similar to sample S4. Failure planes very irregular intersecting both end surfaces of the specimen. Failure partly due to shearing and partly to crushing.

Sample S6

Shale with minor slightly silty or more calcareous layers. Laminae generally 1 mm. or less in thickness. Conspicuous desiccation cracks in some layers in a 5 to 10 mm. polygonal pattern, now infilled with calcite. These are more common in the silty layers and the trace of the failure planes on the basal surfaces frequently follows these cracks. They may indicate small planes of weakness along which failure is initiated in specimens of the size tested. Numerous irregular failure planes developed in the upper half of the specimen, approximate inclination  $50$  to  $60^{\circ}$ .

Sample S7

Shale similar to S6. Main fracture planes irregular approximately  $70$  to  $80^{\circ}$  do not intersect either basal surface. Failure mainly shearing some minor crushing.

Most studies indicate an average shear strength for shale of approximately 5000 p.s.i. Although sample S4 is reasonably close to this value the other three shale samples S5, S6 and S7 are less than 2000 p.s.i. The results may in part be due to the testing technique, as it was found impossible to prevent a certain amount of separation along bedding planes before testing. Probably thereby introducing undue differential pressures and premature failure. However, since the same conditions are probably encountered in the weathered or fractured layers of rock, we can probably equate these low values to such zones in the accompanying lithologic descriptions.



K. W. Ingham,  
Geologist.

Table 1

The Unconfined Compressive Strength  
Results of Selected Core Samples

Sample No.	Dimensions of Specimen Inches	Ratio of Core Diameter to Length of Specimen	Unconfined Compressive Strength p.s.i.
S1	2-1/8 x 3-1/2	1 : 1.7	11,550
S2	2-1/8 x 4-1/4	1 : 2.0	10,140
S3	2-1/8 x 2-7/8	1 : 1.4	9,440
S4	2-1/8 x 3-5/8	1 : 1.7	5,980
S5	2-1/8 x 4-1/8	1 : 1.9	1,160
S6	2-1/8 x 3-7/8	1 : 1.8	1,340
S7	2-1/8 x 3-7/8	1 : 1.8	1,900



Hole No. 106

Bedrock at 258.2

- |             |   |
|-------------|---|
| 18.2 - 20.5 | Shale; dark greenish grey, badly weathered, generally thin to platy bedded.   |
| 20.5 - 20.9 | Limestone; medium grey, fine grained, moderately weathered in the upper 0.05 ft.  |
| 20.9 - 21.3 | Shale; dark grey, thin bedded, occasional thin limestone layers.  |
| 21.3 - 22.1 | Limestone; medium grey, fine grained, slightly silty, thin to medium bedded.  |
| 22.1 - 25.0 | Shale; dark grey, thin to medium bedded, occasional limestone layers 0.1 to 0.2 ft. in thickness, some weathering along bedding planes. |

Note 1. Fresh bedrock below 20.6 ft.

Hole No. 109

Bedrock between 257.7 - 259.7

- |             |  |
|-------------|--|
| 15.0 - 17.0 | No recovery; probably badly weathered shale in part.   |
| 17.0 - 17.8 | Limestone; medium grey, fine grained, silty, thin to medium bedded.  |
| 17.8 - 18.1 | Shale; dark grey, thin bedded, slightly weathered.   |
| 18.1 - 18.5 | Limestone; medium grey, fine grained.  |
| 18.5 - 21.0 | Shale; dark grey, thin to platy bedded, occasional limestone layers 0.1 to 0.2 ft. in thickness, some weathering along bedding planes. |
| 21.0 - 21.5 | Shale; dark grey, thin to medium bedded.   |
| 21.5 - 22.0 | Limestone; medium grey, fine grained, thin to medium bedded,   |
| 22.0 - 25.5 | Shale; dark grey, minor thin limestone layers, considerable ground core throughout).   |

Note 1. Fresh bedrock below 21.0.



Hole No. 111

Bedrock at 246.2

17.3 - 18.5	Shale; dark greenish grey, platy bedded, badly weathered.
18.5 - 19.1	Shale; dark grey, platy bedded, moderately weathered and fractured throughout.
19.1 - 19.6	Limestone; medium grey, fine grained, thin bedded, fractured in the upper 0.2 ft.
19.6 - 19.9	Shale; dark grey, slightly weathered.
19.9 - 20.2	Limestone; medium grey, fine grained, slightly silty.
20.2 - 20.5	Shale; dark grey, moderately weathered.
20.5 - 20.9	Interbedded shale and limestone in thin layers; moderately weathered throughout.
20.9 - 21.1	Limestone; medium grey, fine grained.
21.1 - 21.7	Shale; dark grey, thin bedded, weathered in the upper 0.2 ft.
21.7 - 22.0	Limestone; medium grey, fine grained.
22.0 - 22.3	Limestone; dark grey, fine grained, shaly.
22.3 - 22.5	Limestone; medium grey, fine grained.
22.5 - 22.9	Shale; dark grey, slightly to moderately weathered.
22.9 - 23.2	Limestone; medium grey, fine grained.
23.2 - 23.3	Shale; dark grey, slightly to moderately weathered.
23.3 - 23.7	Limestone; medium grey, fine grained.
23.7 - 27.0	Shale; dark grey, occasional to frequent thin limestone layers, some weathering along bedding planes.

Note 1. Sample S3 26.4 to 26.7 ft.

Note 2. Generally fresh bedrock below 21.3 ft., however, evidence of slight weathering to the bottom of the hole.

Hole No. 112

Bedrock between 256.8 - 259.3

- |             |  |
|-------------|--|
| 22.5 - 25.0 | No recovery; badly weathered shale in part.  |
| 25.0 - 26.0 | Limestone; medium grey, fine grained, thin shale layer 0.1 ft. from the top.   |
| 26.0 - 30.0 | Shale; dark grey, thin to medium bedded, minor limestone layers 0.1 to 0.2 ft. in thickness, slightly weathered in the upper 2.0 ft. |

Note 1. Fresh bedrock below 28.0 ft.



Hole No. 111

Bedrock at 256.5

22.0 - 22.9

Limestone; medium grey,  
fine grained.

22.9 - 27.3

Shale; dark grey, generally  
medium bedded, some thin to  
platy bedded sections, minor limestone  
layers 0.1 to 0.2 ft. in thickness.

Hole No. 115

Bedrock at 257.1

- |             |  |
|-------------|--|
| 19.3 - 19.8 | Clayey silt till with gravel size shale fragments.   |
| 19.8 - 20.8 | Limestone; medium grey, fine grained, silty, thin bedded, prominent vertical fracture.   |
| 20.8 - 22.3 | Shale; dark grey, generally thin bedded, some platy sections, occasional thin limestone layers, slightly weathered throughout. |
| 22.3 - 23.0 | Limestone; medium grey, fine grained, medium bedded.   |
| 23.0 - 23.5 | Shale; dark grey, platy bedded.  |
| 23.5 - 26.5 | Interbedded dark grey shale, shaly limestone and layers of limestone 0.05 to 0.2 ft. in thickness.                             |



Hole No. 117

Bedrock at 256.8

21.0 - 21.7	Shale; dark greenish grey, platy bedded, badly weathered.
21.7 - 21.8	Limestone; medium grey, fine grained, moderately weathered and fractured.
21.8 - 22.3	Shale; dark grey, platy bedded, badly weathered.
22.3 - 22.4	Limestone; medium grey, fine grained.
22.4 - 22.7	Limestone; dark grey, fine grained, shaly, prominent vertical fracture.
22.7 - 23.0	Limestone; medium grey, fine grained.
23.0 - 23.5	Shale; dark grey, platy bedded, moderately weathered.
23.5 - 24.2	Limestone; medium grey, fine grained, slightly silty.
24.2 - 25.0	Shale; dark grey, thin bedded.
25.0 - 25.4	Limestone; dark grey, shaly.
25.4 - 25.5	Shale; dark grey.
25.5 - 25.7	Limestone; medium grey, fine grained.
25.7 - 25.8	Shale; dark grey.
25.8 - 26.0	Limestone; medium grey, fine grained.
26.0 - 26.5	Limestone, dark grey, shaly.

Note 1. Generally fresh bedrock below 23.5, however, evidence of slight weathering to the bottom of the hole.

Hole No. 120

Bedrock at 238.2

18.0 - 18.4	Clayey silt till with gravel size fragments of limestone and shale.
18.4 - 18.9	Limestone; light grey, fine grained, silty.
18.9 - 19.4	Shale; medium to dark grey, thin to medium bedded, slightly weathered.
19.4 - 19.9	Limestone; light grey, fine grained, silty.
19.9 - 23.0	Shale; dark grey, thin to medium bedded, thin bands of silty limestone 20.3 - 20.7, thin bands of fossiliferous calcareous shale 21.0 - 22.8.

Note 1. Fresh bedrock below 19.4 ft.



Hole No. 122

Bedrock at 237.0

- |             |  |
|-------------|--|
| 15.0 - 15.9 | Shale; dark greenish grey, platy bedded, fissile, 0.1 ft. bed of limestone at the top, generally badly weathered throughout. |
| 15.9 - 16.8 | Limestone; medium grey, thin to medium bedded, thin bands of moderately weathered shale at 16.2 and 16.5.                    |
| 16.8 - 17.1 | Shale; dark grey, moderately weathered.  |
| 17.1 - 17.2 | Limestone; medium grey, fine grained.  |
| 17.2 - 17.4 | Shale; dark grey, slightly weathered.  |
| 17.4 - 17.6 | Limestone; medium grey, fine grained.  |
| 17.6 - 19.1 | Shale; dark grey, medium bedded.   |
| 19.1 - 19.3 | Limestone; medium grey, fine grained, slightly silty.  |
| 19.3 - 23.0 | Shale, dark grey, medium bedded, occasional thin limestone beds.   |

Note 1. Fresh bedrock below 17.4 ft.

Hole No. 12h

Bedrock Between 232.5 - 236.5

15.0 - 19.0	No recovery; probably badly weathered shale in part.
19.0 - 19.3	Limestone; light grey, thin bedded, moderately fractured.
19.3 - 24.0	Shale; dark grey, occasional thin limestone layers.

Note 1. Fresh bedrock below 19.3 ft.

Note 2. Sample Sh 20.1 - 20.5 ft.



Hole No. 126

Bedrock at 235.6

15.0 - 15.4	Limestone; medium grey, slightly silty.
15.4 - 15.8	Limestone; medium grey, frequent thin shale interbeds, moderately fractured.
15.8 - 16.5	Shale; medium to dark grey, thin bedded, weathered along the bedding planes.
16.5 - 16.7	Limestone; medium grey, fine grained.
16.7 - 18.0	Shale; dark grey, thin to medium bedded, minor thin limestone bands, moderately weathered throughout, badly weathered and fragmented 17.0 - 17.4 ft. and 17.6 - 18.0 ft.
18.0 - 21.0	Shale; dark grey, thin to medium bedded, moderately weathered and badly fragmented sections.
21.0 - 21.8	Shale; dark grey, thin to medium bedded, moderately weathered.
21.8 - 21.9	Limestone; medium grey, fine grained.
21.9 - 22.0	Shale; dark grey, thin bedded.

Note 1. Fresh bedrock below 21.8 ft.

Hole No. 132

Bedrock at 233.2

19.0 - 19.4	Clayey silt till with sand and gravel size shale fragments.
19.4 - 24.0	Shale; dark grey, thin to medium bedded, moderately to badly weathered, occasional limestone layers 0.05 - 0.2 ft. in thickness.
24.0 - 24.3	Limestone; medium grey, fine grained, silty.
24.3 - 24.8	Shale; dark grey, medium bedded.
24.8 - 25.5	Limestone; medium grey, fine grained, prominent vertical fracture.
25.5 - 28.3	Shale; dark grey, thin to medium bedded, frequent limestone layers 0.1 to 0.2 ft. in thickness.
28.3 - 28.7	Limestone; medium grey, fine grained.
28.7 - 30.3	Shale; dark grey, thin to medium bedded, occasional thin limestone bands.
30.3 - 30.5	Limestone; medium grey, fine grained.
30.5 - 33.0	Shale; dark grey, thin to medium bedded, occasional to frequent thin limestone layers.

Note 1. Fresh bedrock below 24.0 ft.

Note 2. Sample S2 30.8 - 31.3 ft.



Hole No. 134

Bedrock at 235.3

17.5 - 18.3	Shale; dark grey, thin bedded, badly weathered.
18.3 - 19.1	Shale; dark grey, thin to medium bedded, moderately weathered throughout.
19.1 - 19.5	Limestone; light grey, fine grained, thin bedded, silty.
19.5 - 19.9	Shale; dark grey, thin bedded, slightly weathered.
19.9 - 20.3	Shale; dark grey, frequent thin bands of shaly limestone.
20.3 - 22.8	Shale; dark grey, thin to medium bedded, occasional to frequent limestone layers 0.05 to 0.1 ft. in thickness.
22.8 - 23.2	Limestone; medium grey, fine grained, slightly silty.
23.2 - 23.5	Shale; dark grey.

Note 1. Fresh bedrock below 19.9 ft.

Hole No. 137

Bedrock at 243.6

23.0 - 29.0

Shale; thin to medium bedded,  
occasional thin limestone  
layers, slight weathering  
along bedding plane at 23.8 ft.

Note 1. Fresh bedrock below 23.8 ft.



Hole No. 144

Bedrock between 256.6 - 260.1

- 18.0 - 23.5      No recovery; badly weathered shale in part.
- 23.5 - 24.9      Limestone; medium grey, fine grained, thin to medium bedded, silty, minor thin shale layers, prominent vertical fracture 24.0 - 24.9 ft.
- 24.9 - 27.5      Shale; dark grey, generally thin to platy bedded, occasional thin limestone layers 0.1 to 0.2 ft. in thickness, prominent vertical fracture 24.9 - 27.5 ft.
- 27.5 - 27.9      Shale; dark grey, platy bedded, fissile, moderately weathered.
- 27.9 - 28.9      Limestone; medium grey, fine grained, slightly silty.
- 28.9 - 29.9      Limestone; dark grey, shaly, minor thin shale seams.
- 29.9 - 32.6      Shale; dark grey, thin to medium bedded.

Note 1.      Fresh bedrock below 27.9 ft.

Note 2.      Sample S1 29.2 - 29.6 ft.

Hole No. 145

Bedrock between 256.6 - 259.6

18.0 - 21.0	No recovery; badly weathered shale in part.
21.0 - 21.3	Shale; dark greenish grey, platy bedded, fissile, badly weathered.
21.3 - 21.5	Shale; dark grey, moderately weathered.
21.5 - 22.2	Limestone; medium grey, fine grained, silty, fractured in the lower 0.2 ft.
22.2 - 22.5	Shale; dark grey, platy bedded, slightly weathered sections.
22.5 - 22.9	Limestone; medium grey, fine grained, slightly silty.
22.9 - 23.1	Shale; dark grey, thin bedded, slightly weathered.
23.1 - 23.2	Limestone; medium grey, fine grained.
23.2 - 25.5	Shale; dark grey, generally thin to platy bedded, fissile sections, occasional layers of limestone 0.1 to 0.2 ft. in thickness, slightly weathered throughout.
25.5 - 26.3	Limestone; medium grey, fine grained.

Note 1. Fresh bedrock below 25.5 ft.



Hole No. 101

Bedrock at 238.7

- 15.5 - 16.0 Shale; badly weathered, minor thin limestone bands.
- 16.0 - 16.3 Limestone; medium grey, fine grained.
- 16.3 - 17.0 Shale; dark grey, thin bedded, occasional moderately weathered and fractured layers throughout, occasional thin limestone layers.
- 17.0 - 17.5 Shale; dark grey, thin bedded, minor thin limestone layers.
- 17.5 - 18.0 Limestone; medium grey, fine grained, thin to medium bedded, slightly silty.
- 18.5 - 25.5 Shale; dark grey, thin to medium bedded, occasional limestone layers 0.1 to 0.2 ft. in thickness, minor thin silty layers.

Note 1. Sample 55 19.3 to 20.0 ft.

Note 2. Fresh bedrock below 17.0 ft.

Hole No. 102

Bedrock 257.2

- 23.5 - 25.0 Shale; badly weathered, occasional limestone layers 0.05 to 0.1 ft. in thickness.
- 25.0 - 27.0 Shale; dark greenish grey, thin bedded to platy, frequent thin limestone interbeds, moderately weathered throughout.
- 27.0 - 27.7 Shale; dark grey, thin bedded, moderately weathered in the lower 0.2 ft.
- 27.7 - 28.1 Limestone, medium grey, fine grained.
- 28.1 - 28.7 Shale; dark grey, thin bedded, frequent thin limestone interbeds.
- 28.7 - 29.1 Limestone; medium grey, fine grained, slightly silty.
- 29.1 - 30.0 Shale; dark grey, thin to medium bedded, minor thin limestone layers.
- Note 1. Fresh bedrock below 27.7 ft.



Hole No. 10h

Bedrock between 257.6 and 261.6

- 26.0 - 30.0 No recovery; probably badly weathered shale with minor thin limestone layers.
- 30.0 - 31.0 Shale; dark greenish grey, thin to platy bedded, minor thin limestone bands, slightly weathered.
- 31.0 - 31.4 Limestone; medium grey, fine grained.
- 31.4 - 35.1 Shale; dark grey, thin bedded, minor thin limestone layers.
- 35.1 - 35.4 Limestone; medium grey, fine grained, slightly silty.
- 35.4 - 36.3 Shale; dark grey, thin to medium bedded, occasional thin limestone layers.
- 36.3 - 36.7 Limestone; medium grey.
- 36.7 - 37.1 Shale; dark grey, thin bedded.
- 37.1 - 37.6 Limestone; medium grey, fine grained, thin bedded.
- 37.6 - 39.1 Shale; dark grey, thin to medium bedded, minor thin limestone layers.

Note 1. Fresh bedrock below 31.0 ft.

Hole No. 122

Bedrock at 232.5

- 16.0 - 16.4 Shale; badly weathered.
- 16.4 - 16.8 Shale; dark greenish grey, thin to platy bedded, moderately weathered and fractured.
- 16.8 - 19.4 Shale; dark grey, thin to medium bedded with some platy sections, minor thin limestone layers, slightly weathered.
- 19.4 - 20.0 Interbedded dark grey shale and medium grey limestone; thin bedded, slightly weathered and fractured.
- 20.0 - 21.0 Shale; dark grey, thin bedded, minor thin limestone layers, occasional slightly weathered and fractured layers throughout.
- 21.0 - 21.5 Shale; dark grey, thin to medium bedded.
- 21.5 - 22.0 Limestone; medium grey, fine grained, thin to medium bedded.
- 22.0 - 25.5 Shale; dark grey, thin bedded, minor thin limestone layers.

Note 1. Fresh bedrock below 21.0 ft.



Hole No. 139

Bedrock between 235.8 - 240.8

- 27.0 - 32.0 No recovery; weathered shale in part.
- 32.0 - 33.1 Shale; dark grey, thin bedded, minor limestone bands up to 0.1 ft. in thickness.
- 33.1 - 33.3 Limestone; medium grey, fine grained.
- 33.3 - 36.3 Shale; dark grey, thin to medium bedded, occasional silty layers, minor limestone layers up to 0.1 ft. in thickness.
- 36.3 - 36.6 Limestone; medium grey, fine grained.
- 36.6 - 38.8 Shale; dark grey, thin to medium bedded, occasional limestone layers 0.05 to 0.1 ft. in thickness.
- 38.8 - 40.0 Limestone; medium grey, thin bedded, thin shale bands between beds.

Note 1. Fresh bedrock below 32.0 ft.

Hole No. 113

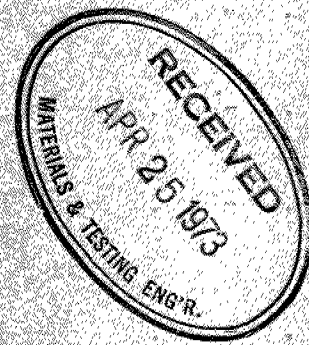
Bedrock between 238.6 and 240.4

- 16.2 - 18.0 No recovery; badly weathered shale in part.
- 18.0 - 19.0 Shale; dark greenish grey, thin bedded, moderately weathered throughout.
- 19.0 - 19.2 Limestone; medium grey, fine grained.
- 19.2 - 22.5 Shale; dark grey thin to medium bedded, occasional thin limestone bands 0.05 to 0.1 ft. in thickness, weathering along the bedding planes in the upper 2.3 ft.
- 22.5 - 23.0 Limestone; medium grey, fine grained.
- 23.0 - 24.1 Shale; dark grey, medium bedded.
- 24.1 - 26.1 Shale; dark grey, medium bedded, minor thin limestone layers.
- 26.1 - 26.5 Limestone, medium grey, fine grained.
- 26.5 - 28.0 Shale; dark grey, thin bedded, frequent limestone layers 0.1 to 0.2 ft. in thickness.

Note 1. Fresh bedrock below 21.5 ft.

Note 2. Sample 56 23.0 - 23.5 ft., sample 57 23.5 - 24.1 ft.

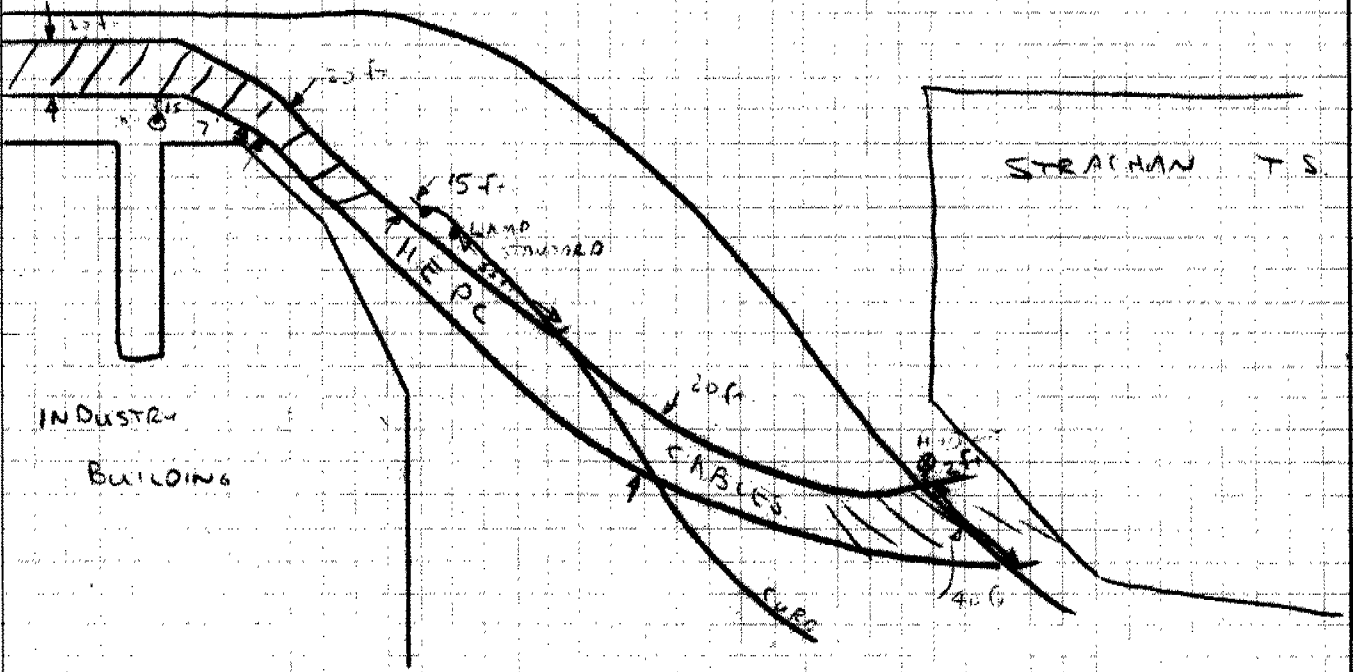






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## underground hydro stake-out report

requested by	name <b>MR CHRIS DOON</b>	date <b>SEPT. 5 1972</b>
	company or contractor <b>HILLMAN DEPT</b>	phone number <b>248-3292</b>
	address	
location of stake-out	location <b>CNE STRACHAN T.S. WEST TO OPPOSITE INDUSTRIAL BUILDING ALONG COUNTESS ROAD</b>	appointment date <b>SEPT. 5, 1972</b>
		time <b>10:00</b> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
why is stake-out needed?		
sketch		
type of plant	<b>115 000 VOLT CABLES</b>	
marking	<input type="checkbox"/> stakes <input checked="" type="checkbox"/> paint <input type="checkbox"/> tape	
given by	signature <b>Harry Ford</b>	date <b>SEPT. 15, 1972</b>
	phone number <b>222-5000</b>	time <b>11:25</b> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
note	<p>It is understood that the above information has been provided from our records and represents our knowledge of the approximate location.</p> <p>The responsibility is that of the contractor to exercise extreme caution where mechanical equipment is used in the vicinity of the underground cable plant, and where necessary to locate by hand its' actual position.</p>	
accepted by	signature <b>Michael T. Elliott</b>	title
	company <b>D.T.C.</b>	



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## underground hydro stake-out report

requested by	name MR. CHRIS POON	date SEPT 6 1972
	company or contractor HIGHWAYS DEPT.	phone number 248 3292
	address	
location of stake-out	location CNE - WEST OF FOOD PRODUCTS BUILDING TO WEST OF ARMED FORCES EXHIBIT AREA	appointment date SEPT 5 1972
		time 1000 <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
why is stake-out needed?	SOIL SAMPLING	
sketch		
type of plant	115,000 volt cable	
marking	<input checked="" type="checkbox"/> stakes <input checked="" type="checkbox"/> paint <input type="checkbox"/> tape	
given by	signature M. A. Pettit	date Sept. 6/72
	phone number 223-5000	time 11:00 <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
note	<p>It is understood that the above information has been provided from our records and represents our knowledge of the approximate location.</p> <p>The responsibility is that of the contractor to exercise extreme caution where mechanical equipment is used in the vicinity of the underground cable plant, and where necessary to locate by hand its' actual position.</p>	
accepted by	signature Michael F. Elbert	title
	company D.T.C.	



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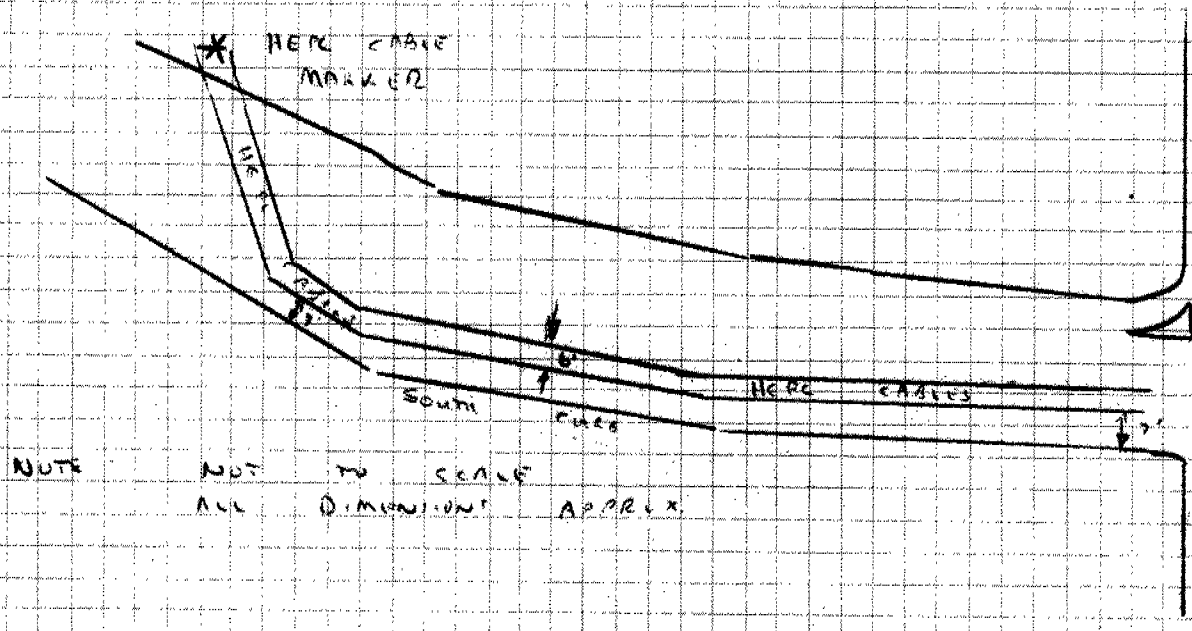
## underground hydro stake-out report

requested by	name <b>MR. CHRIS POON</b>		date <b>SEPT 5 1972</b>	
	company or contractor <b>HIGHWAY DEPT</b>		phone number <b>244-3282</b>	
	address			
location of stake-out	location <b>CNE - CONNAUGHT RD. NORTH 4</b>		appointment date <b>SEPT 5 1972</b>	
	<b>INDUSTRIAL BUILDING, COLISEUM, HOME PALACE</b>		time <b>1000</b> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.	
why is stake-out needed?	<b>SOIL SAMPLING</b>			
sketch				
	type of plant <b>115 000 VOLT UNDERGROUND CABLES.</b>			
marking	<input type="checkbox"/> stakes <input checked="" type="checkbox"/> paint <input type="checkbox"/> tape			
given by	signature <b>Gary Ford</b>		date <b>SEPT 5, 1972</b>	
	phone number <b>223-5000</b>		time <b>15:15</b> <input type="checkbox"/> a.m. <input checked="" type="checkbox"/> p.m.	
note	<p>It is understood that the above information has been provided from our records and represents our knowledge of the approximate location.</p> <p>The responsibility is that of the contractor to exercise extreme caution where mechanical equipment is used in the vicinity of the underground cable plant, and where necessary to locate by hand its' actual position.</p>			
accepted by	signature <b>Michael J. Elliott</b>		title	
	company <b>D.T.C.</b>			



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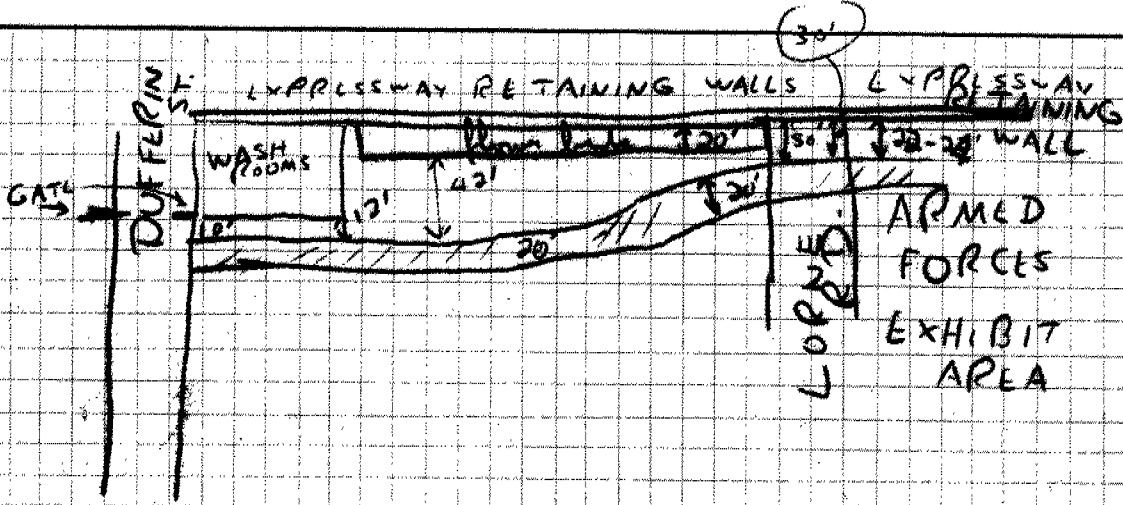
## underground hydro stake-out report

requested by	name MR. CHRIS POON	date SEPT. 5 1972
	company or contractor HIGHWAYS DEPT.	phone number 248-3292
	address	
location of stake-out	location CNC - STRACHAN AVE TO EAST OF INDUSTRIAL AVE. (SOUTH) CONNAUGHT ROAD.	appointment date SEPT. 5, 1972
		time 10:00 <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
why is stake-out needed?	SOIL SAMPLING BORING	
sketch		
	NOTE NOT TO SCALE ALL DIMENSIONS APPROX.	
type of plant	115000 VOLT CABLES	
marking	<input checked="" type="checkbox"/> stakes <input checked="" type="checkbox"/> paint <input type="checkbox"/> tape	
given by	signature Mary Faw	date SEPT. 5, 1972
	phone number 223-5000	time 10:55 <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
note	<p>It is understood that the above information has been provided from our records and represents our knowledge of the approximate location.</p> <p>The responsibility is that of the contractor to exercise extreme caution where mechanical equipment is used in the vicinity of the underground cable plant, and where necessary to locate by hand its' actual position.</p>	
accepted by	signature Michael F. Elliot	title
	company D.T.C.	



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rev. 12-68

## underground hydro stake-out report

requested by	name <i>Mr. Chris Poon</i>	date <i>Sept 6/72</i>
	company or contractor <i>MT+C</i>	phone number <i>248-3282</i>
	address	
location of stake-out	location <i>CNE - WEST FROM Armed Forces Exhibit Area to Sufferin St.</i>	appointment date <i>Sept 6/72</i>
		time <i>11:00</i> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
why is stake-out needed?		
sketch		
	north direction indication	
type of plant	<i>115,000 volt cables</i>	
marking	<input checked="" type="checkbox"/> stakes <input type="checkbox"/> paint <input type="checkbox"/> tape	
given by	signature <i>M. A. Pettitt</i>	date <i>Sept 6/72</i>
	phone number <i>223-5000</i>	time <i>11:30-15:00</i> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m.
note	<p><i>It is understood that the above information has been provided from our records and represents our knowledge of the approximate location.</i></p> <p><i>The responsibility is that of the contractor to exercise extreme caution where mechanical equipment is used in the vicinity of the underground cable plant, and where necessary to locate by hand its' actual position.</i></p>	
accepted by	signature <i>Michael J. Elliott</i>	title
	company <i>DEPT TRANSPORTATION &amp; COMMUNICATION</i>	



**COLE, SHERMAN & ASSOCIATES LIMITED**

**CONSULTANTS**

February 13, 1973  
Our Ref: 5072.1.1.1

Ministry of Transportation  
and Communications  
West Building  
Structural Office  
1201 Wilson Avenue  
Downsview, Ontario

Attention: Mr. B.S. Richardson, P.Eng.  
Regional Structural Design Engineer

Dear Sirs:

Re: N.I.C. T.S. E.S. - Structural  
Aspects - W.P. 97-72

Further to your letter of February 2, 1973, we have the following comments on the Foundation Investigation Report.

Since the new alignment is only partly studied, we restrict our comments to the revisions in general terms only.

1. Additional boreholes are required:

- ✓ 1.1 On new alignment about 200' apart.
- ✓ 1.2 Behind retaining wall adjacent to Dufferin Street.
- ✓ 1.3 Directly under foundations for main crossings of Lakeshore Blvd.
- ✓ 1.4 In area of Maintenance Building and Maintenance Loop.
- ✓ 1.5 On each side of stations to obtain profile of subsoil conditions perpendicular to the main line, thus providing data for the station ramps.
- 1.6 Any further requirements for the new Ontario Place alignment based on the finalization and selection of the alignment possibly necessitating the investigation of soil offshore.

2. Load Tests:

- 2.1 Vertical load test on shale.
- 2.2 Pull out test to evaluate skin friction of socketed caisson in shale.

Continued.../2



2.3 Tests to indicate shear strength of shale. This could be used as an aid in evaluating the capacity of the shale to resist the forces of a caisson embedded in the shale and subject to bending moments.

3. Construction:

3.1 A comprehensive discussion with recommendations on caisson construction, liner installation, dewatering, tremic concrete and inspection.

3.2 Type and magnitude of short and long term settlements expected under the design loads applied to the glacial till.

We will be pleased to discuss any of the above requirements in further detail with you at your convenience.

Yours very truly,

COLE, SHERMAN & ASSOCIATES LIMITED



R. Kruk, P.Eng.

RK:njc

cc: Mr. K.G. Miles  
Mr. C.S. Lepper



Copy to HE Delta



MCCORMICK, RANKIN & ASSOCIATES  
LIMITED  
CONSULTING ENGINEERS

5 STAVESBANK ROAD  
PORT CREDIT, ONT. N4C 1A6  
TELEPHONE 874-0477

February 13, 1973



Mr. B. S. Richardson, P. Eng.,  
Systems Research Branch,  
Ministry of Transportation  
and Communications,  
DOWNSVIEW 464, Ontario

RE: C. N. E. Transit Demonstration System  
Our File: W. O. 709-73

Dear Sir:

As requested, we have reviewed our requirements with regard to the Foundation Investigation for the above-noted project and our comments are as follows:

1. Additional boreholes will be required along the alignment, at an interval of approximately 150 to 200 feet depending on the consistency of the subsoil, in those areas where the alignment differs from the original proposal.
2. Additional boreholes will be required at the location of the proposed stations and maintenance area.
3. Caisson load tests will be required in order to determine the design parameters for the Caissons. Predominantly the site is comprised of two main areas of subsoil conditions, namely;
  - a) the northern part of the site
  - b) the southern part of the site in the reclaimed area.

.....

-2-

Mr. B. S. Richardson, P. Eng.

We will require recommendations regarding the ability of the subsoil to provide support for the lateral movement of the caissons, recommendations regarding anchoring the caissons into bedrock, as well as recommendations regarding the allowable vertical and horizontal loads on the caissons. This information is required by April 1, 1973.

If there are any further questions in this regard, please do not hesitate to telephone.

Yours very truly,

MCCORMICK, RANKIN & ASSOCIATES LIMITED

  
J. W. Tuck, P. Eng.

JWT:lc

cc: Mr. M. Schulmeister  
Mr. M. Harmelink



# THE MUNICIPALITY OF METROPOLITAN TORONTO

## PARKS DEPARTMENT

Planning Division 367-8177

File No. 91-C-2

### APPLICATION FOR CONSTRUCTION

February 6, 1973

Date

Foundations Office,  
Design Services Branch,

Ministry of Transportation & Communications, 401 & Keele, Downsview, 248-3282.  
Name of Applicant Address Telephone

Description of Proposed Construction: Size, Type, Length, etc.  
Field survey to confirm alignment and additional boreholes relative to  
pier locations & foundations.

Attach Plan - Show location of proposed construction, working area required and  
access route.

February 9, 1973

Date of Commencement

March 30, 1973.

Date of Completion

Ministry of Transportation & Communications, 401 & Keele, Downsview, 248-3282.  
Name of Contractor Address Telephone

ON APPROVAL OF APPLICATION THE APPLICANT AGREES, AT HIS EXPENSE:

1. To obtain any permit or approval necessary from and comply with all statutes, by-law, ordinances and regulations of any municipal or other body which may be necessary for the lawful execution of the work.
2. To indemnify and save harmless the Metropolitan Corporation, its successors and assigns from any claims, actions, loss, costs or damages arising out of the use by the applicant of the land of the Metropolitan Corporation.
3. To restore the work site area to its original condition, or as approved, leaving no undrained depressions, no litter, and no undue mud or dirt on grass, roads and walks.
4. Pay for loss of any trees to be replaced by the Parks Department.
5. To repair damaged services and facilities whether shown on plan or not.
6. To repair roadway cuts conforming to specification (a) for asphalt surfaced roads or (b) for crushed stone surfaced roads.
7. To notify this Department immediately on completion of the work for an inspection and to supply an 'as built' plan of the work. The applicant further agrees that the Metropolitan Parks Commissioner shall be the sole and only judge of the adequacy of any restoration and replacement.
8. To erect and maintain adequate hoarding around work area.

Crossing or diversion of any water course to be approved by the M.T.R.C.A.  
Storm sewer outfall structural design must be approved by the M.T.R.C.A.  
Connections made to services other than the applicant's must be approved by the owner of such service.

*C. H. Bon* Proj. Foundation Engr.  
Signature of Applicant

*T. W. Thompson*  
Metropolitan Parks Commissioner

### FOR DEPARTMENTAL USE ONLY

Remarks

THOMAS W. THOMPSON, B.S.A.  
PARKS COMMISSIONER



72-11101  
CITY HALL  
100 QUEEN STREET WEST  
TORONTO 100, ONTARIO  
367-8177.

THE MUNICIPALITY OF METROPOLITAN TORONTO  
PARKS DEPARTMENT

August 30, 1972.

Mr. M. Devata,  
Supervising Foundations Engineer,  
Ministry of Transportation and Communications,  
Design Services Branch,  
Downsview 464, Ontario.

Dear Sir:

Re: Foundation Investigation; Exhibition Park.

Further to your letter of August 29, 1972, this will authorize your entry onto the above park site commencing on September 5, 1972, for the purpose of drilling approximately 40 boreholes.

Please note that each hole is to be backfilled to the surface immediately on completion. You should obtain a restoration permit for the work from Mr. J. Ponzo of this office (367-8179) as quickly as possible, and all required restoration is to be at your expense.

During the first few days of your work there may be some conflict north of the Pure Food Building, the Horse Palace and Coliseum areas. In such cases, please take your instructions from Mr. Sheffield of the Exhibition staff. You will arrange for the appropriate stakeouts by all public utility agencies.

Yours very truly,

*T. W. Thompson*  
Metropolitan Parks Commissioner.

*CR*  
CR:mm

cc: Mr. J. Ponzo.

Mr. D. Garrick-Encl.

Mr. Bill Sheffield.

Mr. L. Bowman.

PLEASE WALK ON THE GRASS

## MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

## MEMORANDUM

TO: A. G. Stermac  
Principal Foundations Engineer  
Foundations Office

FROM: M. D. Harmelink, Head  
Urban Systems Research

ATTENTION: M. Devata  
Supervising Foundations Engineer

DATE: August 25, 1972

OUR FILE REF.

IN REPLY TO

## SUBJECT:

Foundation Investigation on CNE Grounds for an  
Intermediate Capacity Public Transit System

Further to our discussion regarding the Ministry's evaluation of new intermediate capacity transit systems with the objective of selecting the most promising system for a pilot scale testing on CNE grounds in 1973-1974, would you please conduct a basic foundation investigation in order to obtain sufficient data for a preliminary design and cost estimate of the guideway? The proposed horizontal and vertical alignment and location of stations are shown on the plans given you this morning. As you know, our schedule is very tight, and I would appreciate anything you can do to provide us the information as soon as possible.

Thank you for your co-operation.

*M. D. Harmelink*

M. D. Harmelink

*W.D. 72-11101*

72-11-101 (C)





**Golder Associates**  
CONSULTING GEOTECHNICAL ENGINEERS

March 21, 1973.

Principal Foundations Engineer,  
Design Services Branch,  
Ministry of Transportation and  
Communications,  
DOWNSVIEW 464, Ontario.

Attention: Mr. A.G. Stermac, P. Eng.

RE: PRESSUREMETER TESTING,  
C.N.E. PILOT PROJECT,  
PUBLIC TRANSIT SYSTEM,  
TORONTO, ONTARIO.

Dear Sirs:

H.Q. Golder and Associates Limited have been retained by the Ministry of Transportation and Communications in a letter dated February 22, 1973, to carry out in situ testing at the above site using the Menard Pressuremeter. The purpose of this investigation was to determine the engineering properties of the soils and rock encountered across the site, by means of the pressuremeter apparatus, and, based on this information, to provide engineering recommendations concerning the geotechnical aspects of the design of pier foundations subjected to high lateral shear forces and overturning moments.



### DESCRIPTION OF PROJECT

It is understood that the proposed project involves the construction of a full scale pilot project for a medium capacity public transit system. This system will consist of several cars mounted on a single rail (a monorail) travelling at a height of some 15 to 25 feet above ground surface. Foundation support and resistance to the anticipated large lateral forces and overturning moments will be provided by either single or multiple piers. It is further understood that the route of the proposed transit system will encircle the Canadian National Exhibition grounds and will extend south to the entrance of Ontario Place, south of Lakeshore Boulevard.

### PROCEDURE

Pressuremeter testing was carried out in six (6) boreholes put down along the alignment of the proposed transit system. The boreholes were advanced to depths ranging from about 25 to 40 feet below existing ground surface using a hollow stem power auger supplied and operated by Master Soil Investigations Ltd. At each borehole, bedrock was proved by coring in NXL size to a depth of at least 5 ft. Supervision was provided throughout by a member of our engineering staff.

Pressuremeter tests were carried out at regular intervals of depth within each borehole. Within the overburden, standard penetration tests were carried out below each pressuremeter test to obtain samples for detailed visual examination and laboratory testing.

All overburden samples and rock core were transported to the Ministry laboratory in Downsview upon completion of the project.

Water levels in the open boreholes were measured upon completion of each borehole.

The locations and elevations of the boreholes were provided by the Ministry of Transportation and Communications. It is understood that the elevations refer to Geodetic datum.

#### PRESSUREMETER RESULTS

##### General

The pressuremeter is a borehole expansion device with which in situ load tests can be conducted at any depth in soil or rock. It consists, in essence, of a cylindrical cell which is lowered into the borehole to the desired depth, and expanded against the walls of the borehole by applying pressure to the fluid within the cell. Pressure to the cell fluid is applied in increments, and the volume of fluid which has entered the cell after each increment of pressure is measured. From the results of a pressuremeter test, the following parameters can be obtained.

- E - the modulus of deformation in the horizontal direction.
- $P_0$  - the lateral earth pressure at rest.
- $P_f$  - the creep pressure, i.e., the pressure at which local shear failure of the soil begins.
- $P_L$  - the limit pressure, i.e., the pressure for which the soil is in limiting equilibrium and at which pressure excessive deformation occurs.

In practice, fluid volume readings are taken at time

intervals of 30 and 60 seconds after each increment of pressure is applied, and the field data is plotted on two curves. One curve is the volume of the measuring cell plotted against pressure, and from this, values of  $E$  and  $P_L$  can be determined. The other curve, known as the creep curve, is the difference in volume readings for the 30 and 60 second time intervals plotted against pressure, from which values of  $P_O$  and  $P_f$  are determined. These values determined from field data are approximate. The field readings are corrected for piezometric head and for the response of the pressuremeter and measuring system themselves to changes in cell pressure in order to determine the actual values of the parameters.

#### Test Results

The locations of the detailed sampled boreholes put down during this investigation are shown on Fig. 1.

The subsurface and groundwater conditions, together with the locations of the pressuremeter tests, are given on the Record of Borehole logs following the text of this report. We have not carried out any laboratory testing on the overburden or bedrock samples; the descriptions given on the borehole logs are based on visual examination of the samples only. Calibration curves for the pressuremeter are shown on Figs. 2 and 3 and the field test data is shown on Figs. 4 to 39, inclusive. Field values of  $P_O$ ,  $P_f$ , and  $P_L$  are shown on these figures where applicable.

Values of  $P_O$ ,  $P_f$ ,  $P_L$  and  $E$  have been calculated for each test, and appropriate corrections made to field data. The corrected values are given in Table I below.

TABLE 1  
RESULTS OF PRESSUREMETER TESTING

BH No.	Test No.	Depth of test below gr. surface feet	P <sub>o</sub> tons/sq.ft.	P <sub>f</sub> tons/sq.ft.	P <sub>L</sub> tons/sq.ft.	E modulus of deformation tons/sq.ft.	Type of Material
101	1	4.0	1.63	2.16	5.95	49	Fill
101	2	8.5	1.24	-	2.01	-	Recent Beach Deposit
101	3	13.5	-	-	1.01	-	Recent Beach Deposit
101	4	19.5	15.29	>25	>25	5,220	Sound Shale
101	5	24.5	17.79	>25	>25	5,820	Sound Shale
102	1	4.0	1.0	-	1.91	-	Fill
102	2	8.5	2.04	>15	>15	218	Till
102	3	13.5	-	-	1.94	-	Till (stiff)
102	4	17.0	1.22	2.88	6.94	71	Till (stiff)
102	5	22.0	3.04	4.99	9.94	105	Till (stiff)
102	6	28.0	4.15	>25	>25	885	Fairly Sound Shale
104	1	4.0	-	-	1.5	-	Fill
104	2	8.3	-	-	0.75	-	Fill
104	3	13.3	-	-	0.75	-	Fill
104	4	19.0	2.58	9.54	18.3	292	Till
104	5	23.5	6.51	12.96	26.31	230	Till
104	6	28.5	12.06	>25	>25	2,505	Weathered Shale
104	7	33.0	5.68	>25	>25	18,880	Sound Shale
104	8	38.0	8.09	>25	>25	2,280	Sound Shale
129	1	3.5	1.46	1.94	2.89	26	Fill
129	2	13.5	-	-	1.0	-	Recent Beach Deposit
129	3	19.0	3.10	>25	>25	2,130	Fairly Sound Shale
129	4	24.0	2.10	7.56	21	402	Shale with Clayey Silt Layers

TABLE 1 continued  
RESULTS OF PRESSUREMETER TESTING

6.

<u>BH</u> <u>No.</u>	<u>Test</u> <u>No.</u>	<u>Depth of</u> <u>test below</u> <u>gr. surface</u> <u>feet</u>	<u>P<sub>o</sub></u> <u>tons/</u> <u>sq.ft.</u>	<u>P<sub>f</sub></u> <u>tons/</u> <u>sq.ft.</u>	<u>P<sub>L</sub></u> <u>tons/</u> <u>sq.ft.</u>	<u>E modulus of</u> <u>deformation</u> <u>tons/sq.ft.</u>	<u>Type of</u> <u>Material</u>
139	1	3.5	2.09	5.06	11	123	Till
139	2	8.5	2.23	6.34	17	205	Till
139	3	13.5	2.19	4.16	6	75	Till (stiff)
139	4	18.3	-	-	1.5	-	Till (stiff)
139	5	23.5	1.15	2.09	3.5	26	Till (stiff)
139	6	28.0	2.16	6.06	8.5	64	Weathered Shale
139	7	33.5	4.22	>25	>25	4,980	Sound Shale
139	8	38.5	4.29	>25	>25	1,080	Sound Shale
143	1	4.0	-	-	0.70	-	Fill
143	2	7.0	-	-	1.98	-	Fill
143	3	11.5	-	-	0.98	-	Fill
143	4	21.5	2.24	>25	>25	2,610	Sound Shale
143	5	26.5	2.24	>25	>25	4,720	Sound Shale

On the basis of the limited number of tests performed during this investigation, the engineering properties of the various materials encountered are summarized below.

a) Heterogeneous Fill

Varying thicknesses of fill were encountered in 5 of the 6 boreholes put down. The composition of the fill ranges from sand and gravel to silty sand to clay. Construction debris, organic matter and the like were encountered within the fill, particularly in the fill located south of the original (1912) shoreline.

A total of 9 pressuremeter tests were carried out within the fill. The measured modulus of deformation,  $E$ , was as much as 49 tons/sq.ft. within a zone of compacted fill. However, in general, the resistance to lateral movement as determined by the modulus of deformation,  $E$ , was nil and shear failure of the fill materials occurred under a pressure  $P_L$  of about 1 to 2 tons/sq.ft.

b) Loose Beach Sands

As in the above-mentioned fill, tests within recent beach deposits indicate that the value of the modulus of deformation,  $E$ , is zero.

c) Till

A total of 11 pressuremeter tests were carried out within the clayey till underlying the northern portion of the site. Of these tests, 6 were carried out within hard clayey silt till. The remaining 5 tests indicated that the till tested

was markedly softer. It should be noted that standard penetration test 'N' values were greater than 60 blows/ft. and generally greater than 100 blows/ft. within the hard till while 'N' values within the "soft" till were as low as 15 blows/ft. Consequently, the till is subdivided into two zones, hard clay till and generally stiff clay till.

i) Hard Clay Till

The results of 6 pressuremeter tests carried out within the hard clay till are presented in Table I. The value of lateral earth pressure at rest,  $P_0$ , varies from about 2 to 6.5 tons/sq.ft. with an average value of some 2.5 tons/sq.ft. Test values of the creep pressure,  $P_f$ , range from about 5 to 13 tons/sq.ft. while  $P_L$ , the ultimate capacity of the soil ranges from 11 to 26 tons/sq.ft. and is generally in excess of 15 tons/sq.ft. The modulus of deformation,  $E$ , ranges in value from about 125 tons/sq.ft. to 290 tons/sq.ft. with an average value of 214 tons/sq.ft.

ii) Stiff Clay Till

Test values of  $P_0$  within the "softer" till zone vary from nil to as much as 3 tons/sq.ft. Values of creep pressure,  $P_f$ , range from zero to 5 tons/sq.ft. while the ultimate capacity,  $P_L$ , varies from about 2 to 10 tons/sq.ft. The modulus of deformation,  $E$ , is similarly variable with values ranging from nil to 105 tons/sq.ft.

d) Shale Bedrock

Pressuremeter tests were carried out within the bedrock underlying the site. A total of 13 tests were carried out. Three of the pressuremeter tests were performed within

a thin and possibly discontinuous zone of highly fractured, weathered shale at bedrock surface. The remaining six tests were carried out within relatively sound shale bedrock.

i) Weathered Shale

The results of the limited testing carried out in weathered shale indicate a wide variation in the engineering properties of the weathered rock, ranging from that comparable to stiff clay till to values approaching that of sound shale.

ii) Shale

Test results provide values of  $P_o$  ranging from about 2 to 15 tons/sq.ft., and generally less than 5 tons/sq.ft. while values of  $P_f$  and  $P_L$  are beyond the capacity of the apparatus (i.e. greater than 25 tons/sq.ft.). Values of  $E$  range from 885 tons/sq.ft. to as much as 18,880 tons/sq.ft. with an average value of about 3,600 tons/sq.ft.

DESIGN ENGINEERING PROPERTIES

The engineering properties described above are based on a limited number of tests over a large area encompassing a number of soil and rock types. The values given in Table II may be used for design purposes. However, prior to final design of the foundations, we recommend that additional work be carried out to obtain a more accurate evaluation of the magnitude and variation of the relevant engineering properties.



TABLE IIDESIGN PARAMETERS FROM PRESSUREMETER TESTS

Type of Material	$P_o$ tons/sq.ft.	$P_f$ tons/sq.ft.	$P_L$ tons/sq.ft.	E tons/sq.ft.
Heterogeneous Fill	0	0	1	0
Recent Beach Deposit	0	0	1	0
Stiff Clay Till	1.5	3	6	50
Hard Clay Till	2.5	7.5	15	200
Weathered Shale	2	7.5	10	400
Sound Shale	4	>25	>25	3,600

It should be noted that the modulus of deformation, E, of the shale bedrock shown above is the average modulus over a wide range of pressures varying from the at-rest pressure  $P_o$  up to the maximum test value of 25 tons/sq.ft. The results of the pressuremeter tests indicate that the modulus increases with increasing lateral pressure (i.e. a strain hardening phenomena). The above value was chosen as it is anticipated that the applied lateral loadings will be transient and will increase from the at-rest condition.

MODULUS OF HORIZONTAL SUBGRADE REACTION,  $K_h$ 

The modulus of horizontal subgrade reaction,  $K_h$ , is the resistance to lateral movement provided by the soil surrounding an embedded pile or diaphragm. Numerous studies have

been carried out to analyze the deformation of the soil due to a loaded rigid plate, the original means of determining  $K_h$ , and to correlate this method to that using the pressuremeter modulus of deformation  $E^*$ .

The modulus of horizontal subgrade reaction  $K_h$  for a pile of radius,  $R$ , may be computed knowing the modulus of deformation  $E$  as follows:

$$\frac{1}{K_h} = \frac{1}{3E} \left[ 1.3 R_o \left( 2.65 \frac{R}{R_o} \right)^\alpha + \alpha R \right]$$

where

- $K_h$  - modulus of horizontal subgrade reaction (in bars/cm.)
- $E$  - pressuremetric modulus of deformation (in bars)
- $R_o$  - is a reference dimension equal to 30 cm.
- $R$  - is the radius of the pile (in cm.)
- $\alpha$  - is a dimensionless rheological coefficient of the soil, depending on the gradation characteristics and the rigidity,  $E/P_L$ , of the soil.

- \* "General Method of Calculation For a Pile or Diaphragm Subject to Horizontal Loading in Terms of Pressuremeter Test Results" by L. Menard, G. Bourdan and M. Gambin Sols/Soils 22-23, 1971 (in French)

As given above, all values entered into this equation are in metric units. Equivalent British units of measurement are provided below.

1 bar	=	1.044 tons/sq.ft.
1 cm.	=	0.394 in.
	=	0.0328 ft.
1 bar/cm.	=	31.821 tons/sq.ft./ft.

On the basis of recommended design values given previously for the soil and rock types encountered during this investigation, values of the horizontal modulus of subgrade reaction,  $K_h$ , were computed for each soil type. These values were computed for piles ranging in diameter from 18 in. to 48 in. The results are presented in Table III below.

TABLE III  
MODULUS OF HORIZONTAL SUBGRADE REACTION,  $K_h$   
FOR PILE FOUNDATIONS

Soil Type	Pressuremeter Modulus of De- formation, E, tons/sq.ft.	Modulus of Horizontal Subgrade Reaction, $K_h$ , tons/sq.ft./ft. for 2R =				
		18 in.	24 in.	30 in.	36 in.	48 in.
Heterogeneous Fill	0	0	0	0	0	0
Recent Beach Deposit	0	0	0	0	0	0
Stiff Till	50	60	50	40	35	30
Hard Till	200	245	200	170	150	120
Weathered Shale	400	490	400	340	295	240
Shale Bedrock	3,600	5,000	4,225	3,700	3,300	2,760

The following restrictions on the use of the above moduli must be observed in the design of the pier foundations.

a) The modulus of horizontal subgrade reaction,  $K_h$ , and the modulus of deformation,  $E$ , apply only while the soil acts as an elastic material. In practice, the value of the creep pressure,  $P_f$ , is the upper limit of allowable stress for elastic behaviour. If stresses in excess of this value are transmitted to the soil, irrecoverable plastic yield will occur.

b) At and immediately below ground surface, the value of the ratio  $\frac{P_L}{K_h y_0}$  must not be lower than 2. For values lower than 2, plastic yield occurs. If plastic yield occurs, the modulus of subgrade reaction can no longer be used in determining the lateral reactions of the pile. Further, the deflection of the pile under load cannot be predicted.

We trust that the above information is sufficient for your immediate requirements. If we can be of further assistance to you on this project, please call us.

Yours truly,

H.Q. Golder & Associates Ltd.

  
J.B. Davis, P. Eng.

  
R.C. Butler, P. Eng.

JBD:RCB:rr  
73027

Encl: List of Symbols  
List of Abbreviations  
Record of Borehole Sheets  
Figures:  
1 - Boring Plan  
2-3 - Pressuremeter Calculation Curves  
4-39 - Plot of Field Data - Pressuremeter Testing

**Golder Associates**

## LIST OF ABBREVIATIONS

The abbreviations commonly employed on each "Record of Borehole," on the figures and in the text of the report, are as follows:

### I. SAMPLE TYPES

*AS* auger sample  
*CS* chunk sample  
*DO* drive open  
*DS* Denison type sample  
*FS* foil sample  
*RC* rock core  
*ST* slotted tube  
*TO* thin-walled, open  
*TP* thin-walled, piston  
*WS* wash sample

### II. PENETRATION RESISTANCES

**Dynamic Penetration Resistance:** The number of blows by a 140-pound hammer dropped 30 inches required to drive a 2-inch diameter, 60 degree cone one foot, where the cone is attached to 'A' size drill rods and casing is not used.

**Standard Penetration Resistance, *N*:** The number of blows by a 140-pound hammer dropped 30 inches required to drive a 2-inch drive open sampler one foot.

*WH* sampler advanced by static weight—weight, hammer

*PH* sampler advanced by pressure—pressure, hydraulic

*PM* sampler advanced by pressure—pressure, manual

### III. SOIL DESCRIPTION

#### (a) *Cohesionless Soils*

<i>Relative Density</i>	<i>N, blows/ft.</i>
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

#### (b) *Cohesive Soils*

<i>Consistency</i>	<i>c<sub>u</sub>, lb./sq. ft.</i>
Very soft	Less than 250
Soft	250 to 500
Firm	500 to 1,000
Stiff	1,000 to 2,000
Very stiff	2,000 to 4,000
Hard	over 4,000

### IV. SOIL TESTS

*C* consolidation test  
*H* hydrometer analysis  
*M* sieve analysis  
*MH* combined analysis, sieve and hydrometer<sup>1</sup>  
*Q* undrained triaxial<sup>2</sup>  
*R* consolidated undrained triaxial<sup>2</sup>  
*S* drained triaxial  
*U* unconfined compression  
*V* field vane test

### NOTES:

<sup>1</sup>Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.

<sup>2</sup>Undrained triaxial tests in which pore pressures are measured are shown as  $\bar{Q}$  or  $\bar{R}$ .

## LIST OF SYMBOLS

### I. 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

### II. STRESS AND STRAIN

$u$	pore pressure
$\sigma$	normal stress
$\sigma'$	normal effective stress ( $\bar{\sigma}$ is also used)
$\tau$	shear stress
$\epsilon$	linear strain
$\epsilon_{xy}$	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

### III. SOIL PROPERTIES

#### (a) Unit weight

$\gamma$	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
$G_s$	specific gravity of solid particles $G_s = \gamma_s / \gamma_w$
$e$	void ratio
$n$	porosity
$w$	water content
$S_r$	degree of saturation

#### (b) Consistency

$w_L$	liquid limit
$w_P$	plastic limit
$I_P$	plasticity index
$w_S$	shrinkage limit
$I_L$	liquidity index = $(w - w_P) / I_P$
$I_C$	consistency index = $(w_L - w) / I_P$
$e_{max}$	void ratio in loosest state
$e_{min}$	void ratio in densest state
$D_r$	relative density = $(e_{max} - e) / (e_{max} - e_{min})$

#### (c) Permeability

$h$	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

#### (d) Consolidation (one-dimensional)

$m_v$	coefficient of volume change = $-\Delta e / (1+e) \Delta \sigma'$
$C_c$	compression index = $-\Delta e / \Delta \log_{10} \sigma'$
$c_v$	coefficient of consolidation
$T_v$	time factor = $c_v t / d^2$ ( $d$ , drainage path)
$U$	degree of consolidation

#### (e) Shear strength

$\tau_f$	shear strength
$c'$	effective cohesion
$\phi'$	effective angle of shearing resistance, or friction
$c_u$	apparent cohesion*
$\phi_u$	apparent angle of shearing resistance, or friction
$\mu$	coefficient of friction
$S_f$	sensitivity

\*For the case of a saturated cohesive soil,  $\phi_u = 0$  and the undrained shear strength  $\tau_f = c_u$  is taken as half the undrained compressive strength.

## RECORD OF BOREHOLE 101

LOCATION See Figure 1

BORING DATE MAR. 6, 1973.

DATUM GEODETIC

SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN.

PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT.				COEFFICIENT OF PERMEABILITY, K, CM./SEC.				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ELEV'N DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT.		20 40 60 80				1x10 1x10 1x10 1x10					
								SHEAR STRENGTH Cu., LB./SQ.FT.		NAT. V. - + Q. - ● REM. V. - ⊗ U. - ○		WATER CONTENT, PERCENT w <sub>p</sub> — w — w <sub>L</sub>					
NORTH 853470, EAST 061409																	
HOLLOW STEM AUGER 8" DIA. (UNCASED)	254.2 0.0	GROUND SURFACE					255										
		FIRM MOTTLED BROWN CLAYEY SILT, TRACE SAND GRAVEL AND PIECES OF CONCRETE (FILL)		1	SS	5	250								P <sub>M</sub> <sup>1</sup>		
	247.2 7.0						245								P <sub>M</sub> <sup>2</sup>		
		LOOSE BLACK SILTY SAND TRACE GRAVEL		2	"	6	240								P <sub>M</sub> <sup>3</sup>		
	238.7 16.0	WEATHERED GREY SHALE		3	"	60	235								P <sub>M</sub> <sup>4</sup>		
ROTARY DRILLING NXL CORE		FAIRLY SOUND TO SOUND GREY SHALE BEDROCK OCCASIONAL LIMESTONE BANDS		4	NXL RC	—	230								P <sub>M</sub> <sup>5</sup>		
	228.7			5	"	—	225										
	225.5	END OF HOLE															

P<sub>M</sub> - PRESSUREMETER TEST LOCATION

0  
15 5 10 Percent axial strain at failure

VERTICAL SCALE  
1 IN. TO 5 FT.

Golder Associates

DRAWN AG  
CHECKED KP

DATUM      GEODETIC

PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

DRAWN A.G.  
CHECKED RL



RECORD OF BOREHOLE 104

LOCATION See Figure 1

BORING DATE FEB. 21-22, 1973.

DATUM GEODETIC

SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN.

PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

BORING METHOD	SOIL PROFILE			SAMPLES		ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT. 20 40 60 80 SHEAR STRENGTH Cu, LB./SQ. FT. NAT. V. - + Q - ● REM. V. - ● U - ○	COEFFICIENT OF PERMEABILITY, K, CM./SEC. 1x10 1x10 1x10 1x10				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	ELEV'N. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			BLOWS/FT.	WATER CONTENT, PERCENT					
									wp	w	wL			wU
HOLLOW STEM AUGER 8" DIA. (UNCASED)							NORTH 853338, EAST 056668							
	287.6	GROUND SURFACE												
	0-0	VERY LOOSE TO COMPACT BROWN SAND TO SILTY SAND TRACE TO SOME GRAVEL (FILL)		1	SS	14	285							PM1
				2	"	2	280							PM2
				3	"	19	275							PM3
	272.1			4	"	67	270							
	155	HARD GREY CLAYEY SILT TRACE GRAVEL (TILL)		5		138	265							PM4
				6		130	260							PM5
	262.1	WEATHERED GREY SHALE		7	NXL R.C.	-	255							
255			8	"	-	250								PM8
257.6	SOUND GREY SHALE BEDROCK.													
30-0														
ROTARY DRILLING NXL CORE	248.5													
	39-1	END OF HOLE												

PM - PRESSUREMETER TEST LOCATION

15 10 5 Percent axial strain at failure

VERTICAL SCALE  
1 IN. TO 5 FT.

Golder Associates

DRAWN AG  
CHECKED

RECORD OF BOREHOLE 129

LOCATION See Figure 1

BORING DATE MAR. 5-6, 1973

DATUM GEODETIC

SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN.

PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT. 20 40 60 80 SHEAR STRENGTH Cu, LB./SQ. FT. NAT. V. - + Q. - ● REM. V. - ● U. - O	COEFFICIENT OF PERMEABILITY, K, CM./SEC. 1x10 1x10 1x10 1x10				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ELEV'N DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FT.			WATER CONTENT, PERCENT					
									Wp	W	Ws			
HOLLOW STEM AUGER 8" DIA. (UNCASED)								NORTH 852080, EAST 058662						
	248.5	GROUND SURFACE					250							
	246.5	0.2 CRUSHED STONE (FILL)												
	243.5	2.0 GENERALLY LOOSE SILTY SAND, GRAVEL & CINDERS (FILL)					245							
	235.5	5.0 LOOSE TO COMPACT BROWN TO BLACK HETEROGENEOUS CLAYEY SILT, SAND, GRAVEL, BRICK FRAGMENTS (FILL)		1	SS	9.5"	240							
	232.5	13.0 LOOSE TO DENSE GREY SILTY SAND, SOME GRAVEL		2	"	16"	235							
	232.5			3	"	7.5"								
	223.0	16.0 WEATHERED TO FAIRLY SOUND GREY SHALE OCCASIONAL CLAYEY SILT LAYERS BELOW ELEV. 225.0.		4	NXL R.C.	-	230							
	223.0			5	"	-	225							
	223.0	25.5 END OF HOLE					220							

PM - PRESSUREMETER TEST LOCATION

0 15 10 5 Percent axial strain at failure

## RECORD OF BOREHOLE 139

LOCATION      See Figure

BORING DATE FEB. 23, 26, 1973.

DATUM GEODETIC

SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN.

PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

[illegible]

VERTICAL SCALE  
1 IN. TO 5 FT.

## Goldier Associates

DRAWN AG  
CHECKED PB



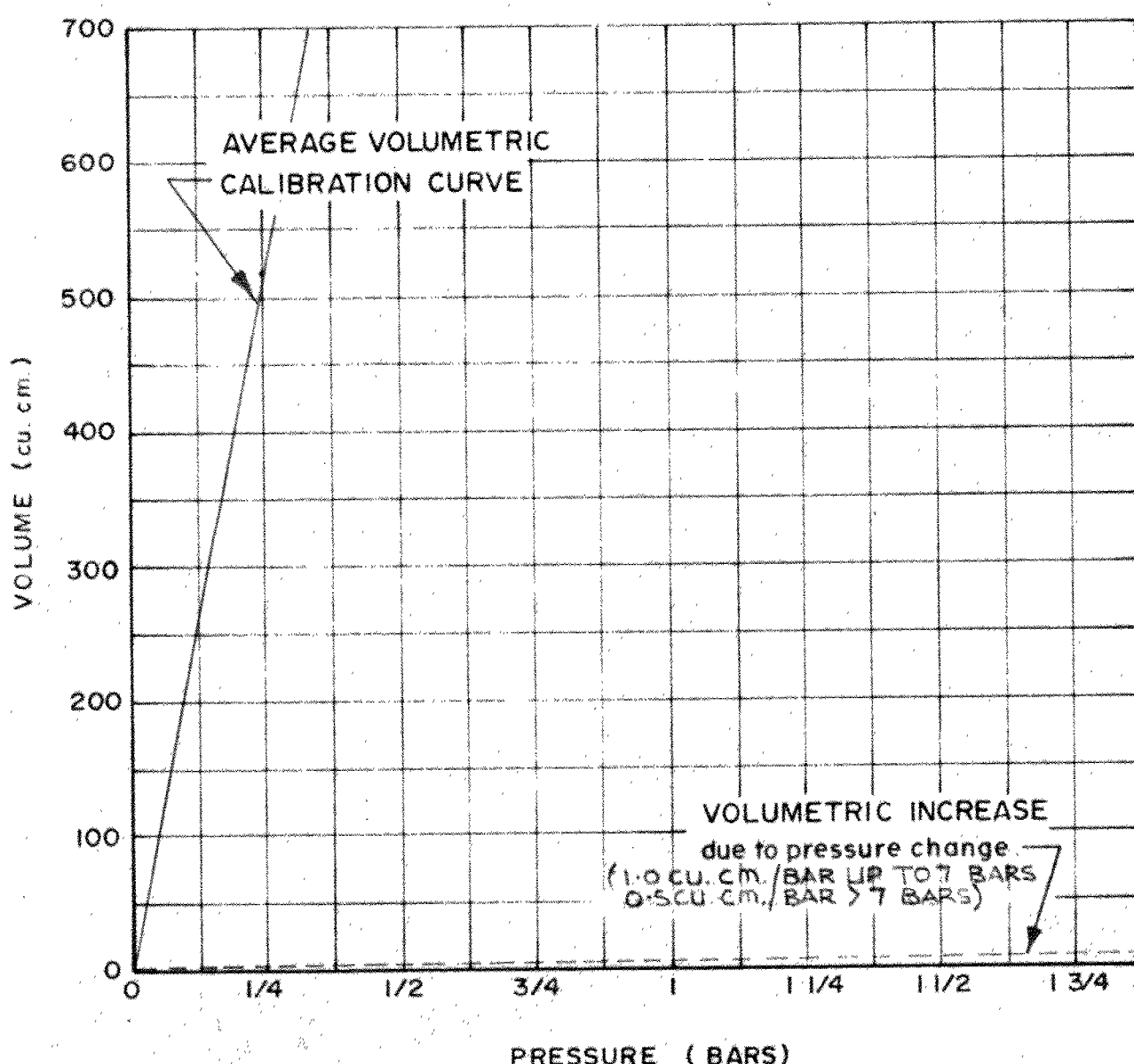
# OVERSIZE DRAWING

# PRESSUREMETER CALIBRATION CURVES

FIGURE 2

TEST NUMBER 1

Note: Calibration curve for tests carried out between FEB. 21 AND MAR. 6/73.



Date MAR. 20, 1973

Golder Associates

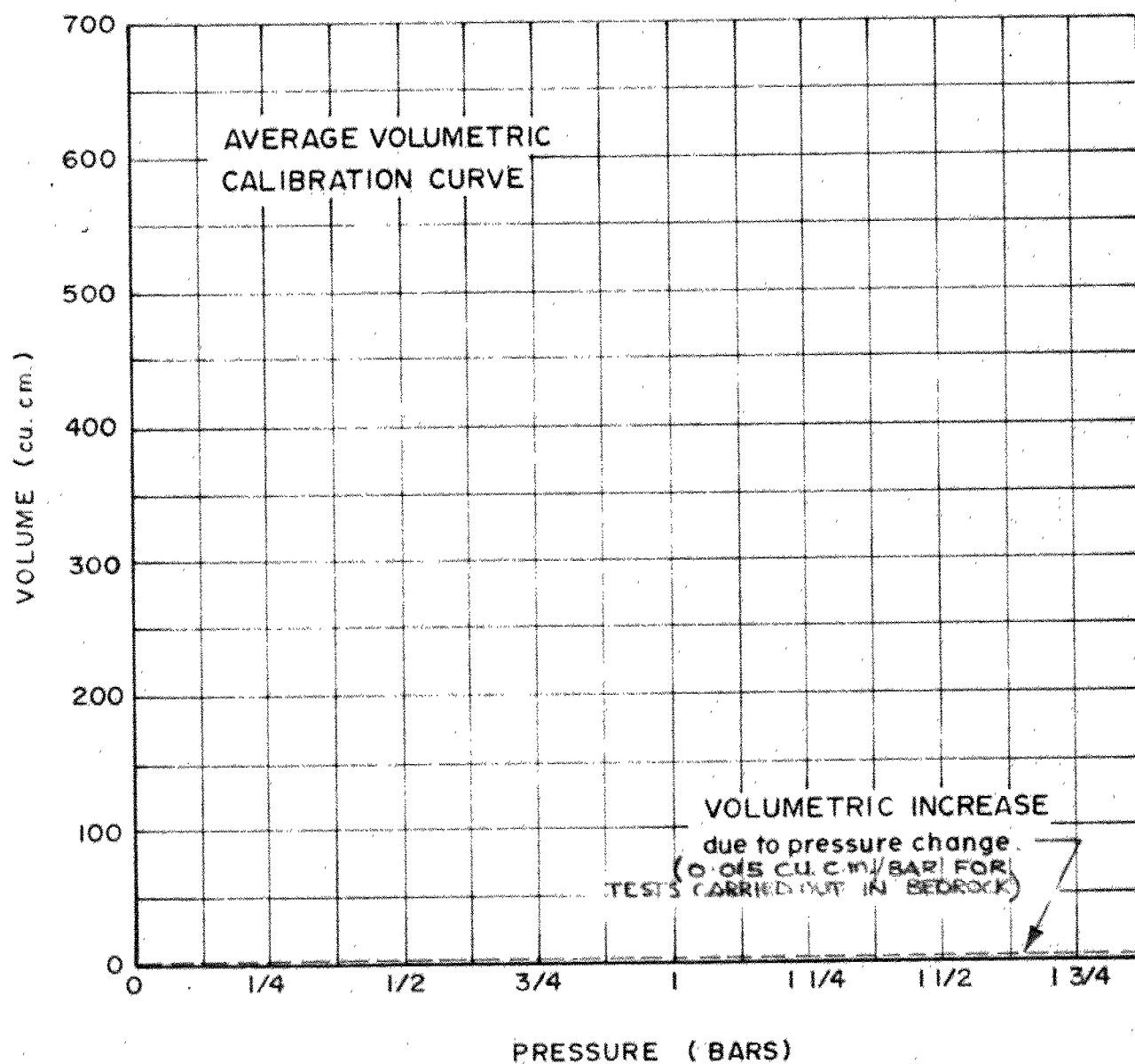
Drawn A.G.  
Chkd. *[Signature]*  
Appd. *[Signature]*

# PRESSUREMETER CALIBRATION CURVES

FIGURE 3

TEST NUMBER 2

Note: Calibration curve for tests carried out between FEB. 21 AND MAR. 6/73.



Date MAR. 20, 1973

Golder Associates

Drawn A.G.  
Chkd.  
Appd.



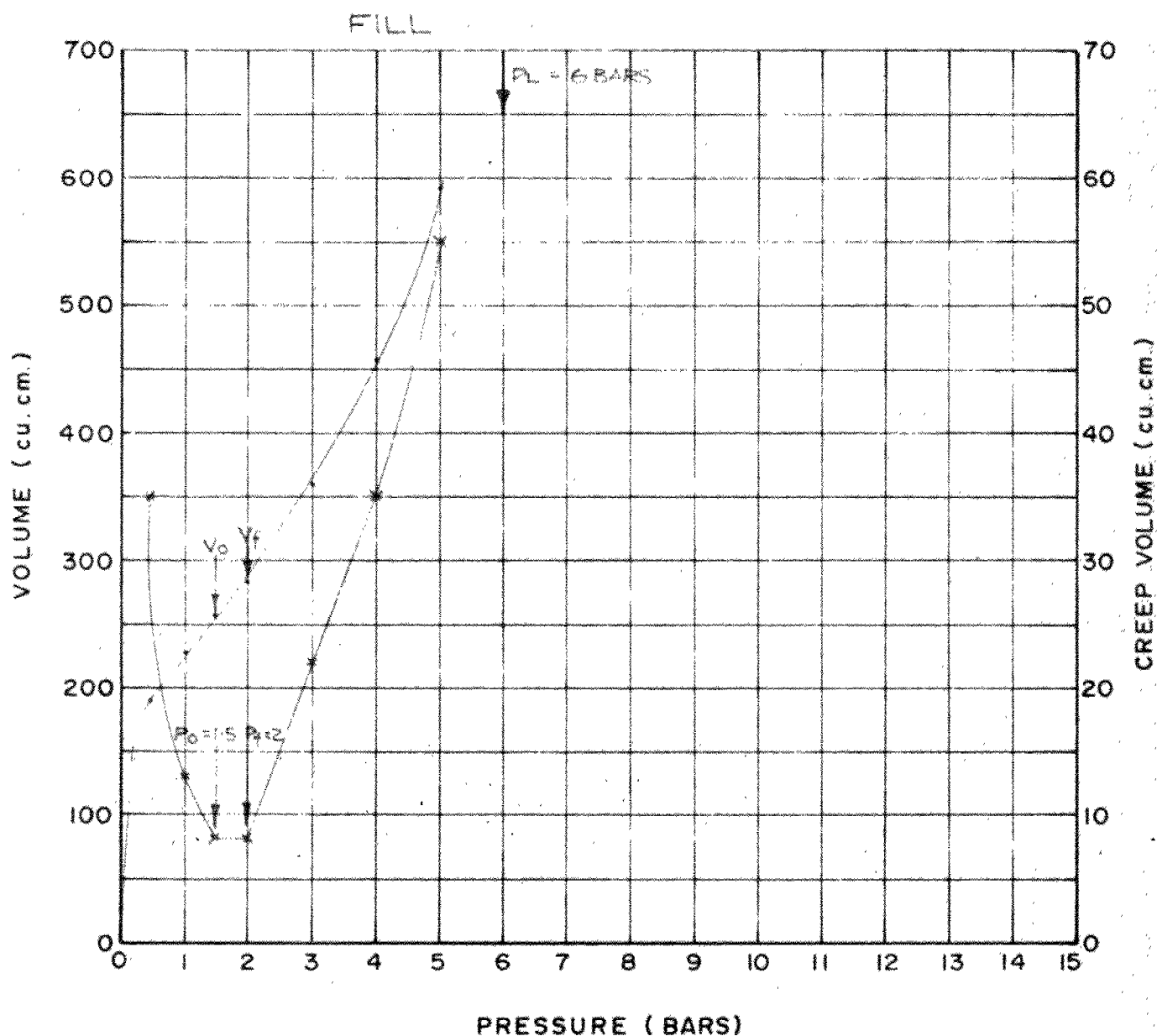
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 4

BOREHOLE No. 101

TEST NUMBER 1

ELEVATION 250.2



Note: for calibration curve see fig.

Date MAR. 7, 1973.

**Golder Associates**

Drawn AG  
Chkd AG  
Appd AG



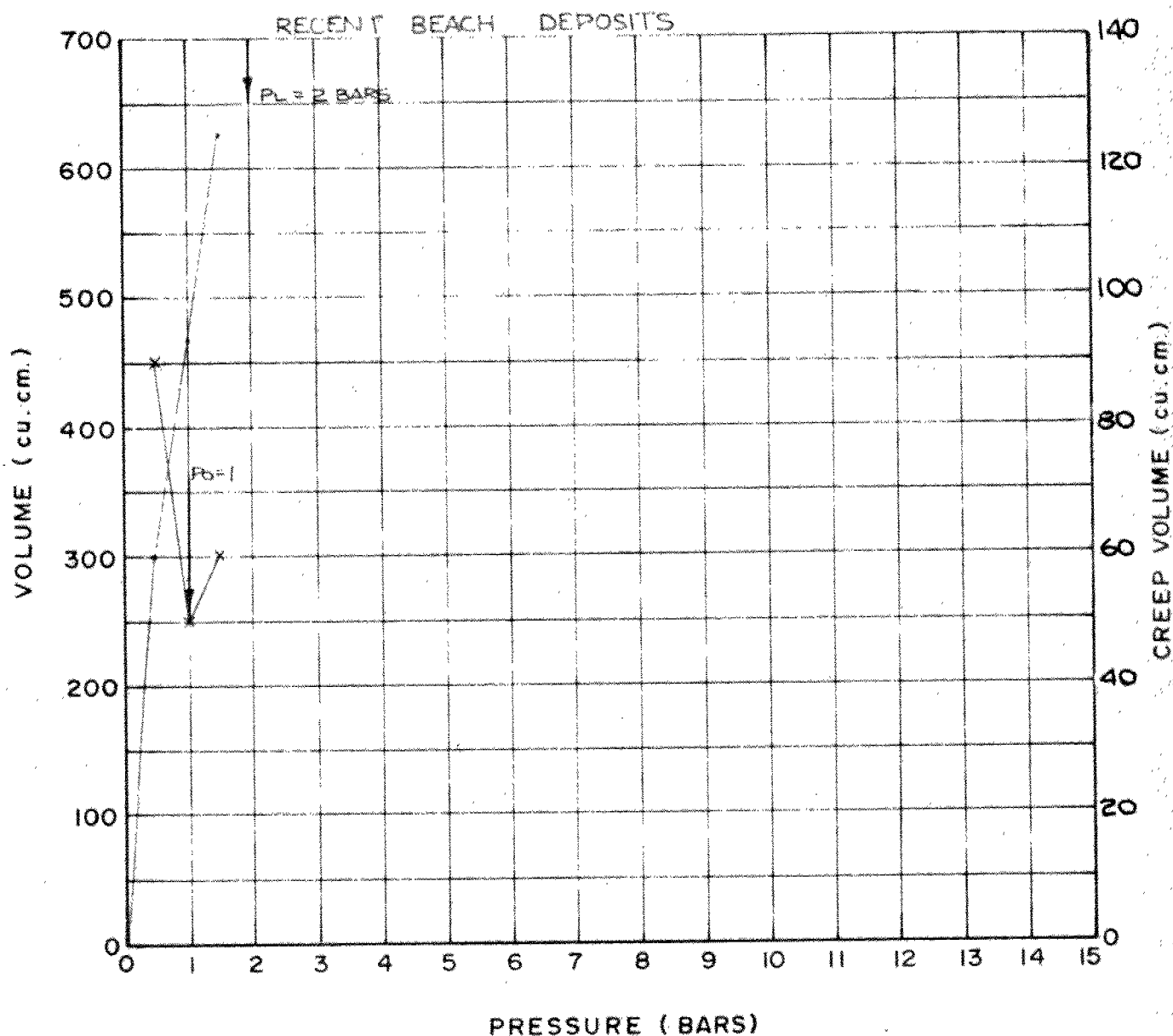
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 5

BOREHOLE No. 101

TEST NUMBER 2

ELEVATION 245.7



Note: for calibration curve see fig.

Date MAR 8, 1973.

Golder Associates

Drawn A.S.  
Chkd  
Appd

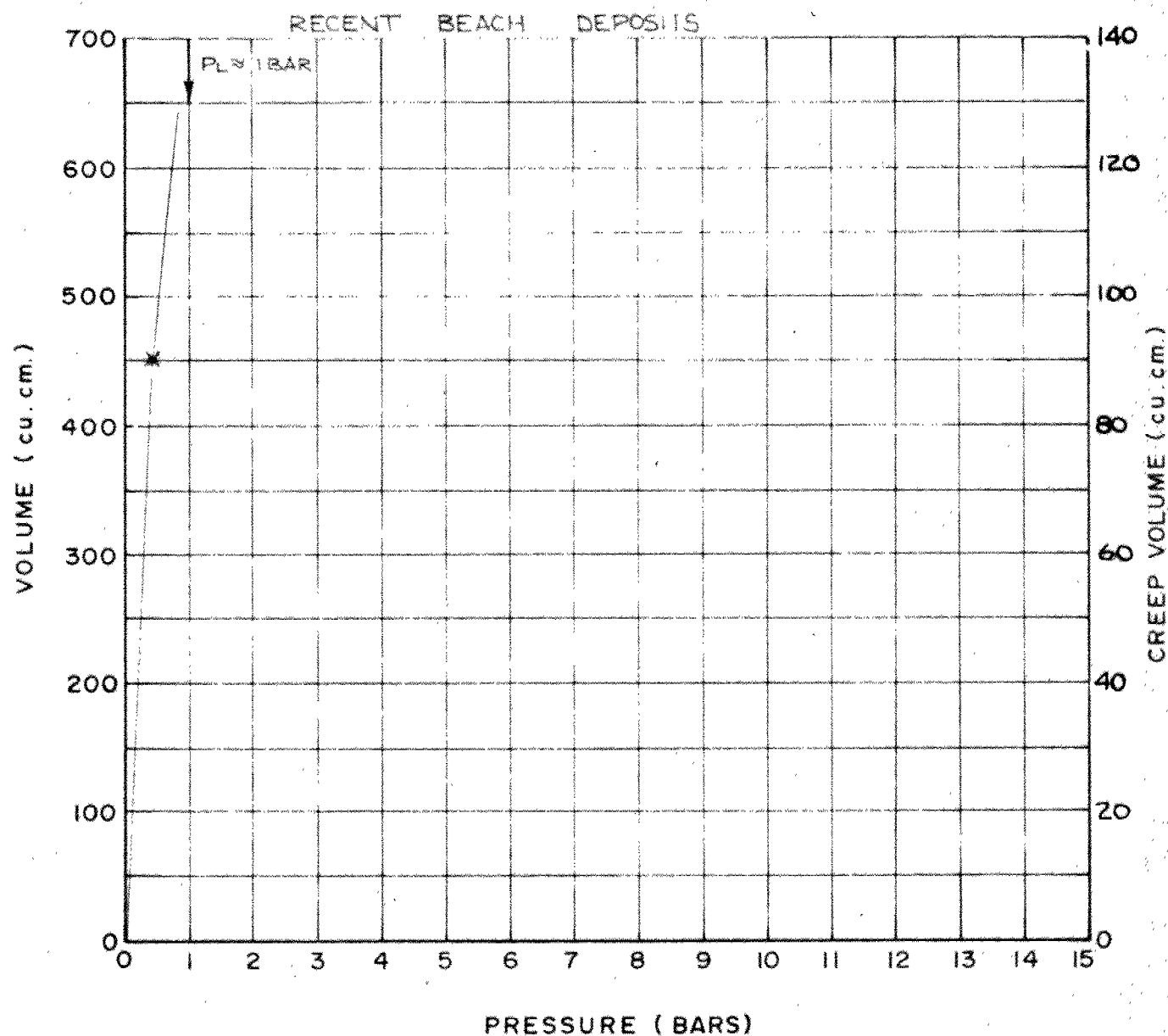
PLOT OF FIELD DATA —  
PRESSUREMETER TESTING

FIGURE 6

BOREHOLE No. 101

TEST NUMBER 3

ELEVATION 240.7



Note: for calibration curve see fig.

Date MAR 6, 1973

Golder Associates

Drawn A.S.  
Chkd. A.S.  
Appd. A.S.

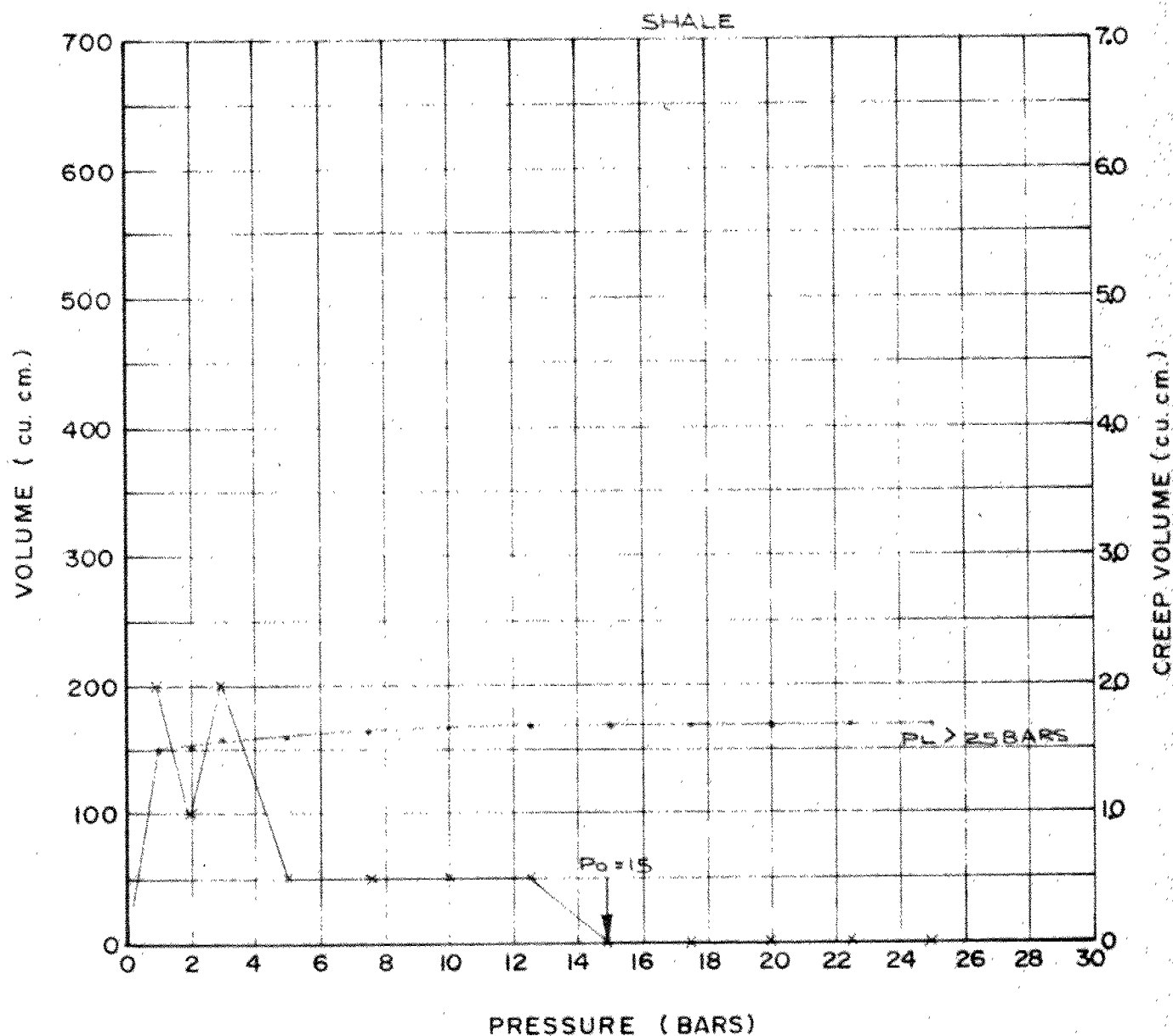
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 7

BOREHOLE No. 101

TEST NUMBER 4

ELEVATION 2347



Note: for calibration curve see fig.

Date MAR. 8, 1973.

Golder Associates

Drawn AC  
Chkd  
Appd

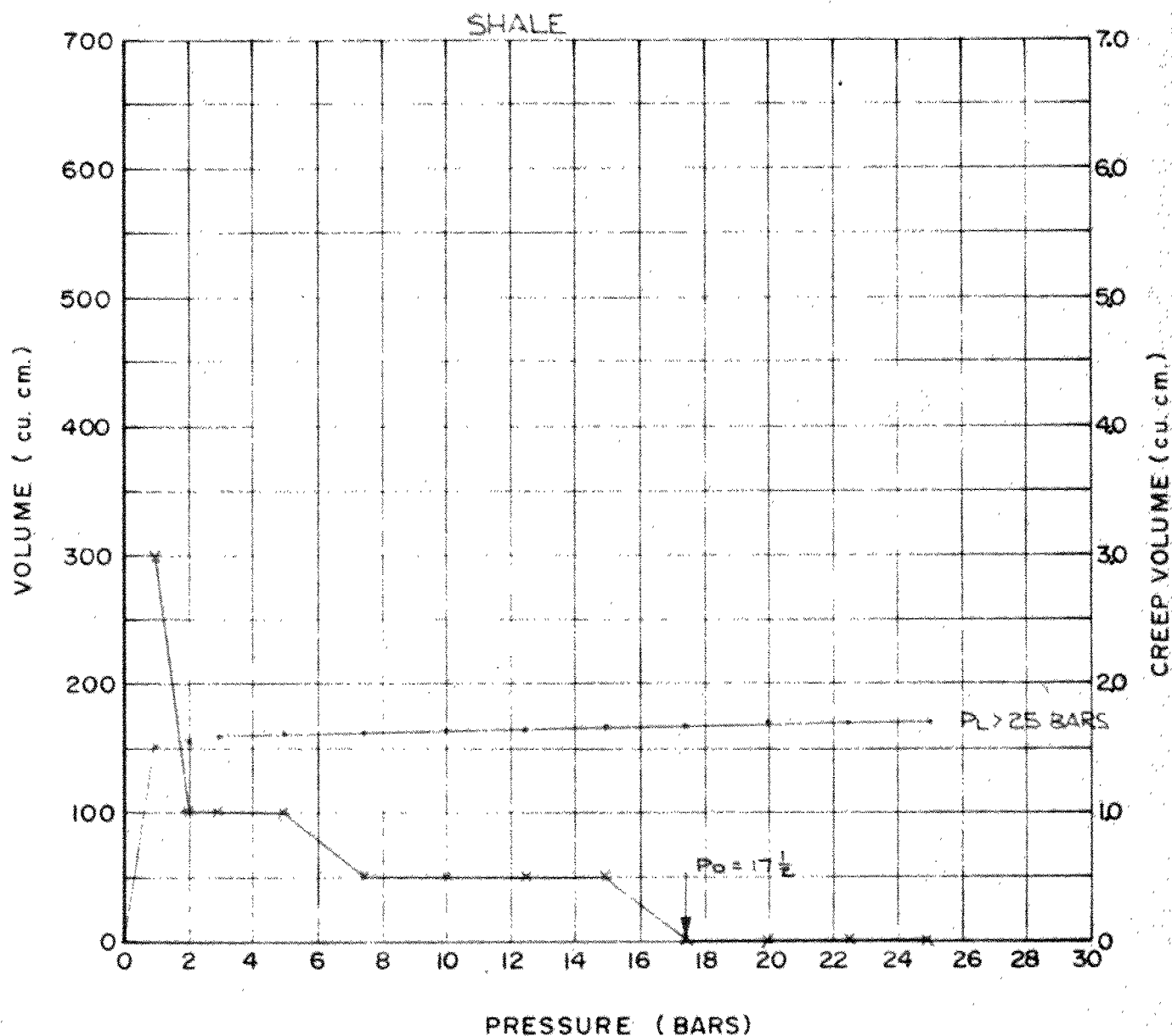
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 8

BOREHOLE No. 101

TEST NUMBER 5

ELEVATION 229.7



Note: for calibration curve see fig.

Date MAR. 8, 1973.

Golder Associates

Drawn A.G.L.  
Chkd. [Signature]  
Appd. [Signature]

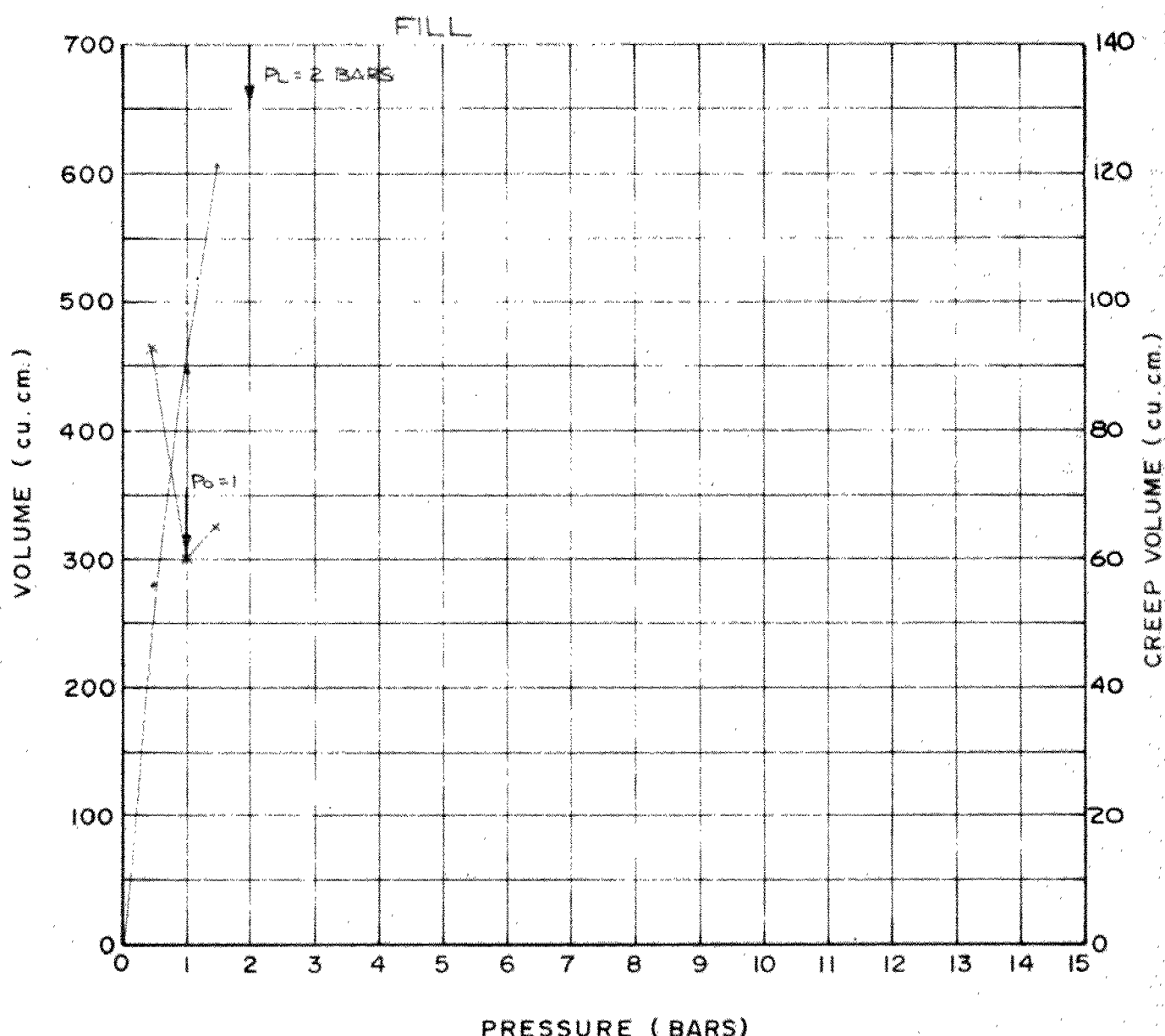
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 9

BOREHOLE No. 102

TEST NUMBER 1

ELEVATION 276.7



Note: for calibration curve see fig.

Date MAY 11, 1964

Golder Associates

Drawn *[Signature]*  
Chkd. *[Signature]*  
Appd. *[Signature]*

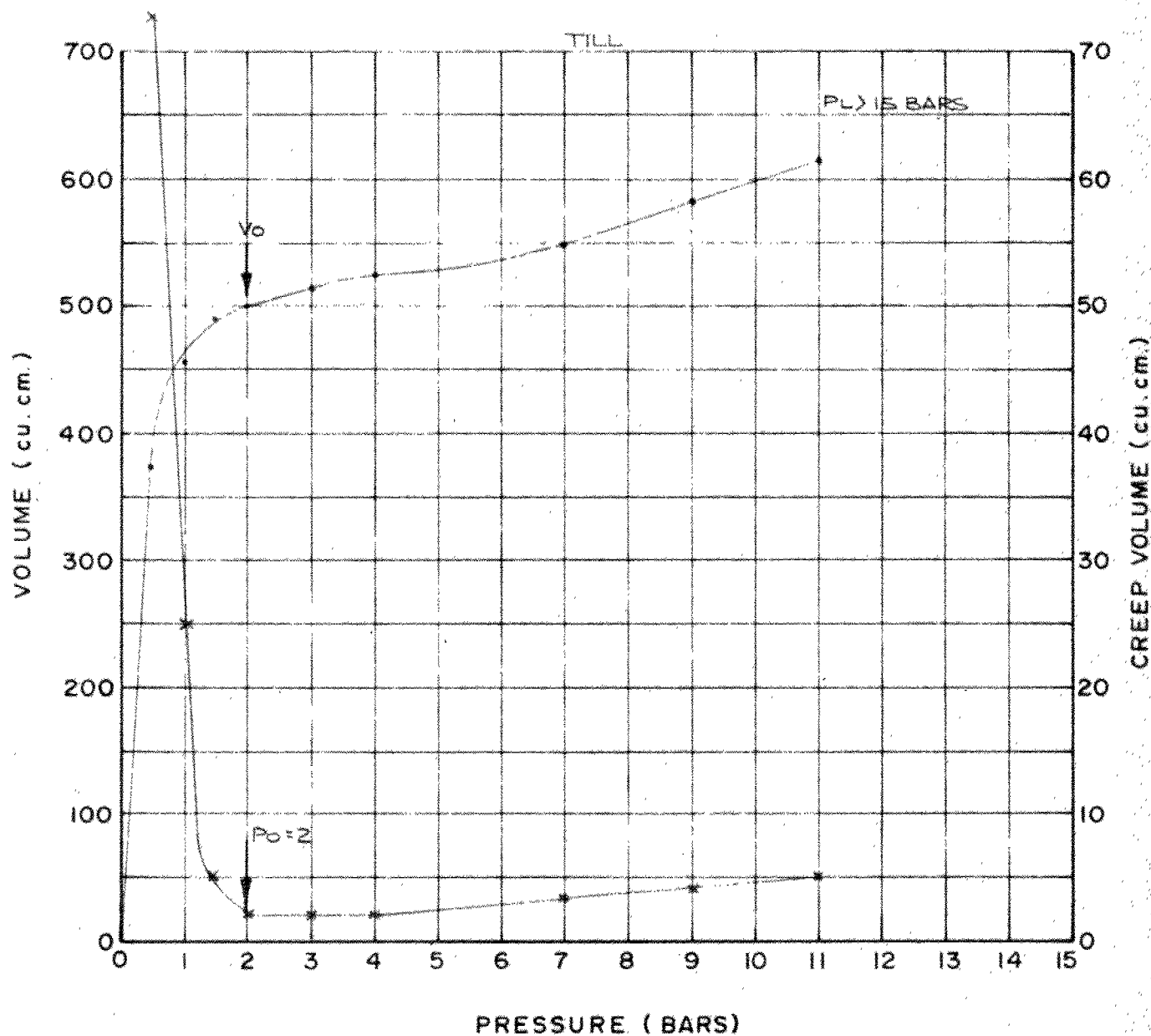
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 10

BOREHOLE No. 102

TEST NUMBER 2

ELEVATION 272.2



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn A.G.  
Chkd: \_\_\_\_\_  
Appd: \_\_\_\_\_

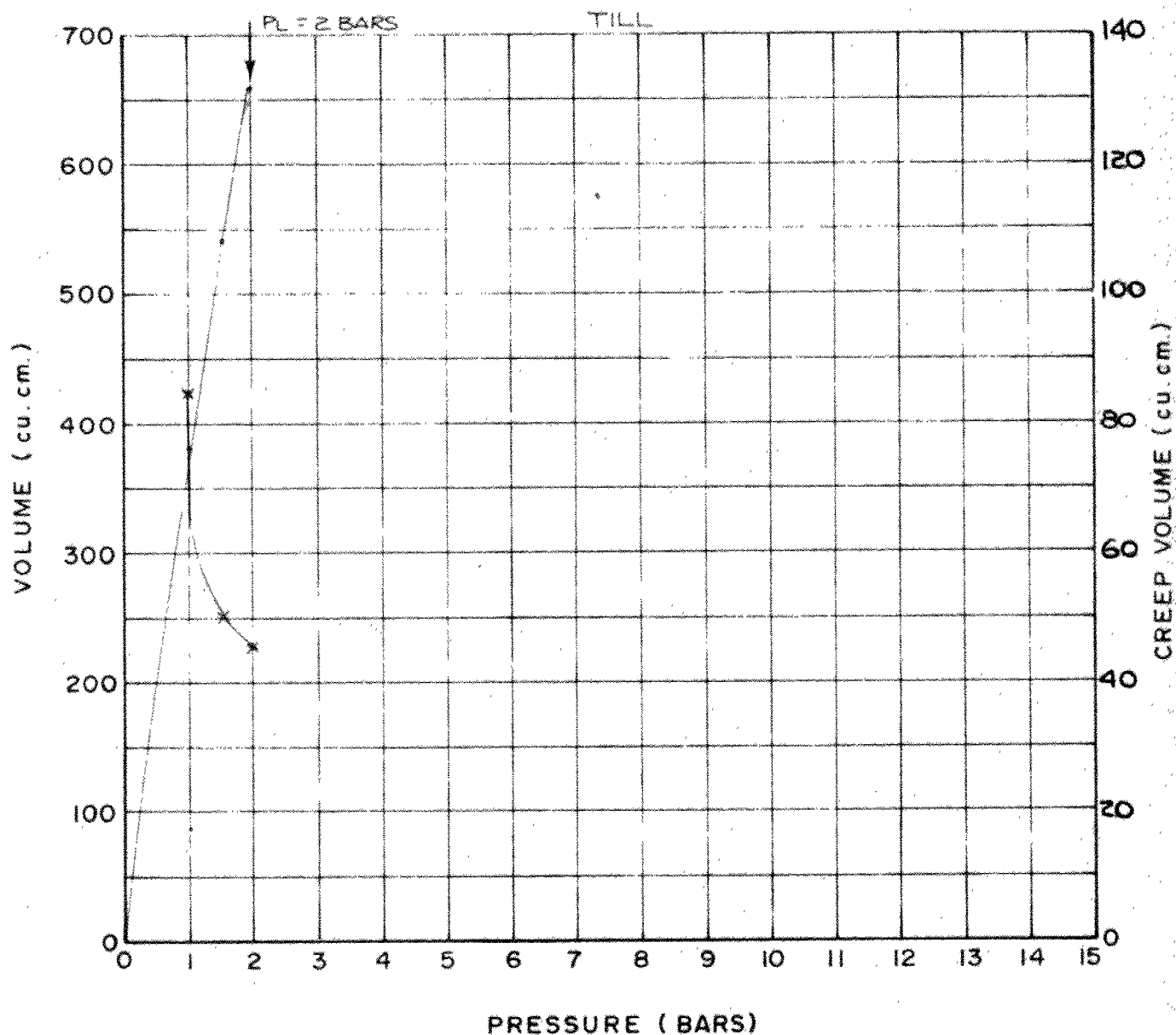
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 11

BOREHOLE No. 102

TEST NUMBER 3

ELEVATION 2672



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn A. G.  
Chkd. [Signature]  
Appd. [Signature]

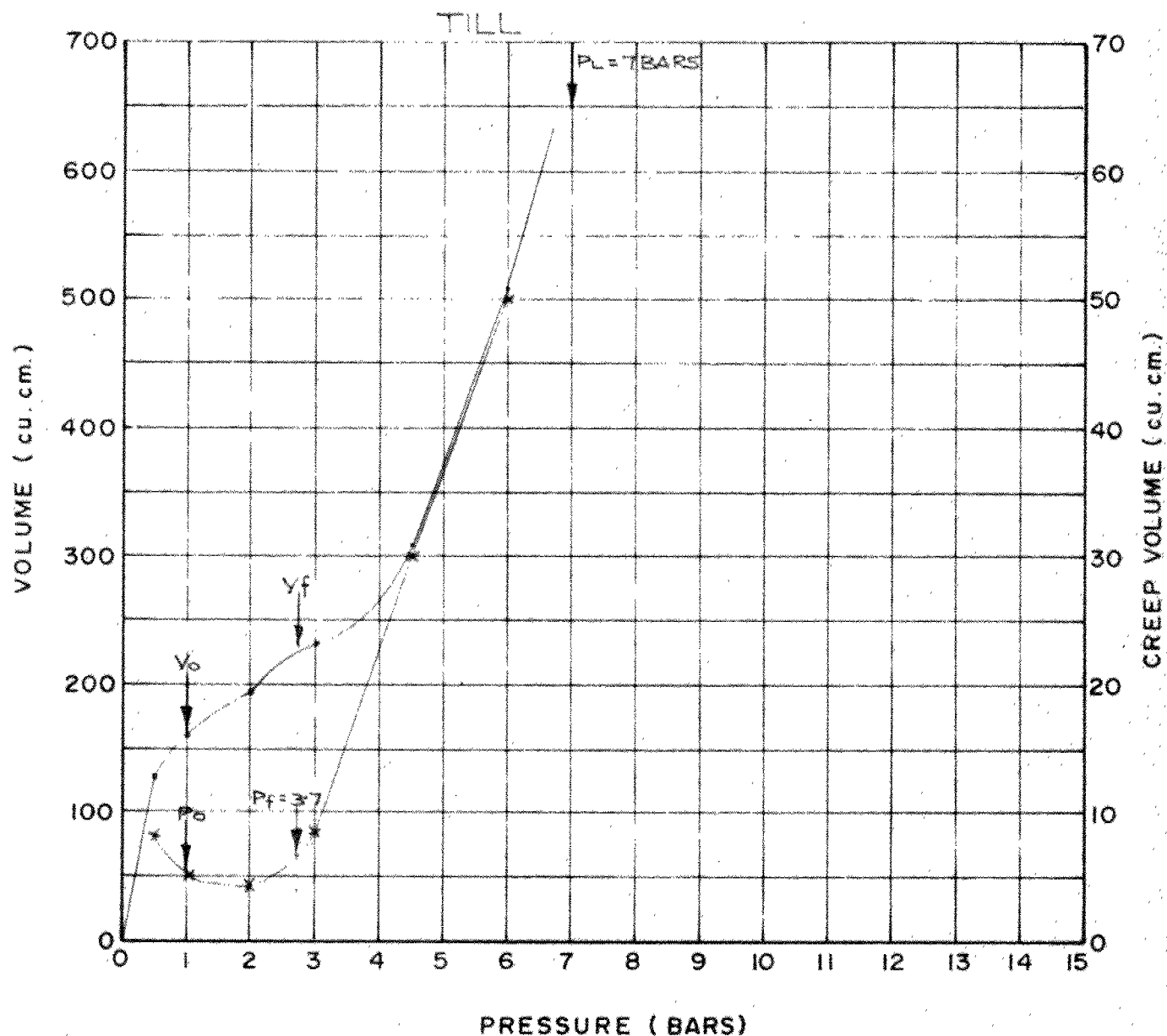
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 12

BOREHOLE No. 102

TEST NUMBER 4

ELEVATION 263.7



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn A.G.  
Chkd  
Appd



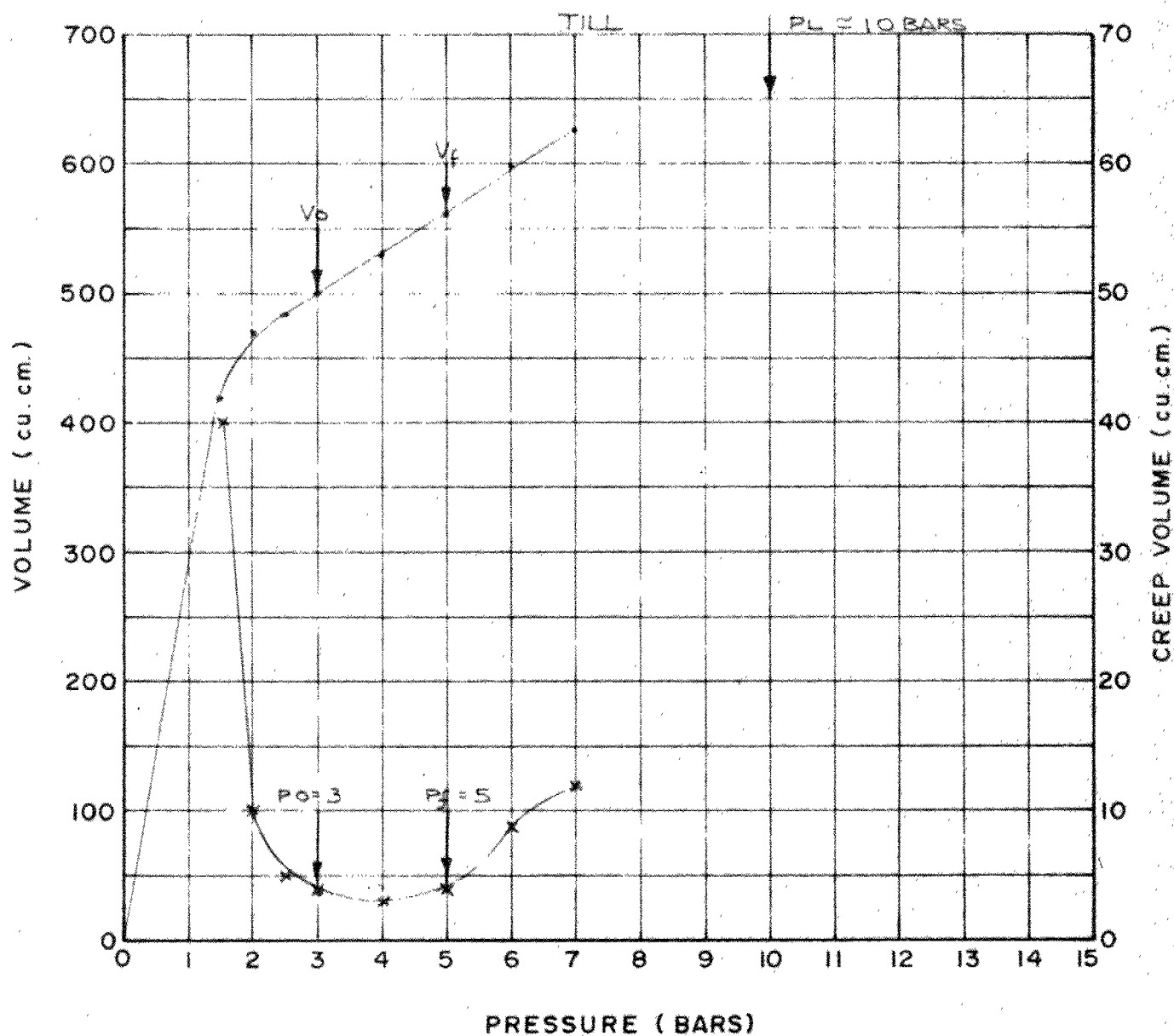
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 13

BOREHOLE No. 102

TEST NUMBER 5

ELEVATION 258.7



Note: for calibration curve see fig.

Date MAR 6, 1973

Golder Associates

Drawn A.G.  
Chkd. *[Signature]*  
Appd. *[Signature]*

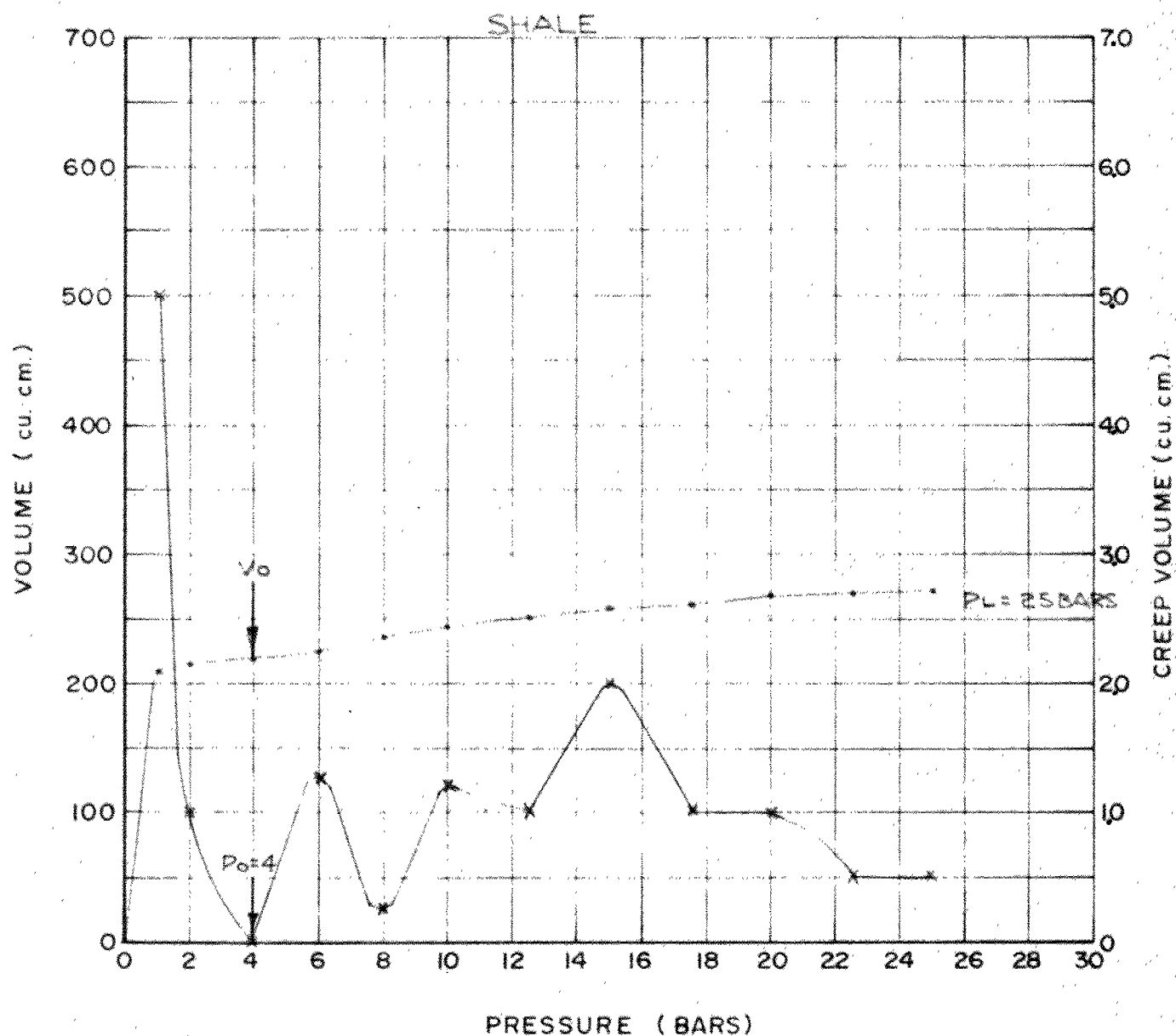
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 14

BOREHOLE No. 102

TEST NUMBER 6

ELEVATION 252.7



Note: for calibration curve see fig.

Date MAR 6, 1973.

Golder Associates

Drawn A.G.  
Chkd. *[Signature]*  
Appd. *[Signature]*

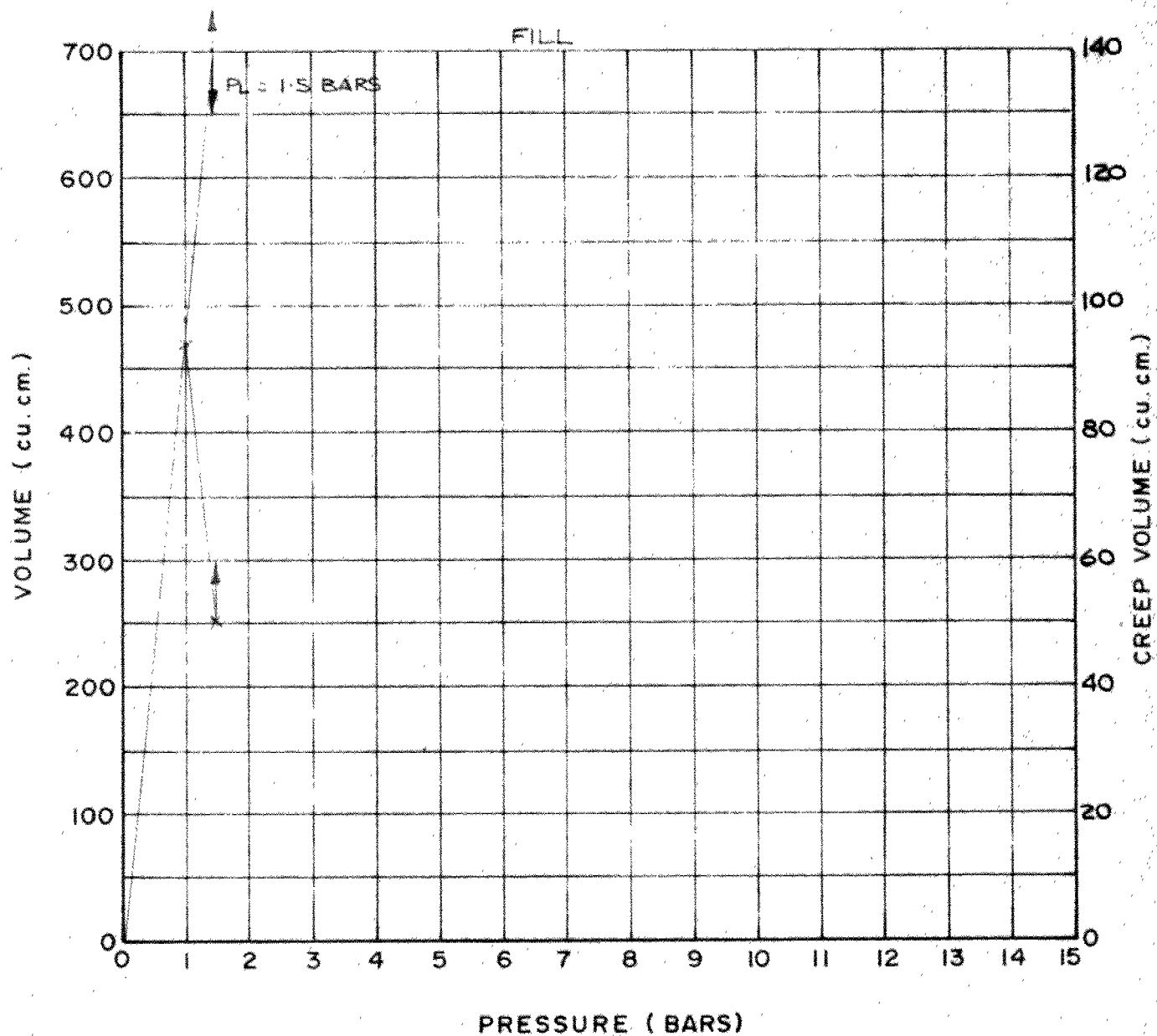
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 15

BOREHOLE No. 104

TEST NUMBER 1

ELEVATION 283.6



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn AG  
Chkd. AG  
Appd. AG

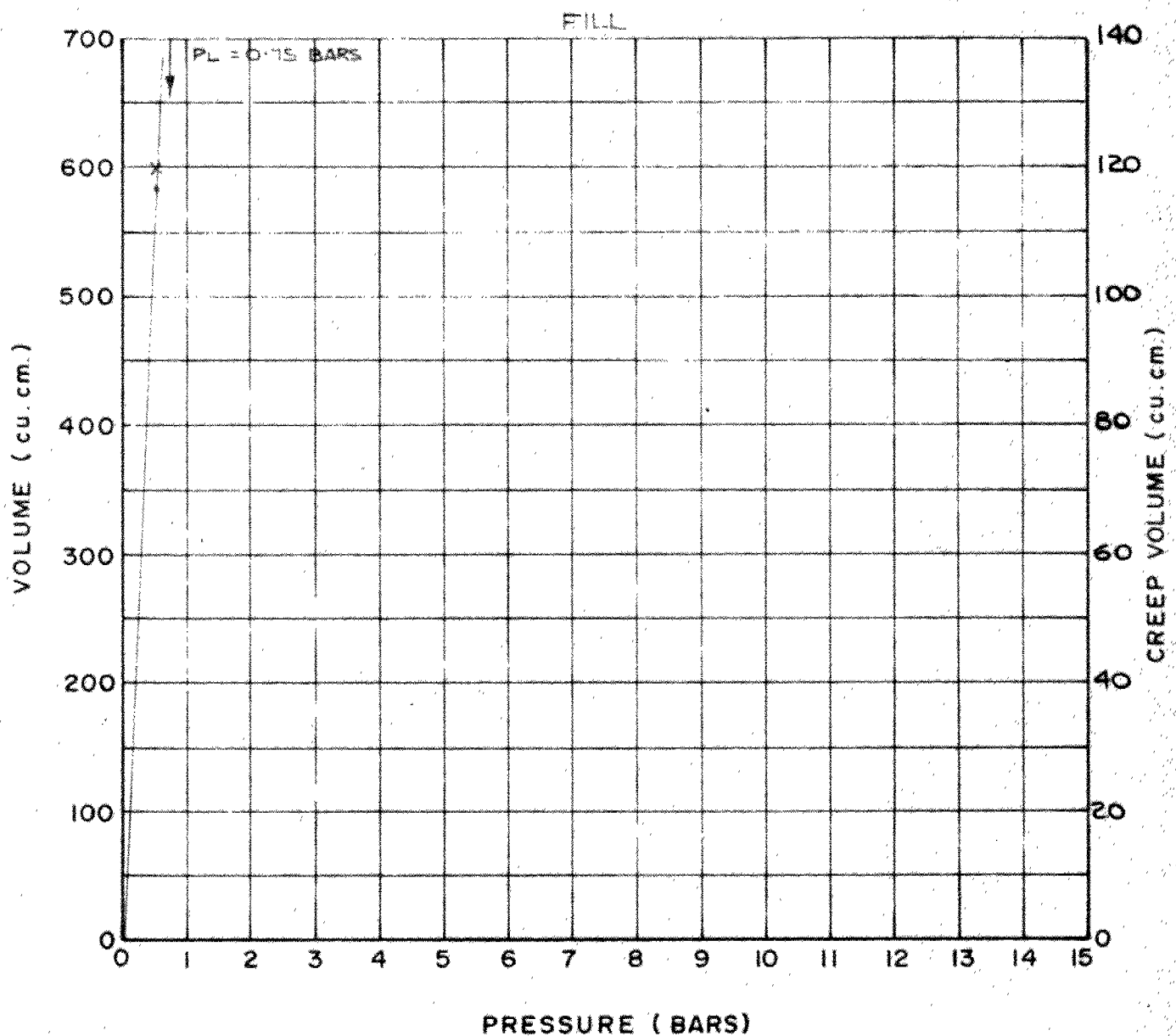
PLOT OF FIELD DATA —  
PRESSUREMETER TESTING

FIGURE 16

BOREHOLE No. 10<sup>2</sup>

TEST NUMBER 2

ELEVATION 279.3



Note: for calibration curve see fig.

Date MAR. 7, 1973

Golder Associates

Drawn A.G.  
Chkd. *[Signature]*  
Appd. *[Signature]*

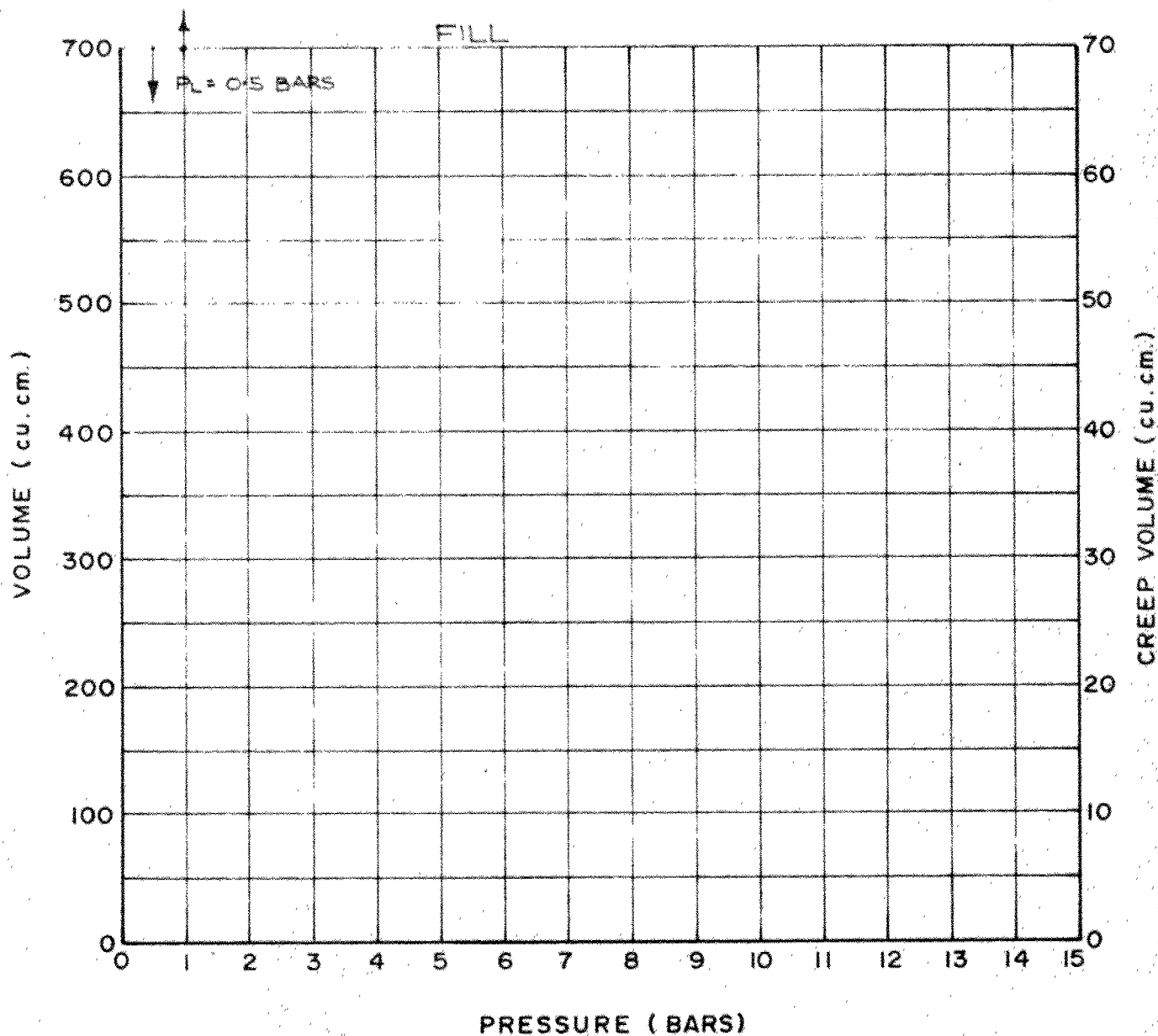
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 17

BOREHOLE No. 104

TEST NUMBER 3

ELEVATION 274.3



Note: for calibration curve see fig.

Date MAR 11 1963

Golder Associates

Drawn A.G.  
Chkd  
Appd

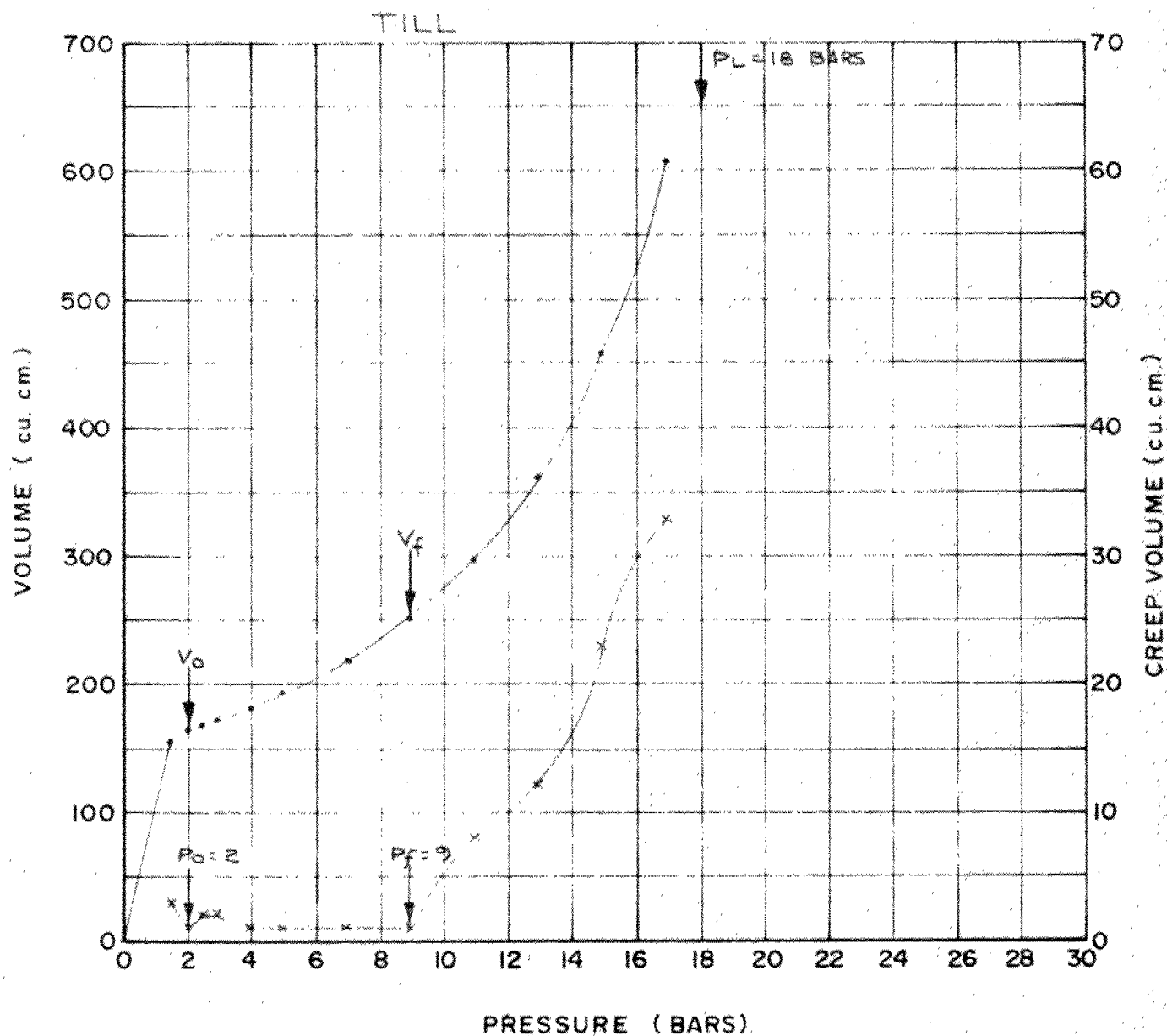
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 18

BOREHOLE No. 104

TEST NUMBER 4

ELEVATION 268.6



Note: for calibration curve see fig.

Date MAR. 1, 1973

Golder Associates

Drawn A.G.  
Chkd.   
Appd.   
Date

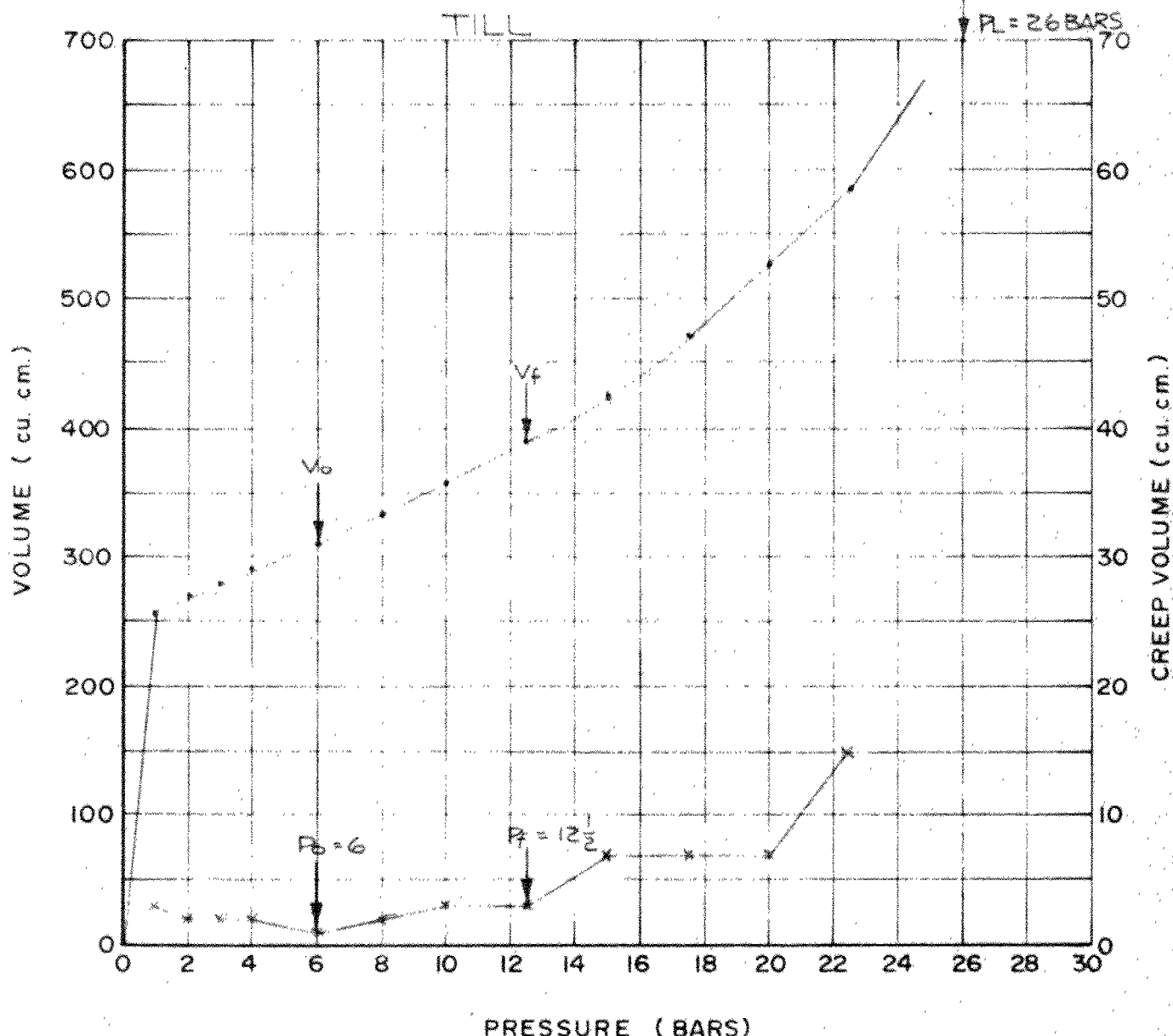
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 19

BOREHOLE No. 104

TEST NUMBER 5

ELEVATION 264.1



Note: for calibration curve see fig.

Date MAR. 6, 1973.

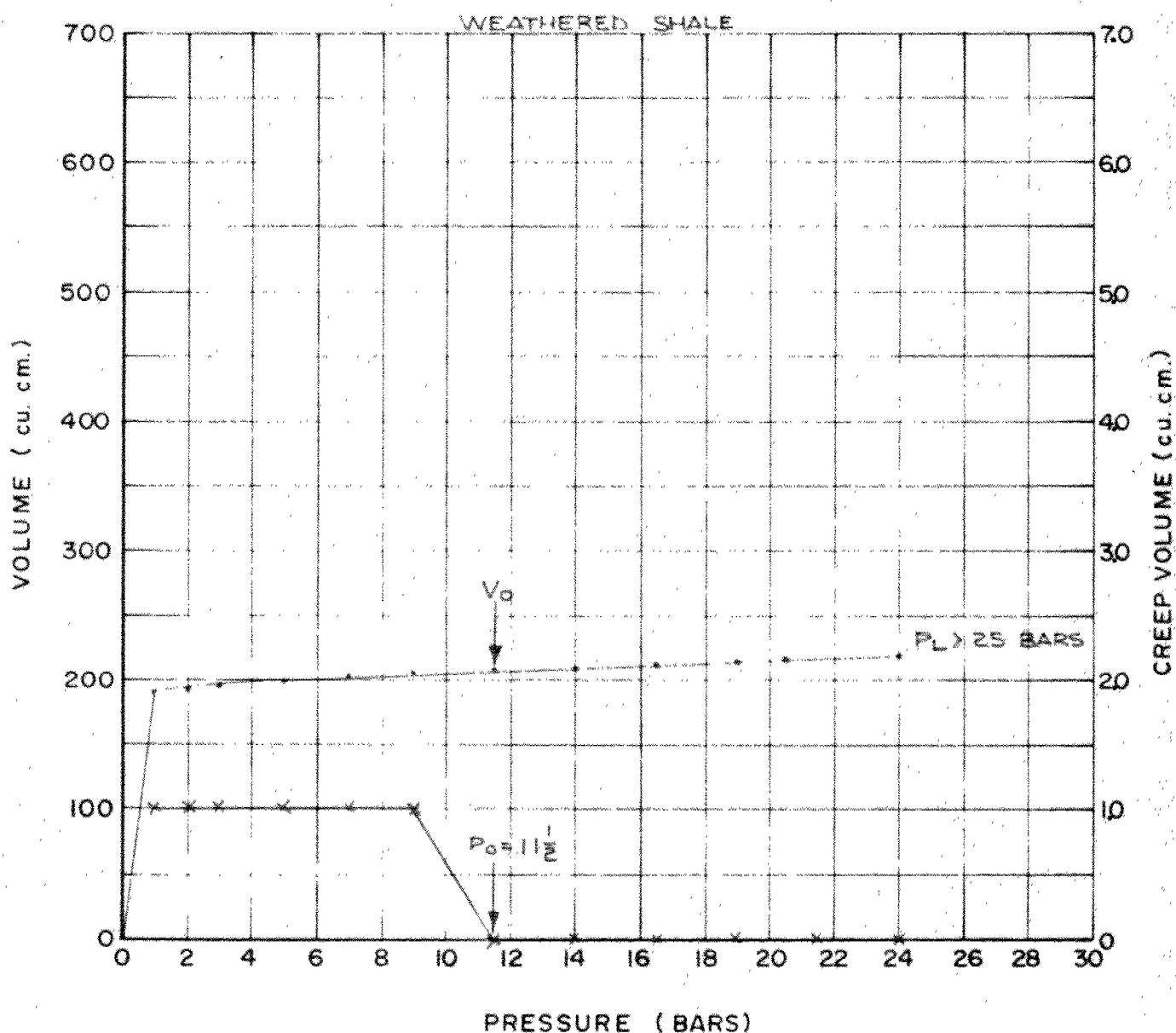
Golder Associates

Drawn AG  
Chkd  
Appd

# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 20

BOREHOLE No. 104  
TEST NUMBER 6  
ELEVATION 259.5



Note: for calibration curve see fig.

Date MAR 6, 1973.

Golder Associates

Drawn A.G.  
Chkd:  
Appd:



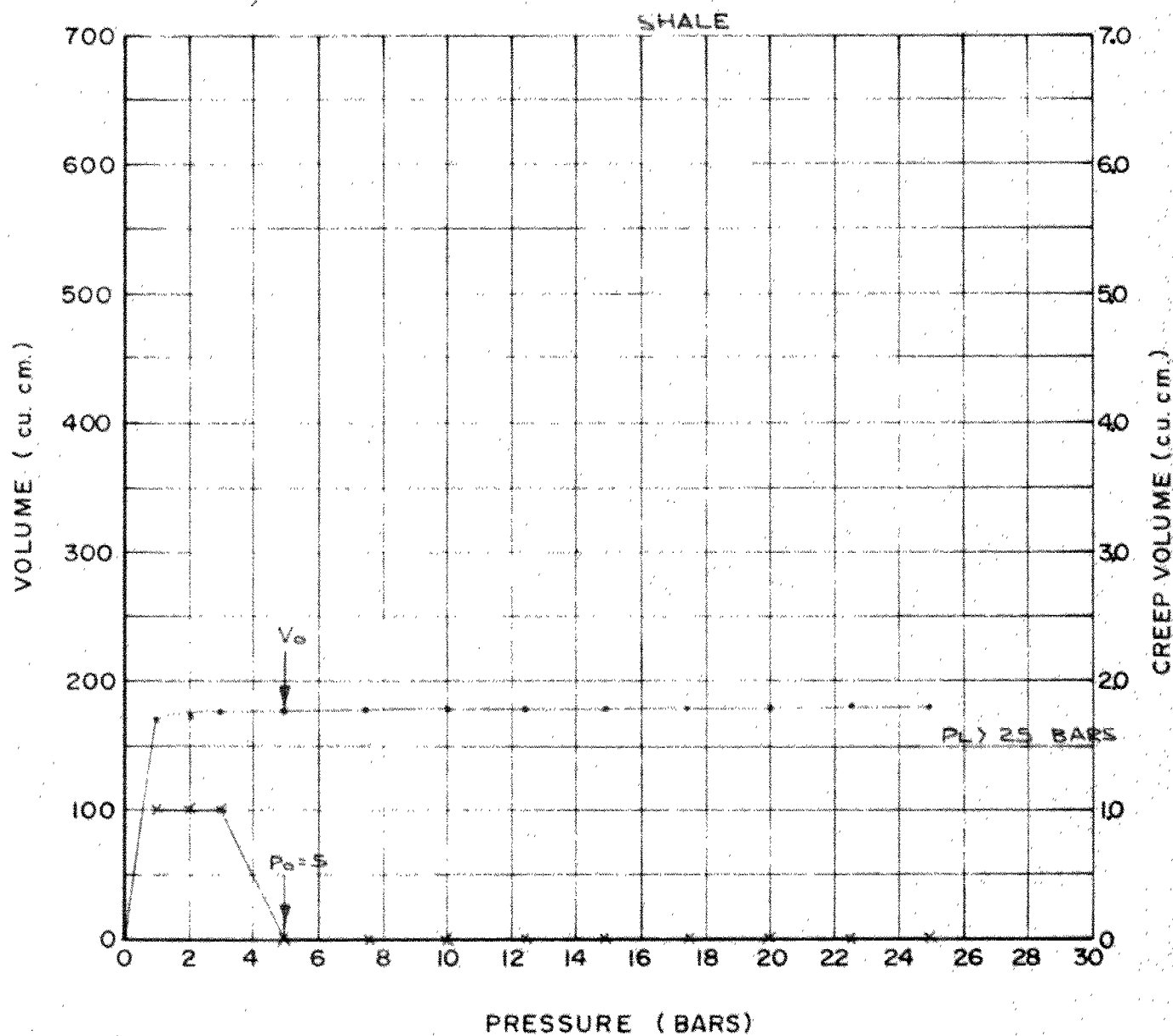
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 21

BOREHOLE No. 104

TEST NUMBER 7

ELEVATION 254.6



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn AG.  
Chkd  
Appd

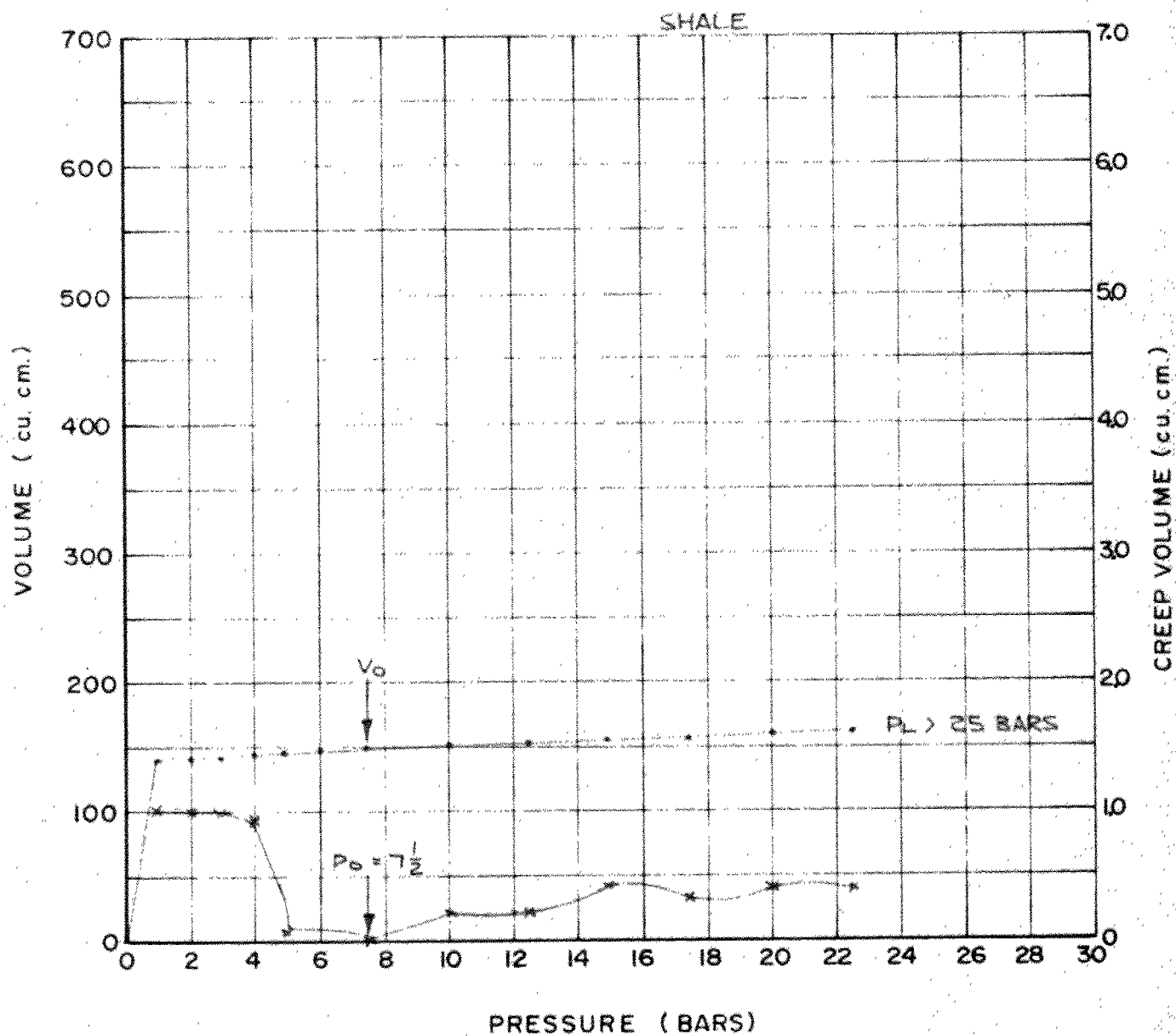
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 22

BOREHOLE No. 104

TEST NUMBER. B

ELEVATION 249.6



Note: for calibration curve see fig.

Date MAR. 6, 1973

Golder Associates

Drawn A.G.  
Chkd  
Appd

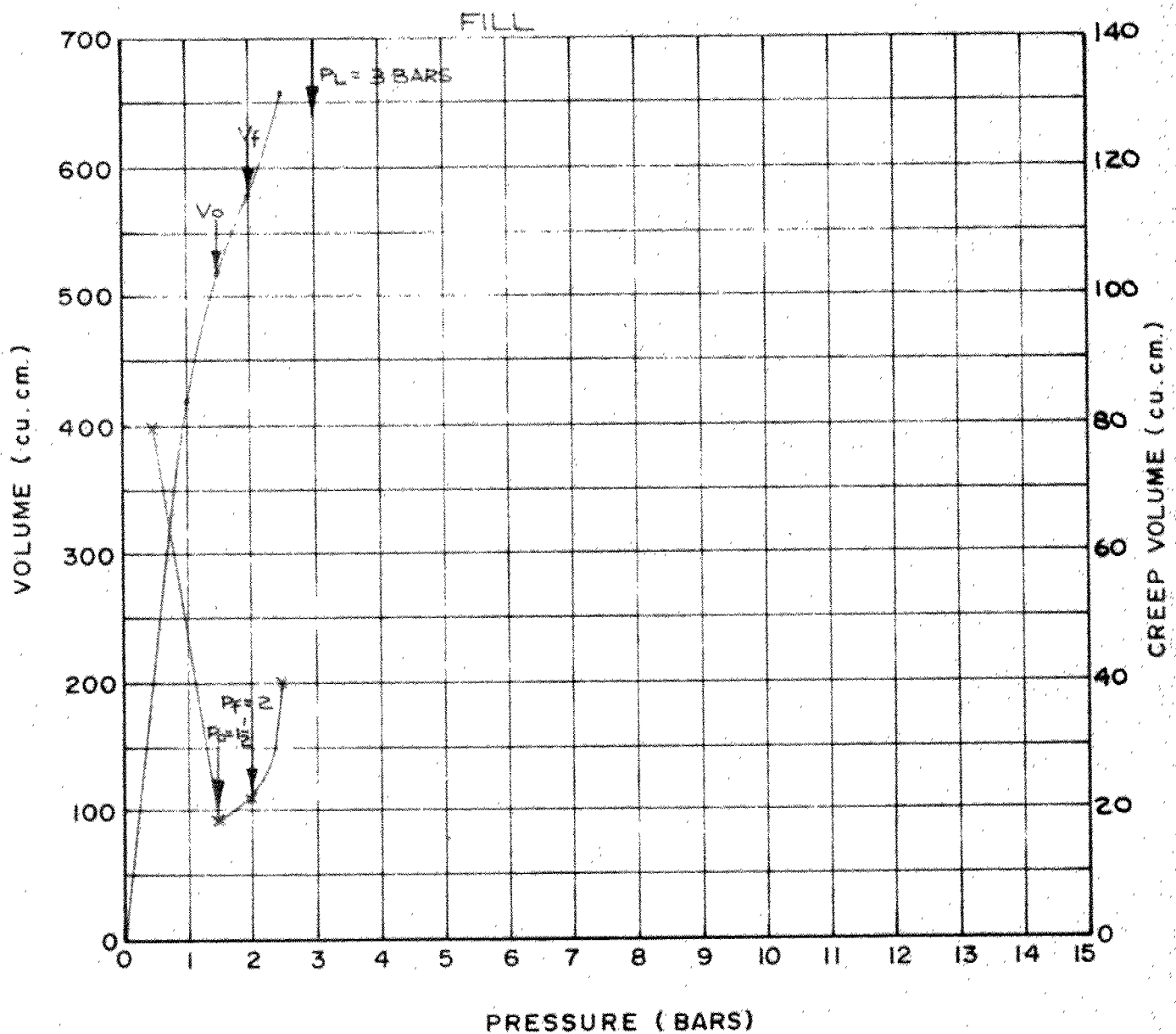
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 23

BOREHOLE No. 129

TEST NUMBER 1

ELEVATION 245.0



Note: for calibration curve see fig.

Date: MAR 7, 1973

Golder Associates

Drawn A.G.  
Chkd. [Signature]  
Appd. [Signature]

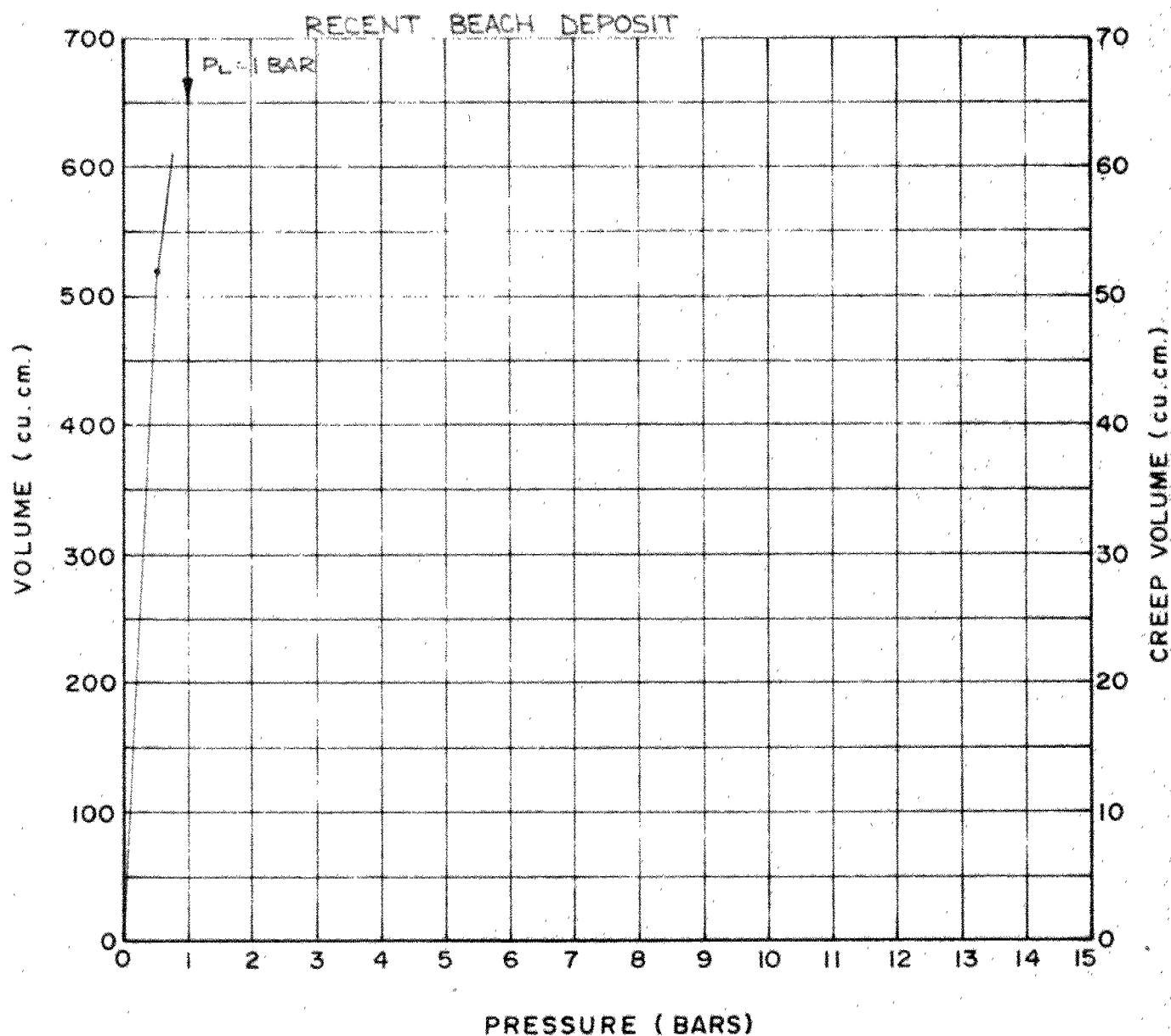
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 24

BOREHOLE No. 20

TEST NUMBER 2

ELEVATION 235.0



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn AG  
Chkd  
Appd

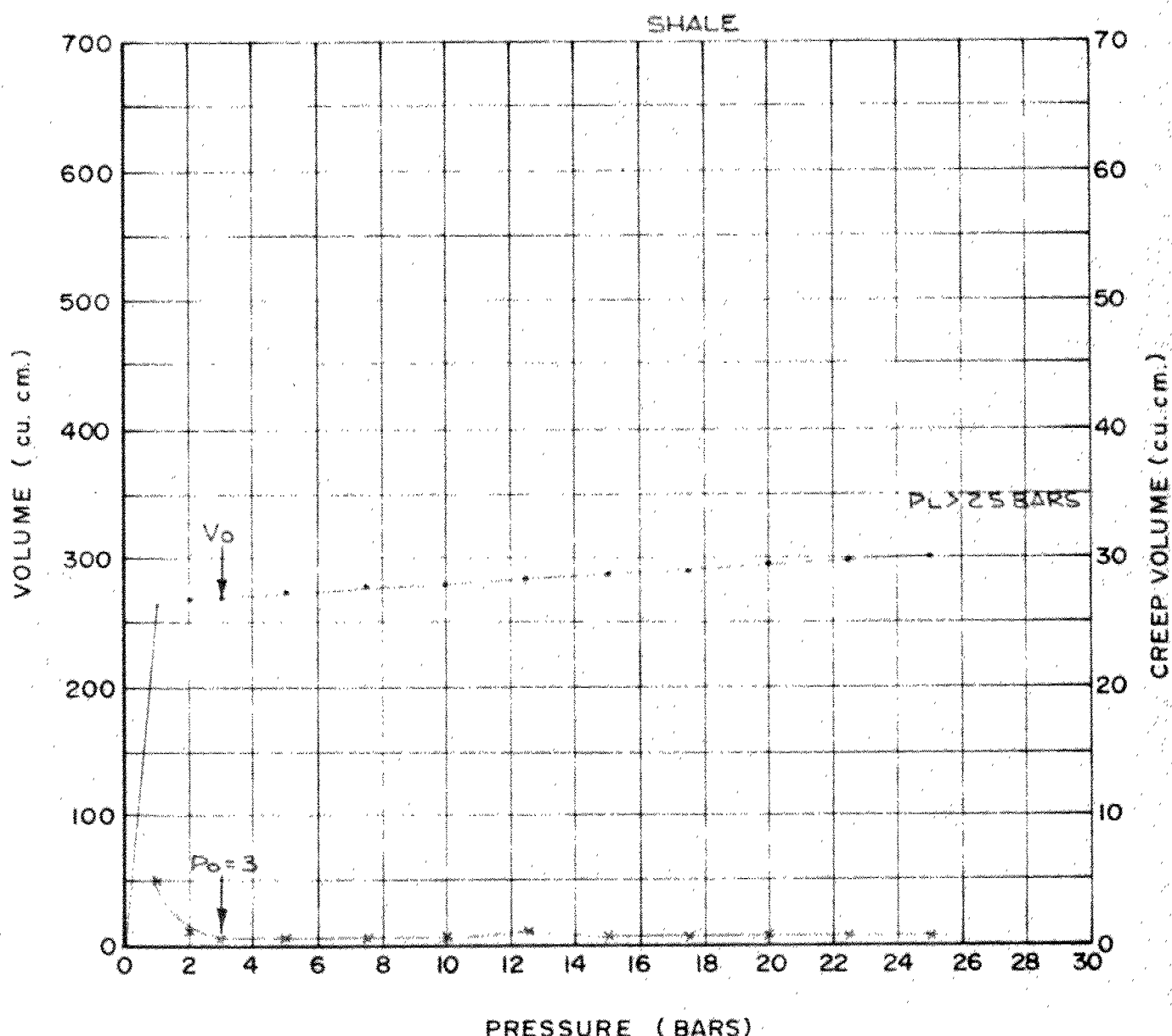
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 25

BOREHOLE No. 129

TEST NUMBER 3

ELEVATION 229.5



Note: for calibration curve see fig.

Date MAR. 6, 1973

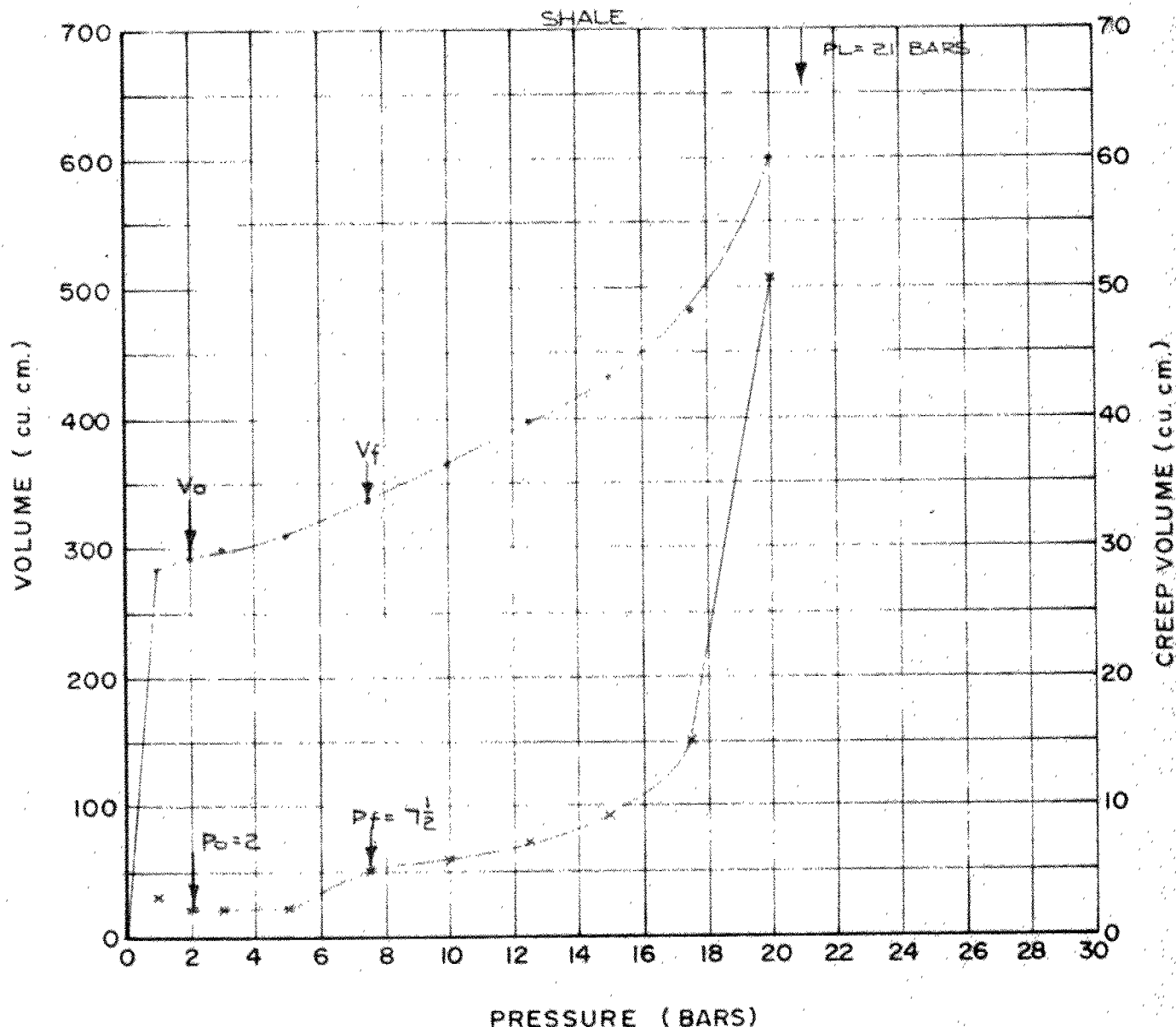
Golder Associates

Drawn A.G.  
Chkd [Signature]  
Appd [Signature]

# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 26

BOREHOLE No. 129  
TEST NUMBER 4  
ELEVATION 2245



Note: for calibration curve see fig.

Date MAR 1, 1973.

Golder Associates

Drawn A.G.  
Chkd. J.G.  
Appd. J.G.

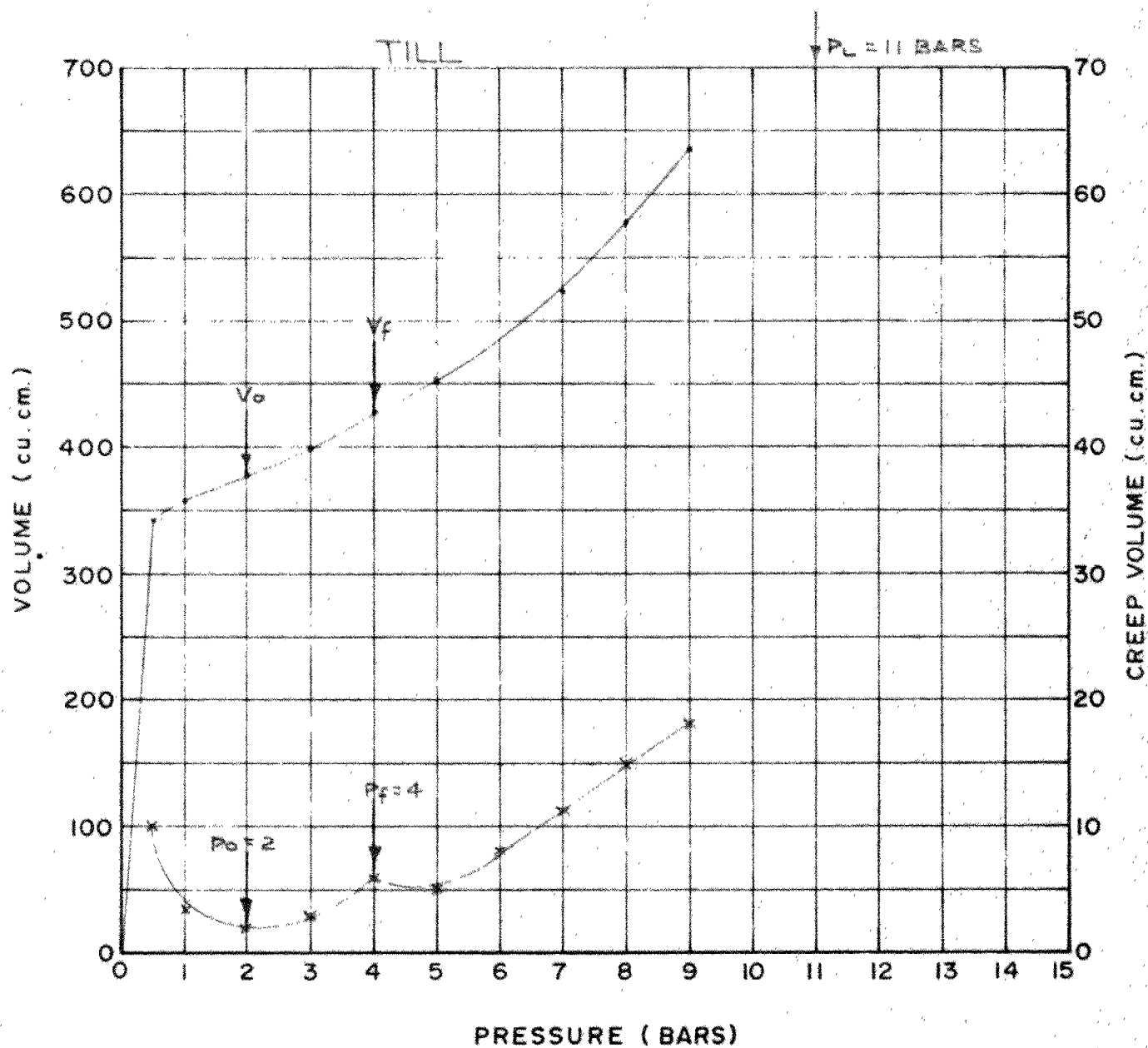
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 27

BOREHOLE No. 139

TEST NUMBER 1

ELEVATION 264.3



Note: for calibration curve see fig.

Date MAR 6, 1973

Golder Associates

Drawn AG  
Chkd.  
Appd.

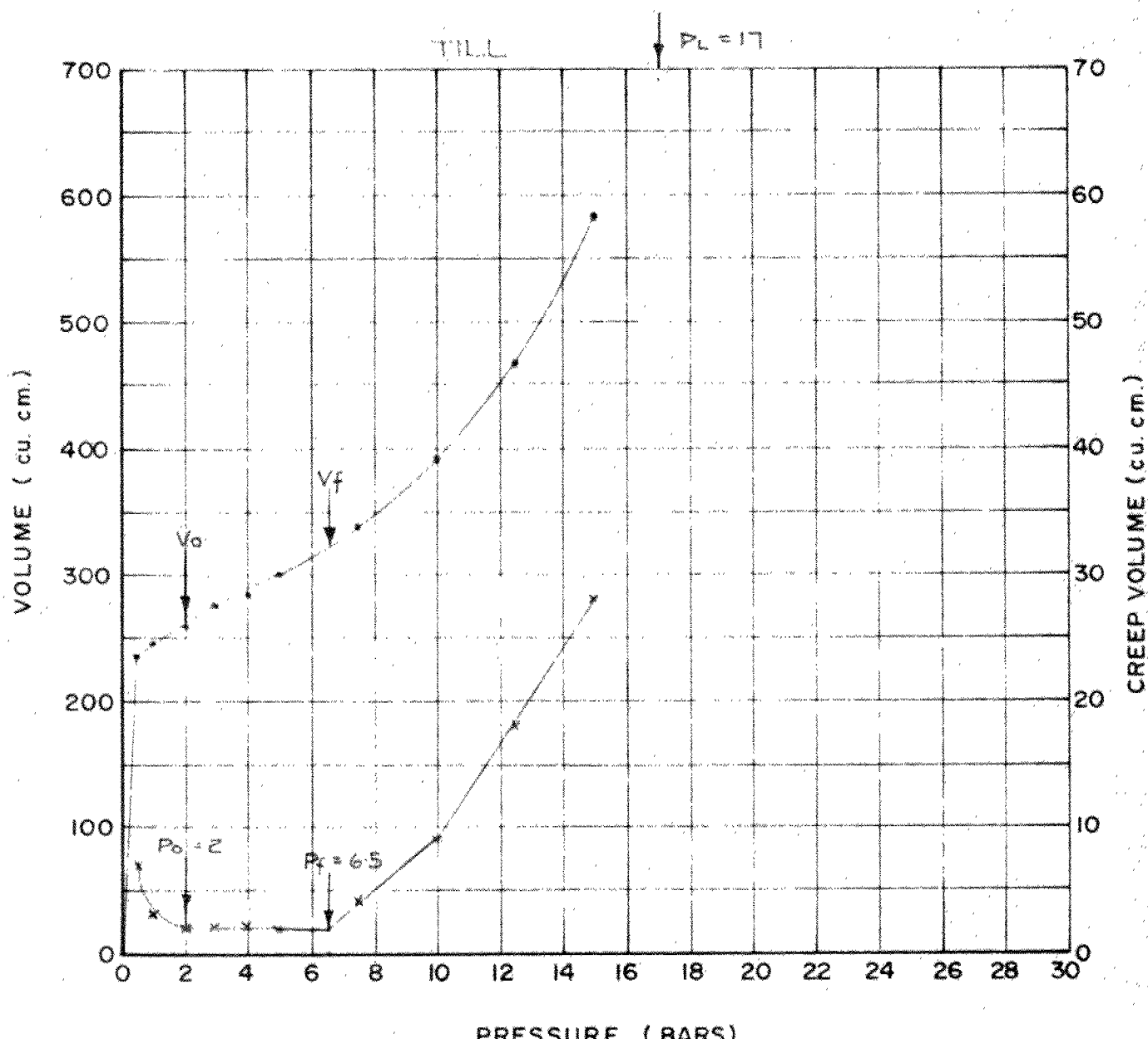
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 28

BOREHOLE No. 139

TEST NUMBER 2

ELEVATION 359.3



Note: for calibration curve see fig.

Date MAR 6, 1973.

**Golder Associates**

Drawn A.G.  
Chkd.  
Appd.



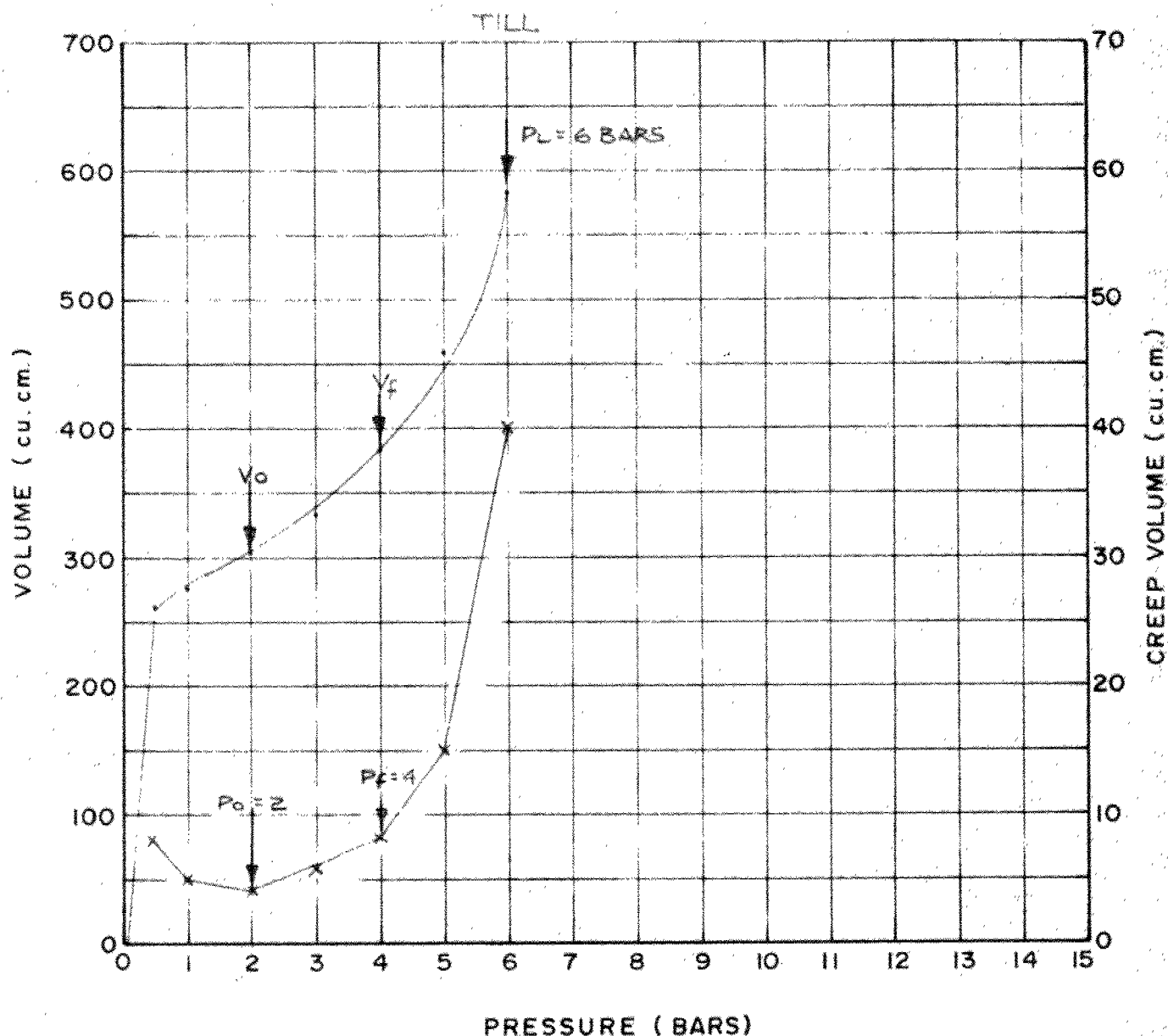
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 29

BOREHOLE No. 139

TEST NUMBER 3

ELEVATION 354.3



Note: for calibration curve see fig.

Date MAR. 6, 1972.

Golder Associates

Drawn A.G.  
Chkd. [Signature]  
Appd. [Signature]

## For

Drawn A. G.  
Chkd. [unclear]  
Appd. [unclear]

The graph shows the relationship between Volume (cu. cm.) and Pressure (BARS) for Till. The volume decreases linearly as pressure increases. The graph is labeled 'TILL' and 'PL = 1.5 BARS'.

Pressure (BARS)	Volume (cu. cm.)
0.5	430
1.0	170

Date: MAR 14 1963

## **Golder Associates**

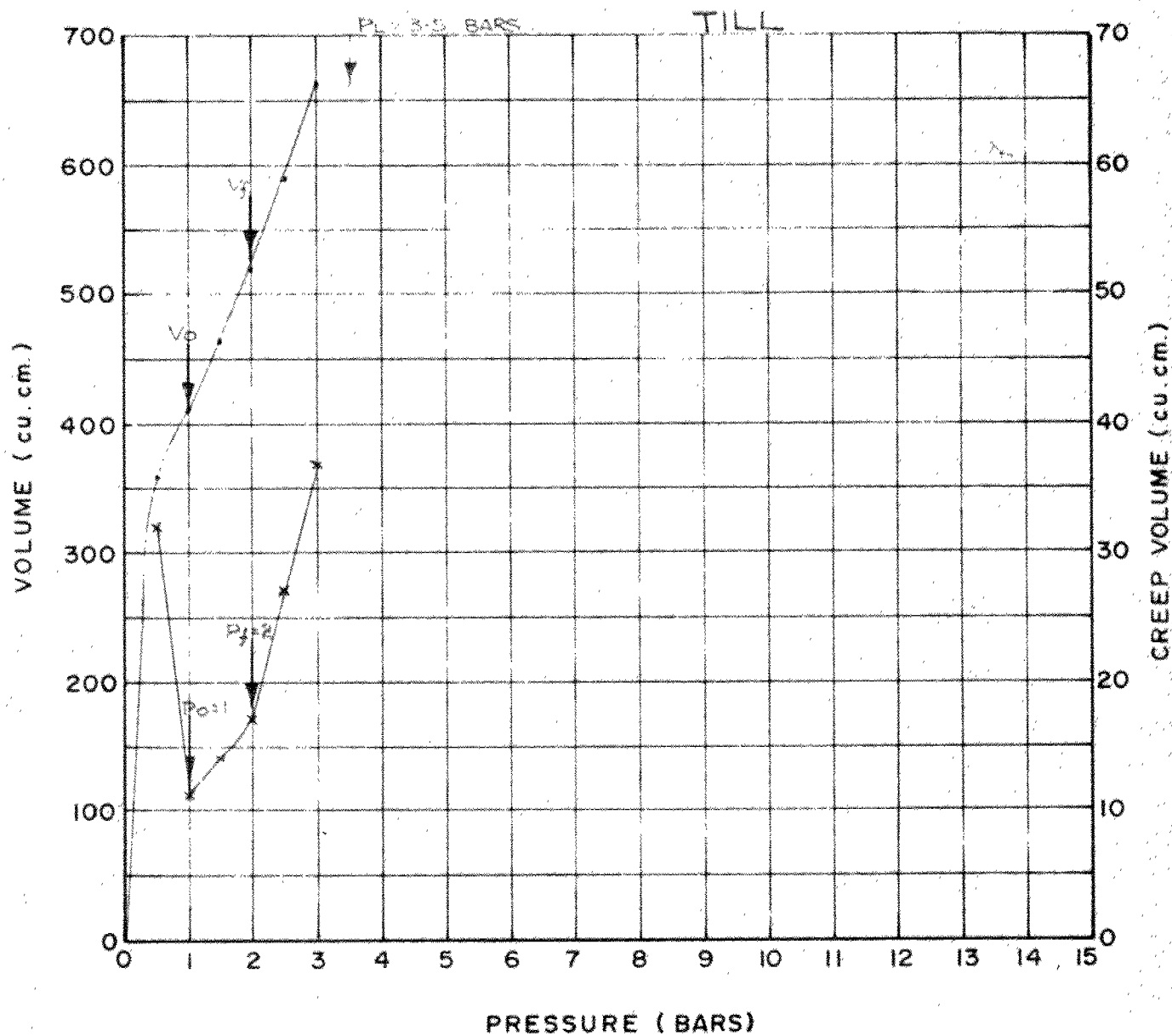
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 31

BOREHOLE No. 139

TEST NUMBER 5

ELEVATION 244.3



Note: for calibration curve see fig.

Date MAR. 6, 1953.

Golder Associates

Drawn AG  
Chkd  
Appd

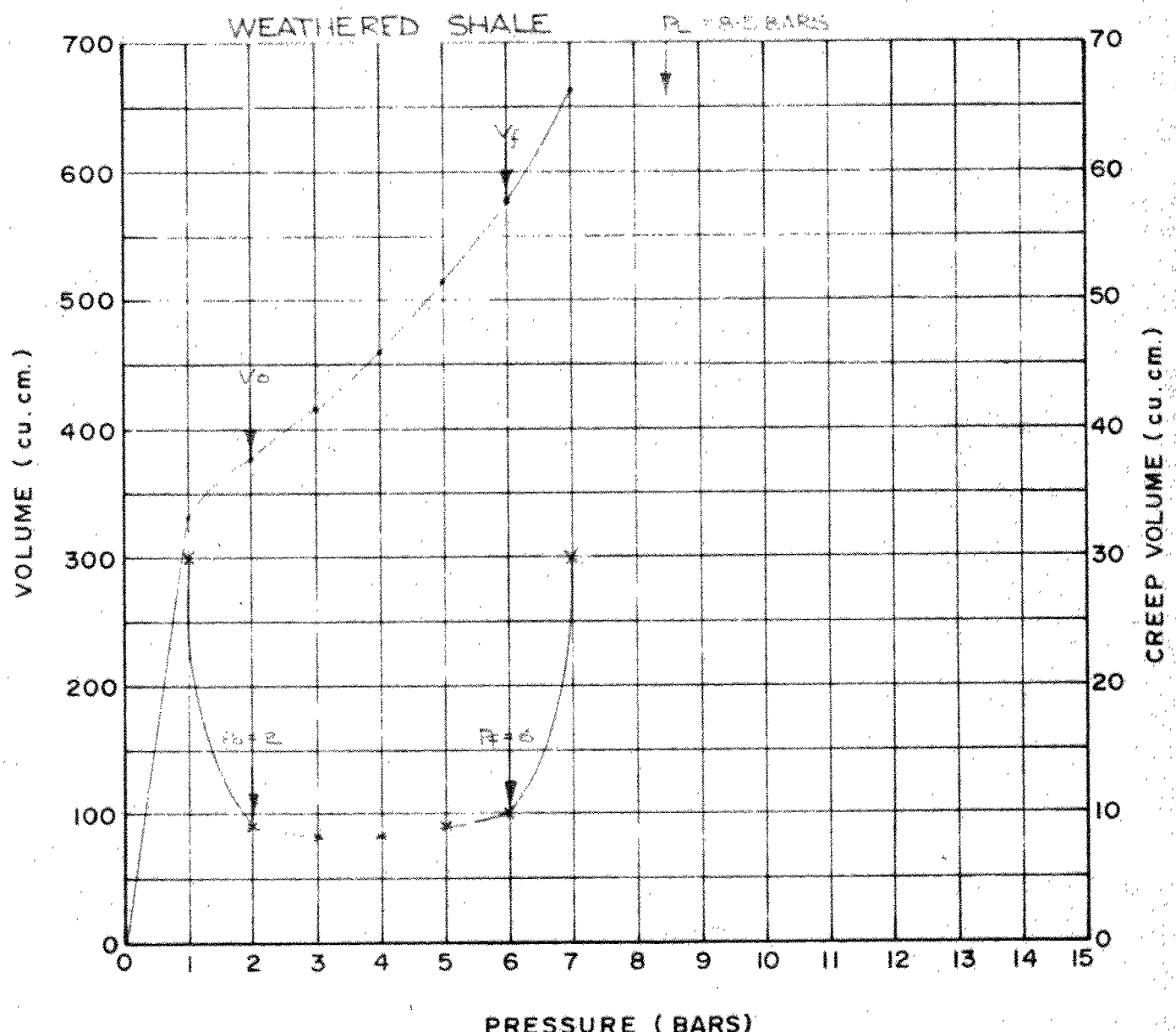
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 32

BOREHOLE No. 139

TEST NUMBER 5

ELEVATION 237.8



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn AG.  
Chkd  
Appd

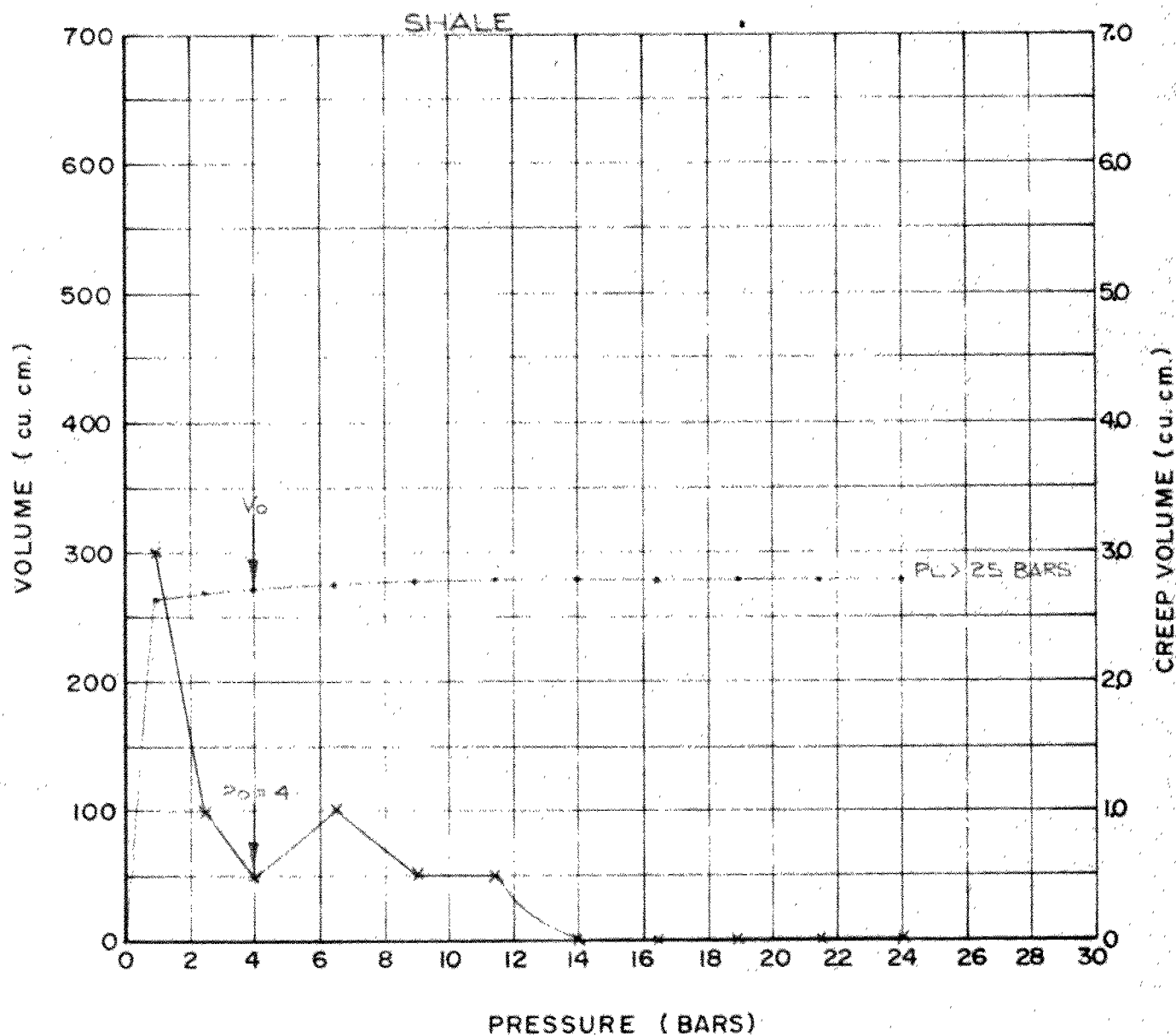
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 33

BOREHOLE No. 139

TEST NUMBER 7

ELEVATION 234.3



Note: for calibration curve see fig.

Date MAR. 6, 1973.

Golder Associates

Drawn AG  
Chkd  
Appd

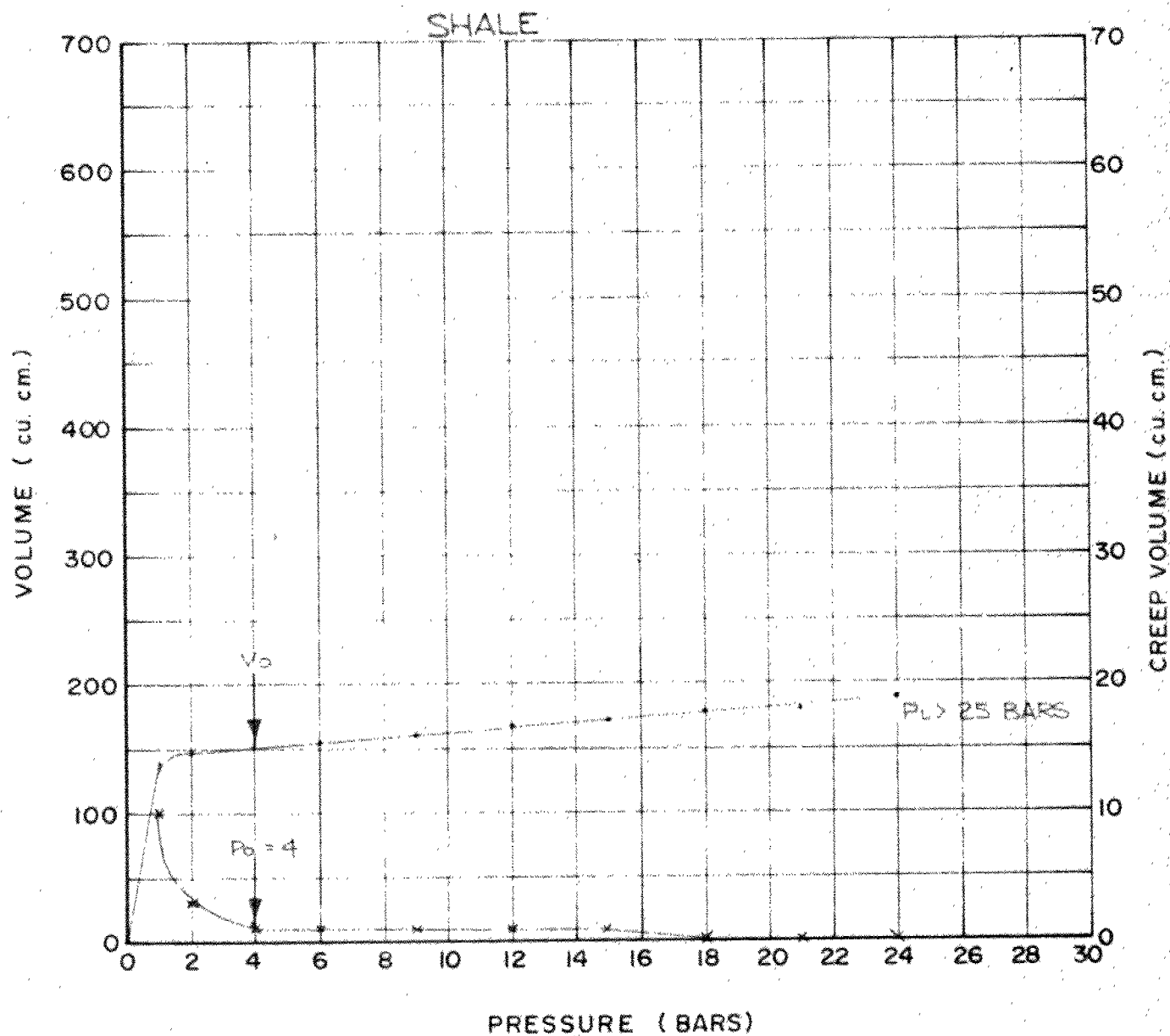
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 34

BOREHOLE No. 139

TEST NUMBER 8

ELEVATION 2293



Note: for calibration curve see fig.

Date MAR 6, 1973

Golder Associates

Drawn A.G.  
Chkd.  
Appd.

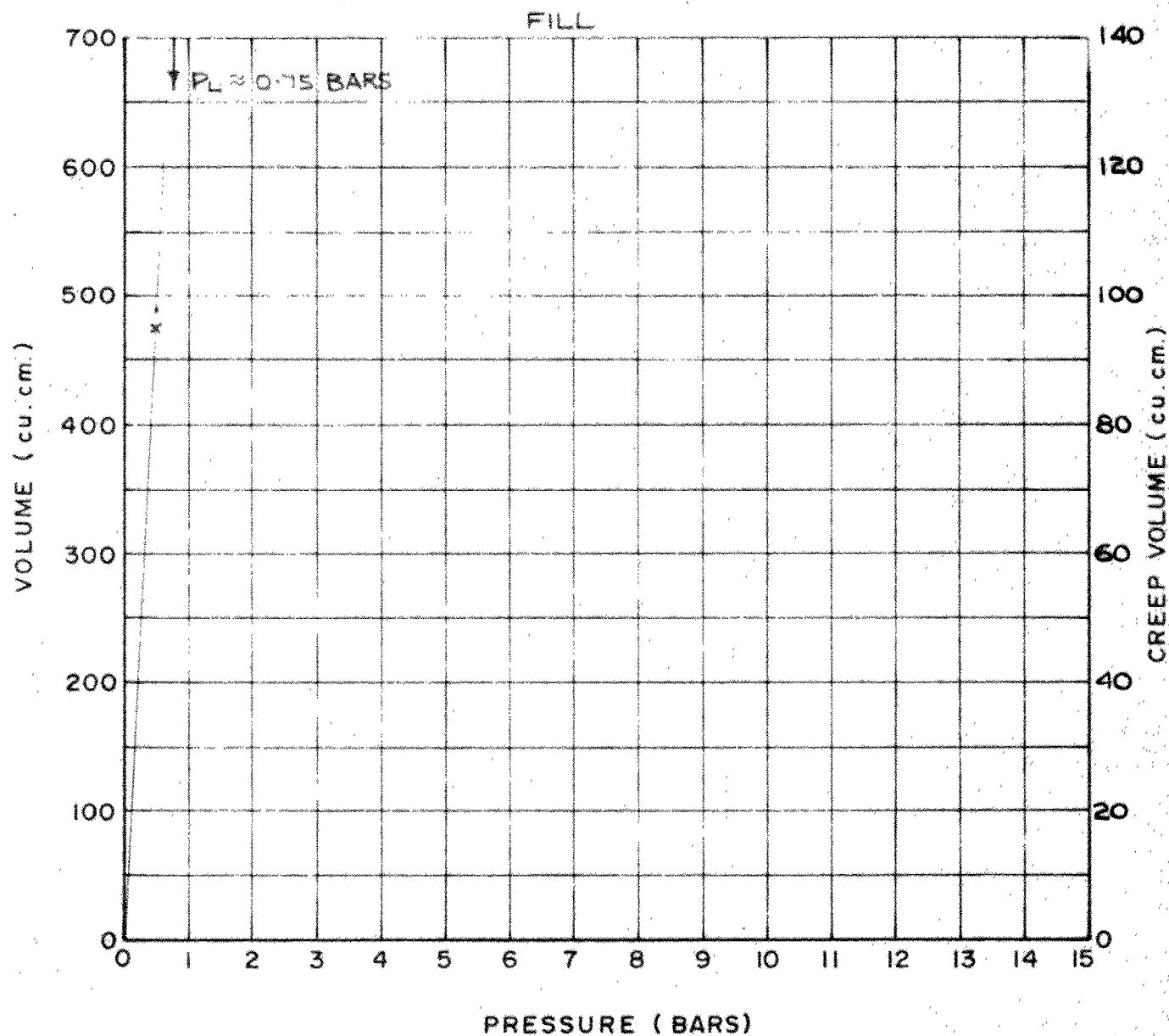
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 35

BOREHOLE No. 143

TEST NUMBER 1

ELEVATION 252.6



Note: for calibration curve see fig.

Date MARCH 6, 1973.

Golder Associates

Drawn A.G.  
Chkd  
Appd

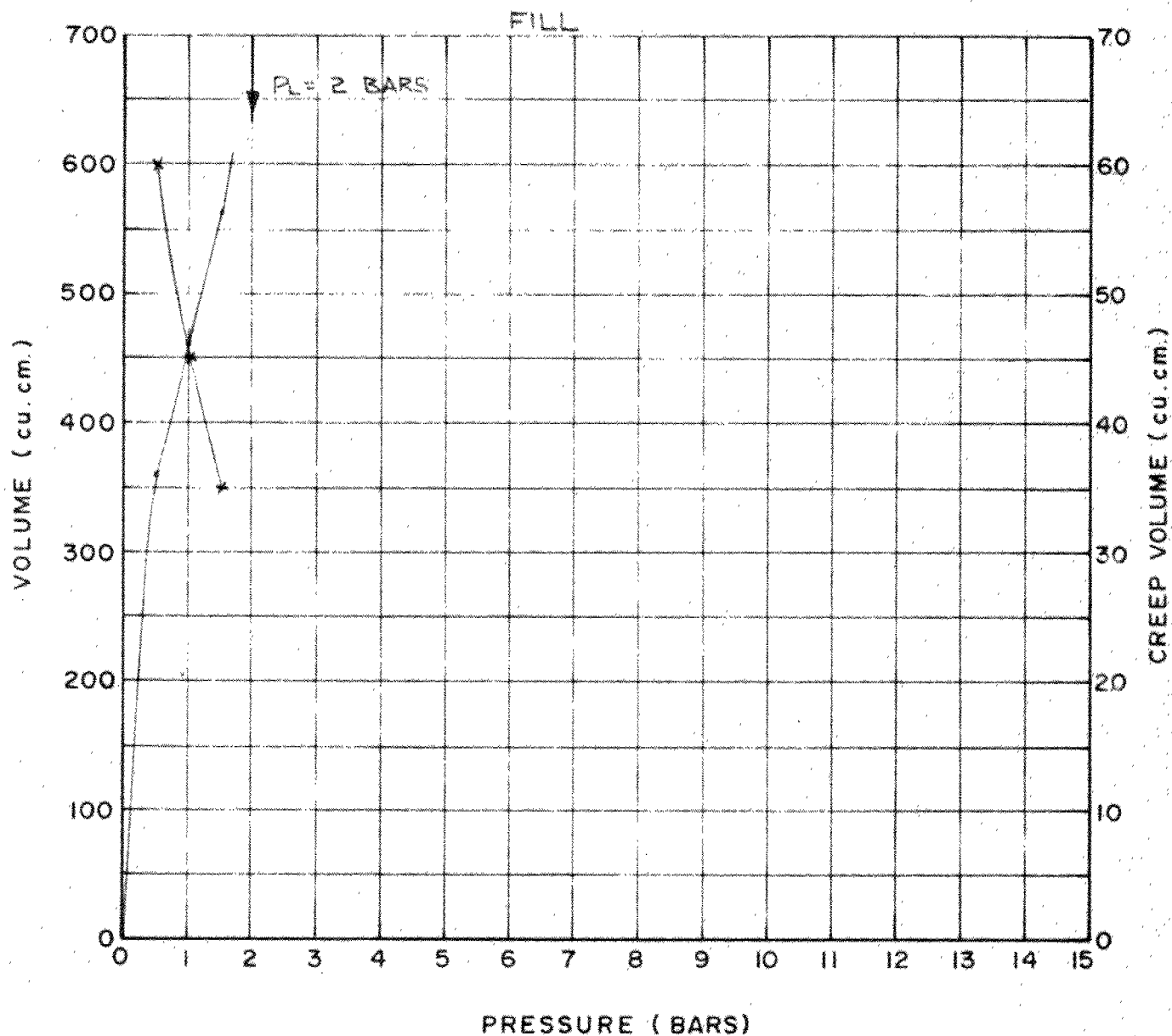
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 36

BOREHOLE No. 143

TEST NUMBER 2

ELEVATION 249.6



Note: for calibration curve see fig.

Date MAR 5, 1973.

Golder Associates

Drawn A.G.  
Chkd.  
Appd.



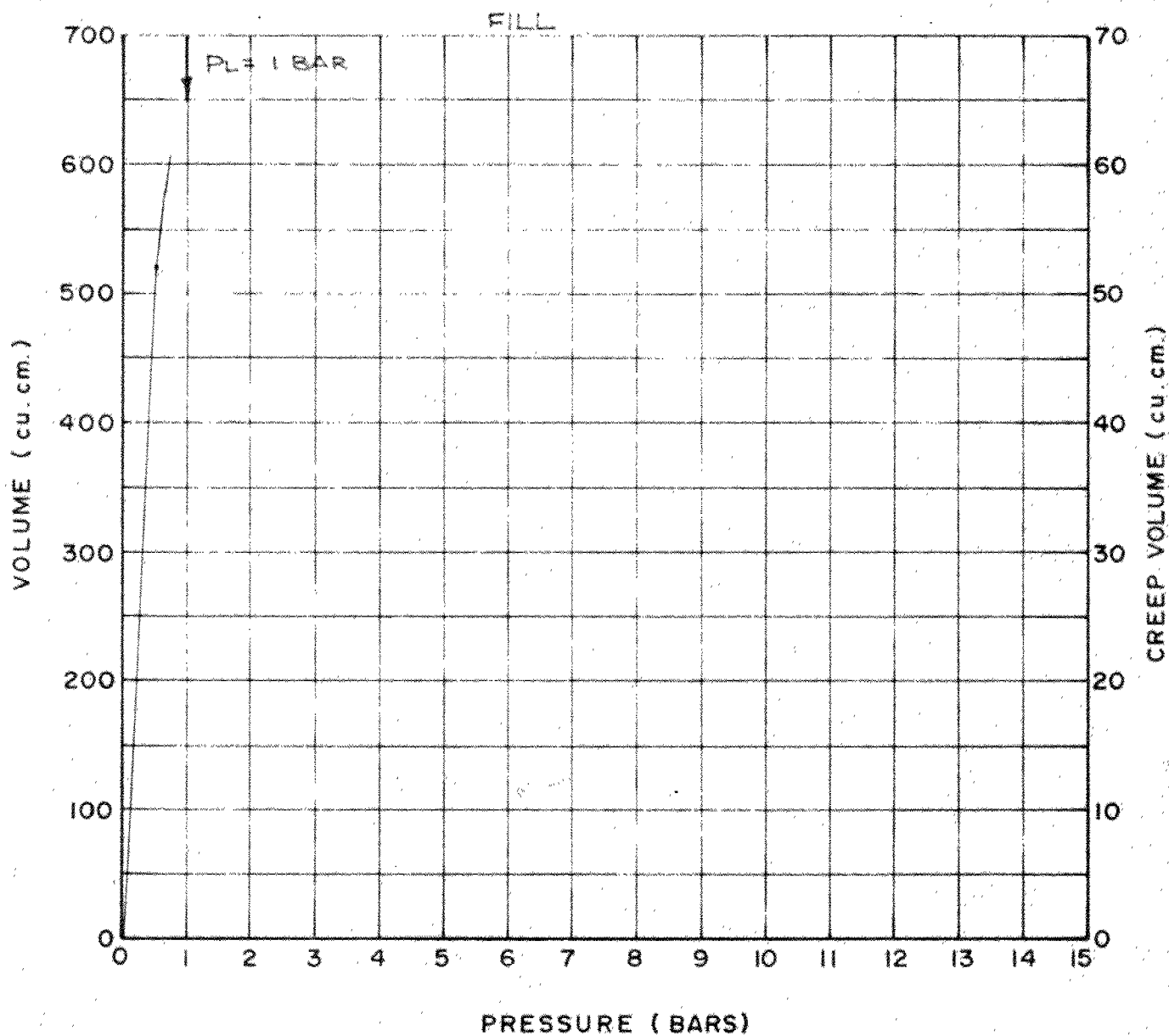
PLOT OF FIELD DATA —  
PRESSUREMETER TESTING

FIGURE 37

BOREHOLE No. 143

TEST NUMBER 3

ELEVATION 245.1



Note: for calibration curve see fig.

Date MAR 5, 1973.

Golder Associates

Drawn A.G.  
Chkd. J.S.  
Appd. J.S.

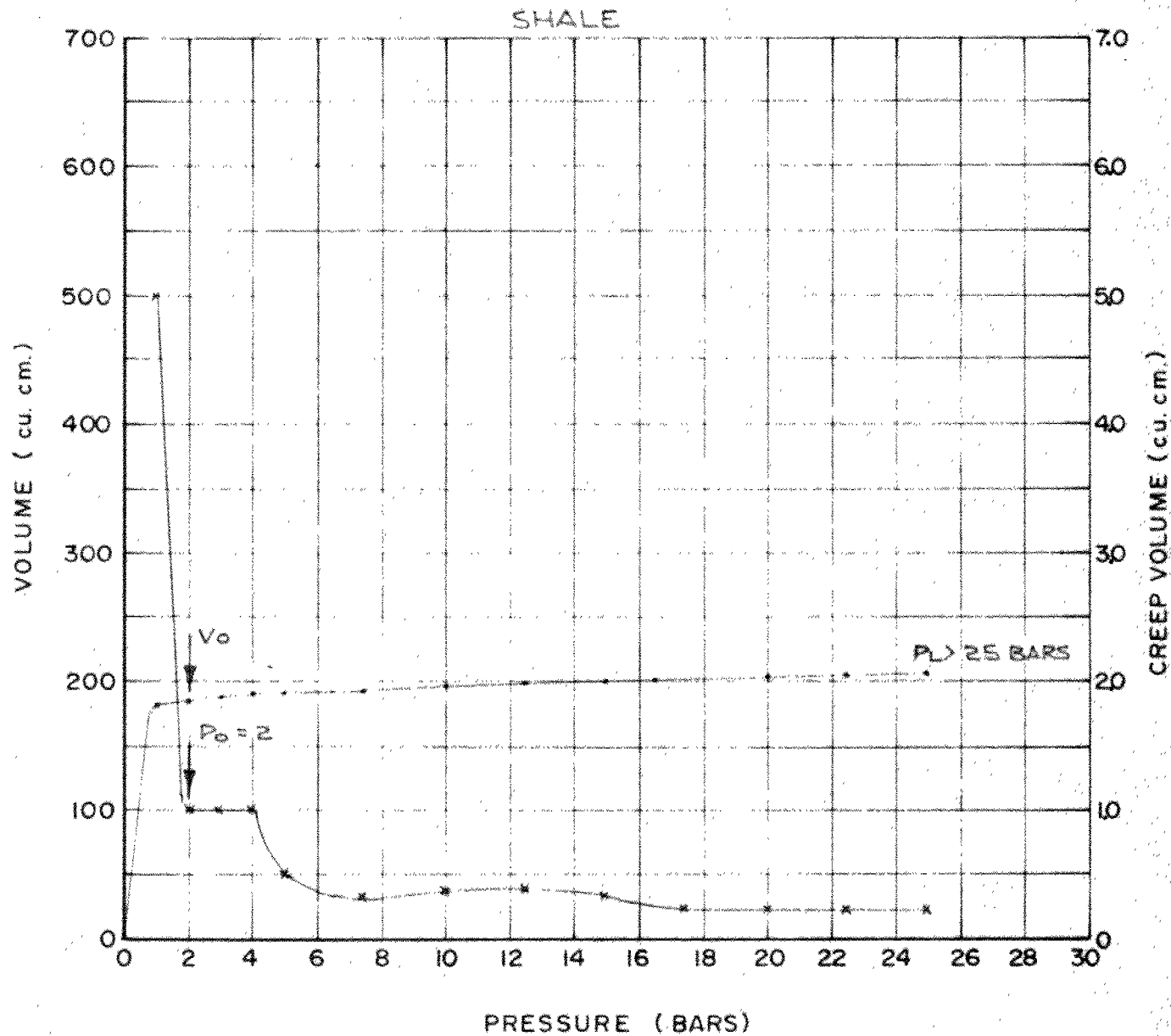
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 38

BOREHOLE No. 143

TEST NUMBER 4

ELEVATION 235.1



Note: for calibration curve see fig.

Date MAR 5 1973

**Golder Associates**

Drawn A.G.  
Chkd ---  
Appd ---

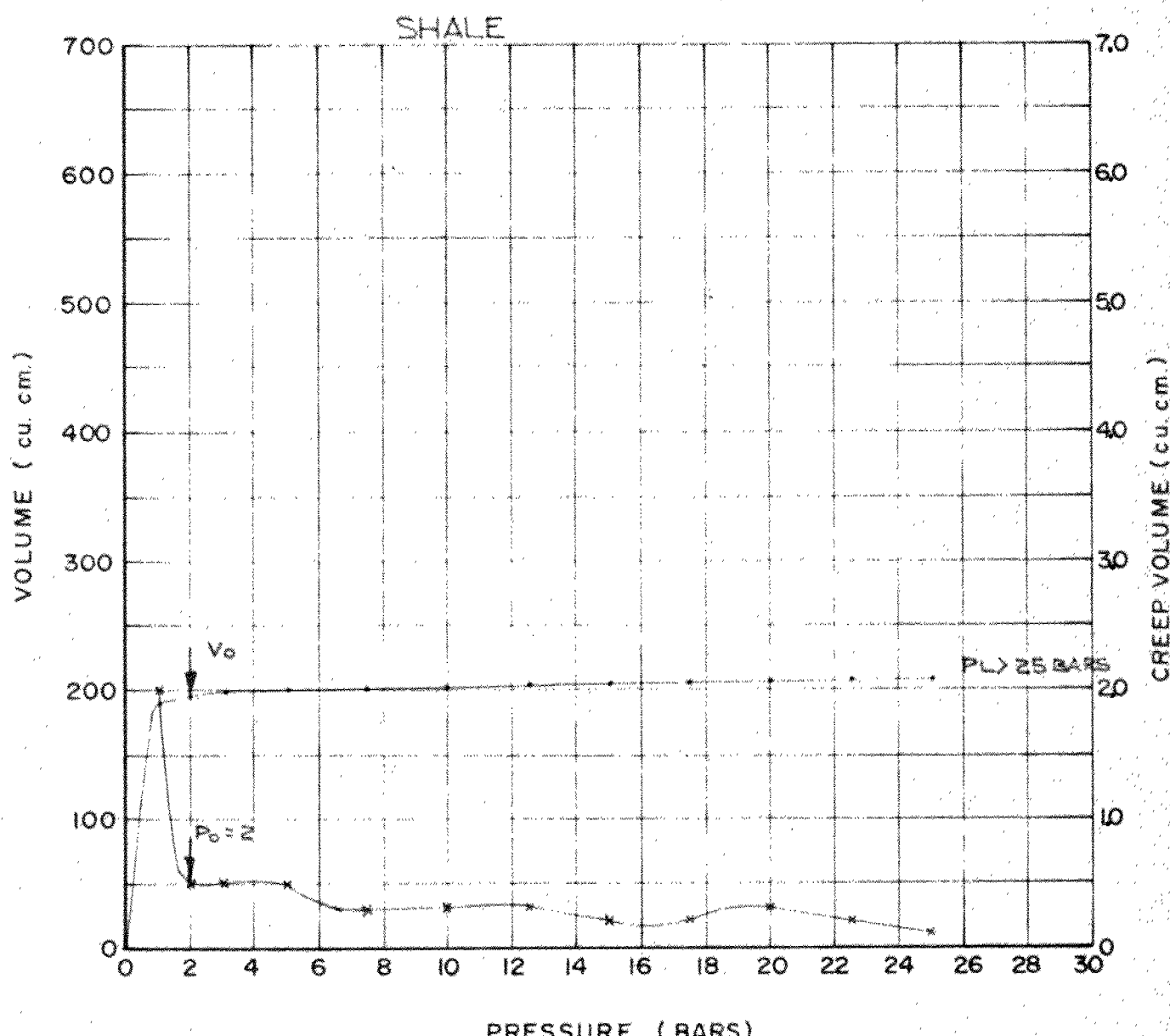
# PLOT OF FIELD DATA — PRESSUREMETER TESTING

FIGURE 39

BOREHOLE No. 143

TEST NUMBER 5

ELEVATION 230.1



Note: for calibration curve see fig.

Date MAR. 5, 1973.

Golder Associates

Drawn A. G.  
Chkd  
Appd

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. M. D. Harmelink, (3)  
Head, Urban Systems Research,  
East Bldg., Downsview.

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

ATTENTION:

DATE: March 26, 1973.

OUR FILE REF.

IN REPLY TO

MAR 27 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
(Pressuremeter Testing by Golder Associates)  
For Proposed  
Intermediate Capacity Public Transit System  
Canadian National Exhibition Grounds  
Metro Toronto, Province of Ontario, Canada  
W.O. 72-11101 (C) -- W.P. 97-72-01

In order to determine the engineering properties of the soils and rock encountered across the site, by means of the pressuremeter apparatus, we have requested Golder Associates, Consulting Geotechnical Engineers, to carry out the necessary investigation. Presented in this report are the results of this investigation together with recommendations concerning the geotechnical aspects of the design of pier foundations subjected to high lateral forces.

We believe that the information contained therein will be sufficient for your design requirements. Should you require further data, or clarification of the report, please contact our Office.

MD/ao  
Attch.

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

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

Foundations Files ✓  
Documents

# Ontario will spend another \$6 million to save GO-Urban

By THOMAS COLEMAN  
The Ontario Government will commit another \$6.1-million over the next 13 months toward salvaging the major components of its GO-Urban futuristic train system and developing them into a new form of transit.

However, Transportation Minister John Rhodes told the Legislature yesterday, the development program won't become "a spectacular" such as the Government originally planned for the Canadian National Exhibition grounds this summer, and it won't be done as quickly as originally proposed.

"We have lost some time and that is regrettable," Mr. Rhodes said. "The cancellation of the CNE demonstration program did not mean that GO-Urban is dead."

The GO-Urban system, whether it is suspended by wheels or magnets, clearly won't be ready for use in Ontario cities by 1978 as envisaged, Mr. Rhodes said outside the Legislature.

"Our engineering analysis in recent weeks leaves no doubt in my mind that our objective can be reached," he said. "It's a question of time. We've lost from 18 months to two years because of the failure of the (CNE) demonstration program."

Mr. Rhodes said Ontario plans to finance further development of the system by its Urban Transportation Development Corp., using mostly Canadian leadership and Canadian resources "to the greatest extent possible."

The program will concentrate primarily on the suspension system—"it may be magnets, it may be wheels or it may be a combination of both"—because, in terms of guideway structure, automatic (computer) train control, design of vehicles, and method of propulsion (linear induction motors), the system has already proved it will work from a technical standpoint, he said.

The next 13 months will be spent on what Mr. Rhodes calls Phases 1 and 2 of the program: detailing design, and manufacturing and testing of prototype hardware.

Phase 3, which would require about 2½ years, would entail construction of a new test track—"which would be located in a suburban location which may have potential for future revenue service"—and would include operational testing.

"I know that it wouldn't be

built at the CNE, and that's for sure," Mr. Rhodes said. "It wouldn't be a glamor project, but just a simple testing structure."

The Government has made no commitment to go ahead with Phase 3 and won't until Phase 1 and 2 are completed.

Phase 4 would consist of manufacturing new test vehicles and testing a system incorporating whatever suspension systems engineers decide are best. This phase would take about 18 months further—or more than five years from now, in total, before a new system could be operating to carry any fare-paying passengers.

In contrast to the visionary scheme which Premier William Davis unveiled at the Ontario Science Centre in November, 1972, the statement of Mr. Rhodes signalled a dramatic cutback in the program.

Instead of a major network of the new trains in Toronto, Hamilton and Ottawa, as envisaged by Mr. Davis, the Transportation Minister said the system would be developed "as one of the options available to Ontario municipalities" for their future public transit needs.

New Democratic Party Leader Stephen Lewis called the announcement "only verbal propulsion" for a system that has already collapsed.

The Liberals, through Vernon Singer (L, Downsview) and Philip Givens (L, York-Forest Hill), asked Mr. Rhodes to table in the Legislature a list of all costs for the system, originally designed by Krauss-Maffei AG of Munich. The German firm's withdrawal from the project last November led to Ontario's abandonment of a demonstration scheme at the CNE.

Mr. Rhodes said the German firm "has paid us very close" to the full \$10-million limit negotiated by Ontario as a withdrawal condition from the CNE contract.

Kirk Foley, president of the Government's transit development corporation, said all Canadian engineers now retrieving data from the Munich test track of Krauss-Maffei will return to Canada by September, and more likely by July 1.

Since the CNE project was cancelled in November, Mr. Rhodes said expenditures on the project have totalled \$275,000, including the collection of data and technology from Germany and the administration of the program.

## Changes for GO-Urban

## Rhodes on the hot seat

By THOMAS COLEMAN

John Rhodes, one of the Ontario Legislature's most congenial Cabinet ministers, is accustomed to taking the heat off hot situations.

His ministry — Transportation and Communications — has been simmering ever since he took over in February, 1974, with controversies ranging from the Spadina Expressway, mandatory seat belts, lower speed limits on highways, to the one-time darling of the Government — the GO-Urban magnetic cushion urban train system.

Mr. Rhodes has had his share of dealing with uncomfortable predicaments and he does it well. He learned the art during several years as a Sault Ste. Marie hot-line radio show host and city mayor, before he ran for provincial office in 1971. Before his radio days, he was a traffic policeman.

But today, in the Legislature, Mr. Rhodes will be in the political hot seat once again, and his performance will have deep repercussions for the soon expected provincial election.

Mr. Rhodes will announce his Government's plans today for the future of GO-Urban, which has been under review by the province for five months — since its German designers backed out of the experiment in November.

Sources say Mr. Rhodes will announce the provincial Government, through its Urban Transportation Development Corp., will go ahead with the futuristic transit system but on a more limited scale than originally envisioned.

It will no longer be a "demonstration program" — the \$25-million, 2.5-mile demonstration planned for this summer at the Canadian National Exhibition has been scrapped.

Instead, it will be a long range "development program," headed by the Government's corporation in concert with Canadian and U.S. private industry, to continue with the basics of research but in a non-political atmosphere.

The GO-Urban system still has technological problems, but Ontario engineers feel they can be overcome at rea-

sonable cost risks if the program is continued.

The Government's backing-down from Premier William Davis's promise in November, 1972, to have a 56-mile network of the futuristic transit system in Metro beginning in 1978, has to be handled delicately so as not to hand the opposition parties too much ammunition to fire in an election campaign.

Many pundits feel the 28 Metro-area seats could provide the key to Ontario's next Government and Mr. Rhodes is the first to admit Metro's transportation problems haven't been solved.

Without a solution to follow up its controversial Spadina Expressway cancellation before the 1971 election, the Conservative Government could face a severe voter backlash in Metro.

But Mr. Rhodes, a straight-from-the-shoulder politician who prides himself on his common-sense approach to decisions, defended the Spadina decision in an interview last week.

His position is that major roadways should be built on both the Spadina right-of-way as far south as Eglinton Avenue, and on the Highway 400 right-of-way as far south as St. Clair Avenue, as recommended by transportation consultant Richard Soberman in his report on Metro's transportation needs.

"But I still think stopping the Spadina Expressway was

a gutsy decision and the right decision," Mr. Rhodes said.

"Rather than jam that thing (the expressway) right clean down to the Gardiner (Expressway), and nobody could convince me that it wouldn't have gone right through the middle of the city, it was the right thing to do at the time."

Mr. Rhodes said, "To be brutally frank about it, the Spadina decision accomplished what it set out to do. It stopped Spadina from being built all the way down and thereby also stopped the need for another east-west expressway which would have been the next thing."

The provincial Government's decision last year to construct Highway 404, the northward extension of the Don Valley Parkway to Newmarket, was not entirely inconsistent with Spadina, Mr. Rhodes said, because "although the Don Valley is a parking lot at rush hours, Don Mills Road and some other streets were also parking lots and they had horrendous accident statistics, too."

The Don Valley, he said, "will undoubtedly have to have major structural and operational changes" soon.

Mr. Rhodes, who turned 45 last September, hasn't had a holiday since he was first elected to the Legislature in 1971 and he says he doesn't feel he needs one.

Besides holding down one of the largest and most controversial portfolios in the Government, he has taken on the added chore leading the Conservative's attack on the opposition in public speaking engagements across the province.

His speaking engagements, ranging from four to six appearances a week, were curtailed for a short time last month when he suffered some severe chest pains, but a full-scale medical revealed it was a hiatus hernia, not his heart.

"The pace doesn't bother me. When I was on a radio at the Soo, I'd get up at 5:30 (a.m.), be at the station for 6, go to City Hall (he was mayor) in the afternoon, go back to the station for supper hour news and sports, then back to City Hall for evening meetings."

That kind of pace, he says, makes a Cabinet minister's pace seem almost normal.

### 1.8% sales rise in daily papers cited for 1974

Latest available circulation figures for 1974 show Canadian daily newspapers sold an average of 4,902,510 copies each weekday, an increase of 73,510 or 1.8 per cent over 1973.

Of the total 3,999,910 copies are printed in English, 871,400 in French, 21,200 in Italian and 10,000 in Chinese.

The number of newspapers publishing five or more days a week is 122, of which 102 are in English, 14 in French, five in Chinese and one in Italian. The total is up one from 1973.

In addition to the daily papers, about 765 weekly papers sell about 3,800,000 copies a week. — CP



# Dome deflection stalls Seattle stadium

New Hong Kong jetport may be financed by sale of old one

The first of 40 reinforced concrete sections that will form a 661-ft-dia thin-shell dome over a stadium in Seattle has deflected about twice the expected amount. The deflection reportedly is so great that the temporary curved steel truss supporting the form for the 300-ton concrete segment cannot be lowered and moved aside for forming of the next segment.

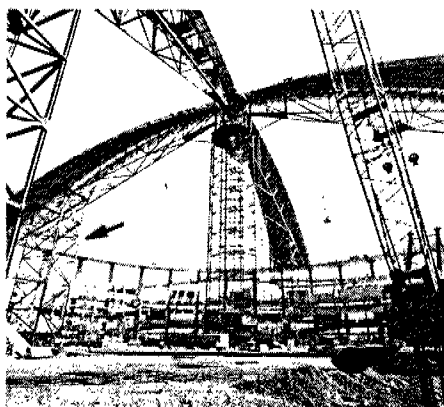
The prime contractor for the \$40-million King County Stadium, Donald M. Drake Co., Portland, Ore., expecting a deflection of 0.5 in. to 0.75 in., provided a clearance of about 2 in. in the movable truss support system. The deflection is now measured at 1.5 to 2 in., according to Dieter Sander, vice president of Drake. The problem will delay the job at least three weeks. The project is already two months behind schedule, and is the object of claims for about \$10.5 million by Drake and several subcontractors (ENR 10/31 p. 19).

The truss is one of four that span between a 250-ft-high erection tower in the center of the stadium and a precast concrete ring beam. The four trusses, which form an X across the stadium, are equipped with wheels on both ends so that as forming takes place the steel assembly can be rotated around the area, the wheels riding on tracks on the stadium's ring beam and the steel erection tower. The trusses are wedge-shaped, tapering from a point on the erection tower to a width of 70 ft at the beam.

Before the first section of concrete was placed last month, a 150-ft-high, rail-mounted tower under the outer extremity of the truss was lifted by sand jacks to raise the form to the desired height. When the triangular segment and 2 x 6-ft ribs had cured, the sides of the 14-in.-sq steel jacks were removed and the sand was blown out.

The supporting tower settled to the ground, but the truss and forms held fast to the concrete. Even after cable jacks applied 396 tons of pressure, the truss and forms could not clear the concrete ribs of the dome.

Plans now call for supporting the tower with an 8 x 16-in. knee brace and 200,000-lb jack while workmen dig about 2.5 in. beneath the four legs of the tower to provide the necessary clearance. If this works, the support tower and truss will be rotated to a new position for forming of another concrete section. The trusses will be removed after completion of the dome.



Trusses holding concrete forms are raised by jacks beneath steel tower (arrow).

The stadium, slated for completion next year, will seat up to 65,000 persons. Design team for the structure is Naramore Skilling Praeger, a joint venture of Naramore, Bain, Brady & Johanson, Seattle architect; Skilling, Helle, Christiansen, Robertson, Seattle structural engineer; and Madigan-Praeger, Inc., New York City engineer-architect.

## Ontario government drops PRT demonstration

The Ontario provincial government last week scrapped plans for a 2.5-mile demonstration line of a magnetically levitated (maglev) personal rapid transit system after the West German government withdrew financial support for development. Sources within Bonn's Ministry of Research and Technology indicated that better alternatives for urban transit systems are available that deserve higher priority for funding.

Without its 80% subsidy, Krauss-Maffei AG (KM), Munich, which held the \$16-million contract for the system, is unable to continue the project. KM has submitted the \$8.5-million cancellation fee to pay for the expenses incurred by the Ontario government to date and will fold up its maglev program, although it will continue in the urban transit field.

The elevated system was to have been built around the Canadian National Exhibition grounds in Toronto and was scheduled for completion in August, 1975. It was to be a pilot for a \$1.3-billion program of proposed systems in three Ontario cities.

Canadian Systems Corp. (CSG), described as the owner of the demonstration project in the bidding documents,

A consultant is expected to recommend a new \$1-billion jetport for Hong Kong. The Ralph M. Parsons Co., Los Angeles (ENR 5/24/73 p. 13), says that a new airport should be built on the island of Chu Lu Kok, 15 miles from Hong Kong harbor off the north side of the colony's Lantau Island.

The project would involve leveling the rocky island and reclaiming a large area from the sea. It would also require an expensive system of bridges and roads to link the new airport with the mainland Kowloon section of Hong Kong via Lantau. Financing is not expected to be a problem, however, because the project would permit abandonment of the existing Kaitak International Airport, releasing 580 acres in central Kowloon for development. Open space in the populous, 400-sq-mile colony is severely limited.

In 1985, Hong Kong is expected to handle 15 million passengers per year, exceeding the capacity of its present airport, and the annual volume may reach 45 million by 1994.

had no indication as late as last Wednesday that the project would be scrapped. The system was well under way with all of the 482 foundation caissons to support the elevated guideway in place. After initial guideway superstructure bids came in high, CSG had redesigned the system, dropping 2,100 ft of guideway.

In the second round of guideway bids, the low bidder came in at \$5.77 million, about 40% below previous bids. This week, CSG planned to let a \$1-million rectifier transformer contract to General Electric Corp., and a \$1.3-million power rail contract was ready to go.

The Ontario government still retains all rights to KM technology in Canada and has complete access to the test facility in Munich. KM plans to retain about 30 engineers to aid in the phase out. The Urban Transit Development Corp. (UTDC), which is sponsored by the Ontario and Alberta governments, estimates that another one and a half years of testing at the Munich test track will bring the system to a point where it can install an operational prototype in a Toronto area community to complete field testing.

Mr. D.E. Thrasher,  
Asst. Project Director, T.D.S.,  
Transit Systems Research & Development  
Branch, East Bldg., Downsview.  
Mr. G.E. Boggis.

Soil Mechanics Section,  
Geotechnical Office,  
West Bldg., Downsview.  
December 6th, 1974.

C.N.E. Transit Demo System,  
W.P. 97-72-01.

Further to your verbal request, we have compiled all the available information pertaining to the duration of field and office work including the names of the Ministry's personnel involved on the abovementioned project.

PRELIMINARY FOUNDATION INVESTIGATION.

Field Work

September 5th to 14th, 1972.

C.S. Poon, Project Foundation Engineer  
E.C. Ballinger, Field Technician  
J. Cortabarría, Field Technician  
G. Aubertin, Field Technician (Golder Assoc)  
V. Katic, Field Technician (Golder Assoc)

Office Work

September 5th to 25th, 1972.

Engineering

M. Devata, Supervising Engineer  
B.T. Darch, Senior Engineer  
C.S. Poon, Project Foundation Engineer  
H. Szymanski, Foundation Reports Technician

Drafting & Assembling

August 31st to September 23rd/72.

S. Osellame  
G. Petruzzello  
O. Janson  
F. Lasa  
H. Reed

Typing (Report, Logs, Mailing, etc.)

A. Occhuitto  
M. Topolski



FINAL FOUNDATION INVESTIGATION.

Field Work Feb. 20th to March 14th, 1973

C.S. Poon, Project Foundation Engineer  
J. Bangs, Project Foundation Engineer  
V. Katic, Field Technician (Golder Assoc.)

Office Work March 15th to May 4th, 1973

Engineering

C.S. Poon, Project Foundation Engineer  
J. Bangs, Project Foundation Engineer  
M. Devata, Supervising Engineer

Drafting & Assembling March 6/73 to April 6/73

S. Osellame  
G. Petruzzello  
H. Reed

Typing (Report, Logs, Mailing, etc.)

A. Occhuitto  
M. Topolski

PRESSURE METER TESTS BY GOLDER ASSOC.

Field Work Feb. 20th, to March 6th, 1973

Report Preparation, etc. March 6th to March 21st, 1973

ADDITIONAL FOUNDATION INVESTIGATION

Field Work June 6th and 7th, 1974

C.S. Poon, Foundation Engineer

Office Work June 10th to June 14th, 1974

Engineering

C.S. Poon, Project Foundation Engineer  
M. Devata, Supervising Engineer

Drafting, etc.

S. Osellame  
H. Reed

Typing, Etc.

M. Jordan

LATERAL LOAD TESTS, ETC.

October 21st to 30th, 1974.

M. Devata, Supervising Engineer

The above information does not include laboratory testing work carried out by the Ministry's Soil Mechanics Laboratory. Any cost details such as hired drilling equipment, services of Technicians from Consultants, etc. should be obtained from Accounting & Administrative Services, Head Office, Downsview.

If we can be of further assistance with regard to the above, please contact our Office.

M. Devata,  
Supervising Engineer.

MD/mj  
c.c. Files,  
Documents.

Mr. D.E. Thrasher,  
Asst. Project Director - TDS  
Transit Systems Research &  
Development Branch,  
East Bldg., Downsview.

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

October 30th, 1974.

C.N.E. Transit Demo System,  
W.P. 97-72-01.

The particular area of concern is from Ontario Place through Bottery Park where poor material is known to exist. According to available information, Trow Associates initially indicated to McCormick & Rankin, Consulting Engineers, that the footings in this area could take the longitudinal forces without any special measures. It is understood now that, due to the new design, the longitudinal forces have been increased and correspondingly, larger lateral movements can be anticipated. In order to increase the passive resistance in front of the footings and thereby minimize the longitudinal movements, Trow Associates suggested certain measures and also proposed field tests to monitor the lateral movements of the footing. As requested by you, we have reviewed the proposals made by Trow Associates and submit the following comments: -

Prior to field testing on the footings, we suggest that analyses should be carried out to determine the effects on caisson foundations for various longitudinal movements of the footing, namely: 1/8", 1/4", 1/2", 3/4" and 1", taking into account the new loading conditions on the system. From results of these analyses, it may be possible to determine the permissible longitudinal movements without endangering the integrity of the foundations of the structural elements. The values of Modulus of sub-grade reaction ( $K_h$ ) quoted in our Foundation Report for various soil and bedrock types, may be used in the analyses.

In our opinion, testing should not be carried out on footings constructed specifically for this purpose as proposed by Trow Associates, but should be incorporated in the assurance testing programme. The field tests should be carried out on two of the TDS project footings in the most unfavourable area, where subsoil conditions are extremely poor. The testing should be carried out initially without removal of poor fill material around the footing. The purpose of this test would be to determine the relationship between the passive resistance of the poor fill material and horizontal movement of the footing. If the test results reveal that the observed longitudinal movements are well within

Mr. D.E. Thrasher - RE: C.N.E. Transit Demo System.

tolerable limits, no special remedial measures would be necessary as suggested by Trow Associates. However, if these movements are well above the permissible limits, it will be necessary to adopt certain remedial measures to increase the passive resistance and minimize the longitudinal movements. One method of achieving this is by providing keys, only in the longitudinal direction on either side of the base of the footing, since the battered caissons would provide adequate resistance in the transverse direction. The addition of keys, in effect, increases the passive resistance and it may be necessary that the sides of the key should have a slope of 1 vertical to at least  $1\frac{1}{2}$  horizontal in view of the presence of soft or loose surrounding fill material. The entire key should be designed as an integral part of the footing with adequate reinforcing steel.

The method suggested by Trow Associates of replacing the partially poor fill material around the footing with well compacted granular material, appears to be a satisfactory solution, but it should be noted that new fill material may induce additional stresses in the underlying poor fill material which, in turn, may create problems of excessive subsidence around the footing area.

In any case, the validity of the remedial measures and the related longitudinal movements can only be judged by carrying out in-situ tests rather than estimating by semi-empirical methods. It is believed that these problems could have been eliminated if the caissons had been extended to a greater depth into the sound shale bedrock as suggested in our foundation report.

We believe that the aforementioned comments will be of some help for your immediate requirements. This Section will be glad to assist your office with regard to in-situ field testing programme of the footings in the poor fill area.

MD/mj

c.c. A. Rutka  
R. Darton  
C.S. Grebski  
Files  
Documents

M. Devata,  
Supervising Engineer.

MEMORANDUM

WP 97-72-01

TO: Mr. D. E. Thrasher  
Asst. Project Director-TDS  
Transit Systems Research &  
Development Branch

FROM: Structural Office  
West Building  
Downsview, Ontario

ATTENTION:

DATE: October 18, 1974

OUR FILE REF.

IN REPLY TO

SUBJECT:

CNE - TDS

The letter of September 30 from William Trow Associates Ltd. is in response to concern expressed at the Progress Meetings on Guideway Design as to whether the footings could resist the applied longitudinal forces without excessive movement. The particular area of concern is from Ontario Place through Battery Park where very poor fill material is known to exist.

McCormick, Rankin were asked to contact Trow to check the validity of their earlier indication that the footings could take the longitudinal forces without any special measures. As the longitudinal forces had gone up and the original anticipated movement of 1/8" to 1/4" looked surprisingly small, it was thought that some site testing of the footings should also be considered. The letter from Trow does not give an opinion as to what longitudinal movement might be expected and implies that a load test should be carried out to determine this. We are having Mr. Devata of our Soil Mechanics Section look into this matter using longitudinal forces from the M.T.C. cast in place alternate design.

I have discussed the question of load testing with Mr. Richardson and Mr. Tuck, and there is agreement among us that testing should not be carried out on footings cast specifically for this purpose as proposed by Trow, but that the first two TDS project footings in the area of concern should be used. The footings could be pulled together and loads and movements measured. The first test should be with the existing fill, and if the test should show excessive movement then remedial measures would be examined and tested.

This testing should be considered as assurance testing and should be included in K.M.'s proposal.

RAD/jl

R. A. Dorton

c.c. M. Devata ✓  
C. Grebski  
B. S. Richardson  
J. Tuck



THE CANADA SYSTEMS GROUP (EST) LIMITED

FIELD OFFICE, WESTERN ENTRANCE C.N.E.  
TORONTO 2D, ONTARIO, CANADA (416) 535-1149

October 9th, 1974

Krauss-Maffei AG.  
Field Office  
Western Entrance C.N.E.  
Toronto, Ontario

Attention: Mr. P. Storke,  
Field Office Manager

Dear Sir:

Please find enclosed copy of a letter from Wm. Trow & Associates Limited to McCormick, Rankin with respect to the Passive Resistance Platform adjacent to the footings.

May we have your comments with respect to the suggested tests outlined in the Trow letter.

Yours truly,



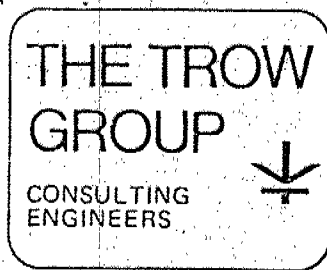
W. Goddard  
Project Manager

Encl:

c.c: ~~Mr. D. Thrasher~~

Copies to Messrs. Dorton, Richardson, Devata-Oct.11/74

W0 780-74



## WILLIAM TROW ASSOCIATES LIMITED

Soil Mechanics Consultants  
43 Baywood Road, Rexdale, Ontario M9V 3Y8  
749-1290

W.A. Trow, M.Sc., M.E.I.C., P.Eng.  
K. Peaker, Ph.D., M.E.I.C., P.Eng.

Project: J 7803

September 30th, 1974

McCormick, Rankin & Associates Limited,  
8 Stavebank Road,  
Port Credit, Ontario.

Attention: Mr. J.W. Tuck, P.Eng. ✓

### C.N.E. Transit Demo System

Dear Sirs,

In answer to your letter dated September 16th I consider that the passive resistance can be increased appreciably by the introduction of well compacted granular material around the footing. The following are the requirements.

The horizontal thickness of granular material adjacent to the side or sides of the footing that transmit horizontal forces must equal twice the depth of the footing as indicated in the attached sketch, Dwg. 1. The granular material should be equivalent or better than Class 'B' pit run gravel. It must be compacted to 100 per cent standard Proctor density.

If these requirements are met the equivalent value for  $K_p$  is 4. The horizontal movement required to develop  $K_p = 4$  will be equal to or less than the movement for  $K_p = 2$  in the fill ground. If  $B$  is the length of the footing and  $2d$  is the horizontal thickness of compacted granular, the overall length over which the passive resistance is generated will be  $(B+2d)$  feet.

Since the tolerable lateral movements are understood to be very small, it is essential that a load test be carried out to determine the relationship between resistance and horizontal movement. This test must simulate the



actual installation conditions, i.e. it must be against fill or compacted granular material and at the depth applicable for the actual footing cap. Dwg. 2 illustrated a suggested load test layout.

Yours very truly,  
WILLIAM TROW ASSOCIATES LIMITED

*W.A. Trow*

WAT:SC

Dist: McCormick, Rankin & Assoc. Ltd. (2)

W.A. Trow, P.Eng.



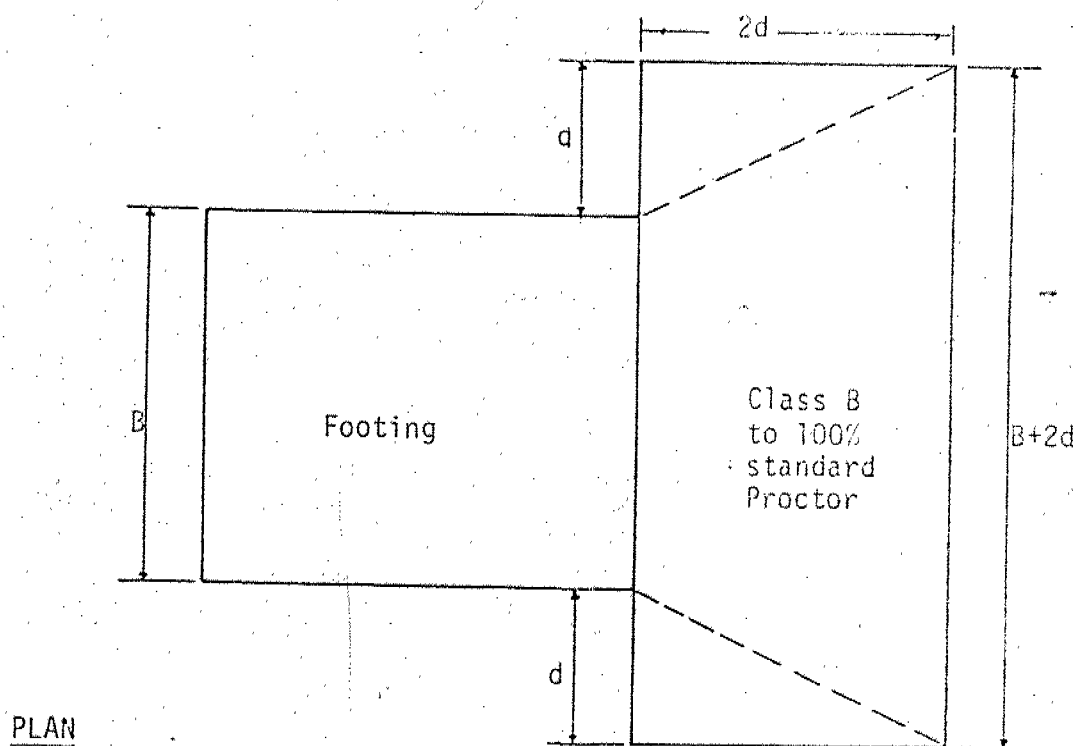
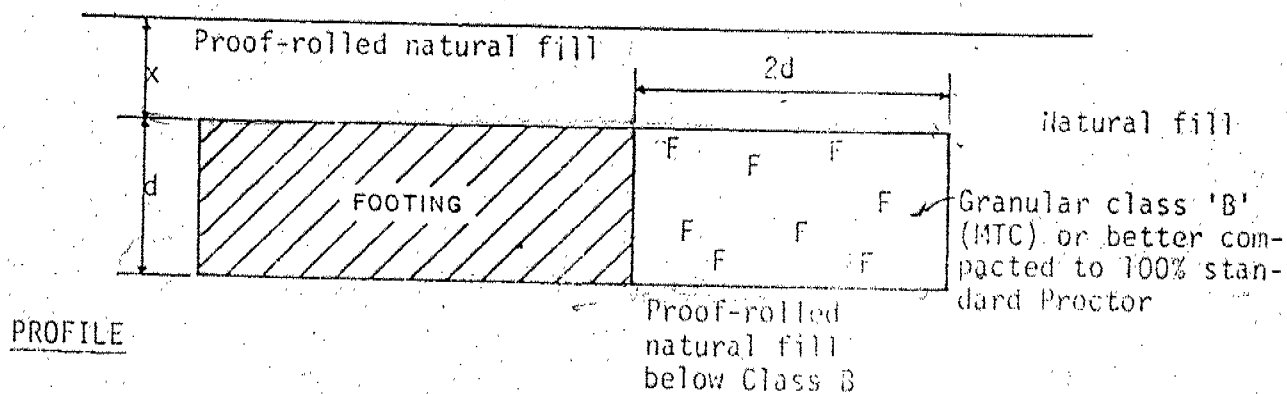
D R A F T

The Contractor shall exercise extreme care in constructing the footing caps over the top of caissons specifically in the area south of the Lakeshore Blvd. where Piers #47 to #65 inclusive are to be constructed.

The Contractor's attention is drawn to the fact that in this area the subsoil consists of pervious loose or soft fill material which may be subjected to "boiling" due to unbalanced hydrostatic head if excavations are carried out below the prevailing water level.

In order to carry out the excavations for the footing caps unless otherwise specifically provided, all excavation shall be dewatered so that the concrete may be placed in the dry. Unless there is an item in the tender for "Unwatering Foundations" the cost of unwatering shall be included in the price bid for "Excavation for Structure Foundations".

If necessary, the Contractor shall provide a water-tight steel sheet cofferdam or any other system to permit the excavation for footing caps down to the required elevation and the placing of the concrete in the dry.

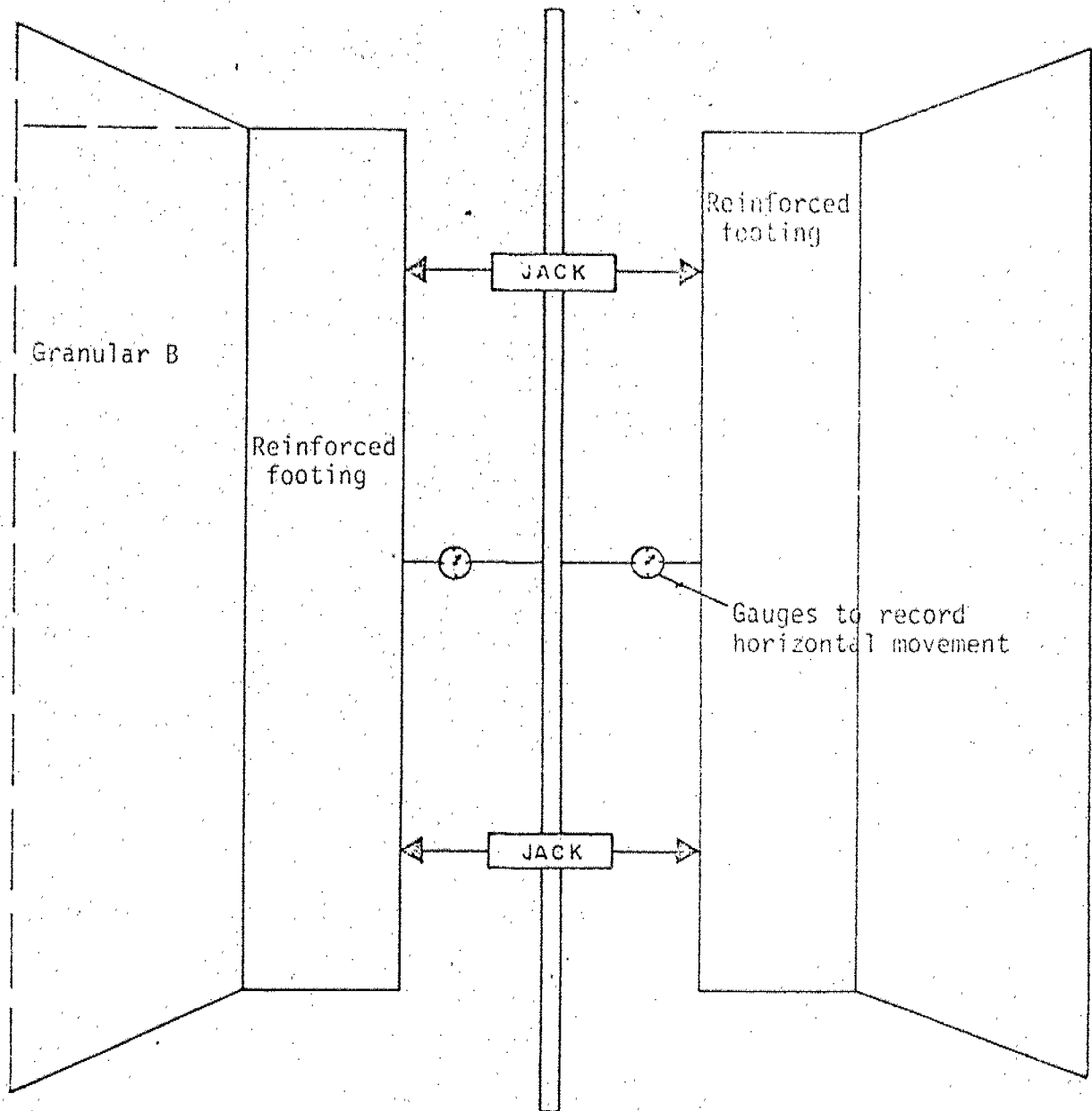


$$\text{Total passive resistance 1 side} = K_p \gamma d \left( \frac{x}{2} + \frac{(x + d)}{2} \right) (B + 2d)$$

$$K_p = 4$$

$$\gamma = 130 \text{ pcf.}$$

Dwg. 1 - Sketch illustrating passive resistance from a compacted granular buffer zone.



Dwg. 2 - Sketch to illustrate horizontal load test requirements.

\* *Structure 30*

WP 97-72-01

WILLIAM TROW ASSOCIATES LIMITED

965-3748

274-3477

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Mueller

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 89DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	<i>Dec 3 / 73</i>				<i>Apr 30 / 74</i>	
DATE POURED	<i>Dec 5 / 73</i>				<i>Apr 30 / 74</i>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		<i>250.7</i>				<i>250.7</i>
CUT OFF ELEVATION	<i>244.75</i>				<i>244.75</i>	
TIP ELEVATION	<i>232</i>	<i>234.5</i>			<i>232.5</i>	<i>232.0</i>
TOP OF BEDROCK (EL.)	<i>235</i>	<i>—</i>			<i>235</i>	<i>above 233.1</i>
TOP OF SOUND BEDROCK (EL.)		<i>234.5</i>				<i>232.5</i>
CONCRETE LENGTH	<i>12.9</i>	<i>10.4</i>			<i>12.4</i>	<i>12.9</i>
CAISSON DIAMETER	<i>36"</i>	<i>36"</i>			<i>36"</i>	<i>36"</i>
SOCKET DEPTH		<i>0.8'</i>				<i>1.1</i>
PLUMBNESS (%) ALONG RAIL	<i>&lt; 2%</i>	<i>2.0%</i>			<i>&lt; 2%</i>	<i>0.5%+</i>
PLUMBNESS (%) ACROSS RAIL						
BATTER	<i>6:12:1</i>	<i>6:0:1</i>			<i>6:12:1</i>	<i>6:3:1</i>
REMARKS	<i>rock sound from base down base clean with slight seepage of water permanent liner installed</i>				<i>base clean with slight seepage of water permanent liner installed</i>	

Structure 30

## WILLIAM TROW ASSOCIATES LIMITED

JOB NO.: J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Mueller

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 91

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Apr 29/74				Apr 29/74	
DATE POURED	Apr 30/74				Apr 30/74	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		255.5				255.5
CUT OFF ELEVATION	249.00				249.00	
TIP ELEVATION	232.5	232.2			232.5	231.8
TOP OF BEDROCK (EL.)	235	above 234.2			235	above 232.2
TOP OF SOUND BEDROCK (EL.)		233.6				above 232.2
CONCRETE LENGTH	16.7	17.0			16.7	17.4
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		2.0'				0.4'
PLUMBNESS (%) ALONG RAIL	22%	0			22%	0.5%
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	5.5:1			6:12:1	6.4:1
REMARKS	base clean with slight seepage of water permanent liner installed				base clean with slight seepage of water permanent liner installed	

*Structure 30*

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Mulla

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 92

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	<i>Dec 6/73</i>				<i>Dec 7/73</i>	
DATE POURED	<i>Dec 10/73</i>				<i>Dec 10/73</i>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION	<i>/</i>	<i>251.5</i>	<i>/</i>		<i>/</i>	<i>251.5</i>
CUT OFF ELEVATION	<i>246.00</i>	<i>/</i>		<i>/</i>	<i>246.00</i>	<i>/</i>
TIP ELEVATION	<i>233</i>	<i>233.0</i>			<i>233</i>	<i>232.9</i>
TOP OF BEDROCK (EL.)	<i>236</i>	<i>—</i>	<i>12</i>		<i>236</i>	<i>—</i>
TOP OF SOUND BEDROCK (EL.)	<i>/</i>	<i>234.2</i>	<i>/</i>		<i>/</i>	<i>233.9</i>
CONCRETE LENGTH	<i>13.2</i>	<i>13.2</i>			<i>13.2</i>	<i>13.3</i>
CAISSON DIAMETER	<i>36"</i>	<i>36"</i>			<i>36"</i>	<i>36"</i>
SOCKET DEPTH	<i>/</i>	<i>2.0'</i>	<i>/</i>		<i>/</i>	<i>1.4'</i>
PLUMBNESS (%) ALONG RAIL	<i>2.2%</i>	<i>3.0%</i>			<i>2.2%</i>	<i>0.5%+</i>
PLUMBNESS (%) ACROSS RAIL	<i>/</i>	<i>/</i>			<i>/</i>	<i>/</i>
BATTER	<i>6:12:1</i>	<i>6:0:1</i>	<i>/</i>		<i>6:12:1</i>	<i>5:7:8</i>
REMARKS	<i>rock sound 14"</i> <i>above base</i> <i>base clean with</i> <i>slight seepage of</i> <i>water</i> <i>permanent lines</i> <i>installed</i> <i>caisson out of</i> <i>plumb but approved</i> <i>by structural</i> <i>engineer</i>				<i>rock sound 12"</i> <i>above base</i> <i>base clean with</i> <i>slight seepage</i> <i>of water</i> <i>permanent lines</i> <i>installed</i>	

*Structure #30*

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Muller

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 93

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 10/73				Dec 10/73	
DATE POURED	Dec 12/73				Dec 12/73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		251.1				251.1
CUT OFF ELEVATION	246.25				246.25	
TIP ELEVATION	231	231.0			231	231.1
TOP OF BEDROCK (EL.)	234	—	3'-2"		234	—
TOP OF SOUND BEDROCK (EL.)		234.2				233.4
CONCRETE LENGTH	15.4	15.4			15.4	15.3
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		3.6'				3.1'
PLUMBNESS (%) ALONG RAIL	2.2%	1.5%+			2.2%	0
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	6:0:1			6:12:1	5:6:1
REMARKS	rock sound from 3'-2" above base base clean with large flow of water into socket permanent liner installed 18 #11 bars 8'-11" long installed in socket				rock sound from 2'-3" above base base clean with large flow of water into socket permanent liner installed 18 #11 bars 8'-11" long installed in socket	

Structure 30-31

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Munn

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 94

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 10 / 73				Dec 10 / 73	
DATE POURED	Dec 10 / 73				Dec 10 / 73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.5				252.5
CUT OFF ELEVATION	246.25				246.25	
TIP ELEVATION	230	231.9			230	231.2
TOP OF BEDROCK (EL.)	233	—			233	—
TOP OF SOUND BEDROCK (EL.)		232.1				232.9
CONCRETE LENGTH	16.5	14.5			16.5	15.2
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		0.5				1.2'
PLUMBNESS (%) ALONG RAIL	< 2%	0			< 2%	0
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	6:5:1			6:12:1	5:9:1
REMARKS	rock sound 2" above base base clean with slight seepage of water permanent liner installed				rock sound 8" above base base clean with slight seepage of water permanent liner installed	



Structure 31\*

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Miller

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 95

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 11/73				Dec 11/73	
DATE POURED	Dec 11/73				Dec 11/73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.4				252.4
CUT OFF ELEVATION	246.25				246.25	
TIP ELEVATION	230	233.9			230	233.1
TOP OF BEDROCK (EL.)	233	—			233	—
TOP OF SOUND BEDROCK (EL.)		above 234.6				above 233.4
CONCRETE LENGTH	16.5	12.5			16.5	13.3
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		0.7				0.3
PLUMBNESS (%) ALONG RAIL	< 2%	1.0%			< 2%	1.0% -
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	6.9:1			6:12:1	6.1:1
REMARKS	Top of sound rock obscured by liner base clean with slight seepage of water permanent liner installed				Top of sound rock obscured by liner base clean with slight seepage of water permanent liner installed base stand drilled	

Structure 3/1\*

WILLIAM TROW ASSOCIATES LIMITED

JOB NO.: J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. M. M.

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 96

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 11/73				Dec 11/73	
DATE POURED	Dec 11/73				Dec 11/73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.3				252.3
CUT OFF ELEVATION	246.00				246.00	
TIP ELEVATION	231	233.4			231	233.3
TOP OF BEDROCK (EL.)	234	—			234	—
TOP OF SOUND BEDROCK (EL.)		233.4				233.3
CONCRETE LENGTH	15.2	12.8			15.2	12.9
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		1.0'				0.5'
PLUMBNESS (%) ALONG RAIL	42%	1.5%—			42%	0.5%—
PLUMBNESS (%) ACROSS RAIL						
BATTER	6.12:1	6.2:1			6.12:1	6.9:1
REMARKS	rock sound from base down base clean with slight seepage of water permanent liner installed				rock sound from base down base clean with slight seepage of water permanent liner installed	

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. M. M.

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 97

DESIGN LOAD (T.S.F.): 2

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 11 / 73				Dec 11 / 73	
DATE POURED	Dec 12 / 73				Dec 12 / 73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.5				252.5
CUT OFF ELEVATION	246.00				246.00	
TIP ELEVATION	231	232.7			231	232.5
TOP OF BEDROCK (EL.)	234	—			234	—
TOP OF SOUND BEDROCK (EL.)		233.7				233.2
CONCRETE LENGTH	15.2	13.5			15.2	13.7
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		1.5'				1.2'
PLUMBNESS (%) ALONG RAIL	22%	0			22%	1.0% -
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	5:7:1			6:12:1	6:0:1
REMARKS	rock sound 12" above base base clean with slight seepage of water permanent liner installed				rock sound 8" above base base clean with slight seepage of water permanent liner installed	

Structure 31

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: *D. M.*

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 98

DESIGN LOAD (T.S.F.): 2

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 12 / 73				Dec 12 / 73	
DATE POURED	Dec 13 / 73				Dec 13 / 73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.1				252.1
CUT OFF ELEVATION	246.00				246.00	
TIP ELEVATION	231	231.6			231	232.0
TOP OF BEDROCK (EL.)	234	—			234	—
TOP OF SOUND BEDROCK (EL.)		above 232.4				above 233.0
CONCRETE LENGTH	15.2	14.6			15.2	14.2
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		0.8'				1.0'
PLUMBNESS (%) ALONG RAIL	22%	0			22%	0.5% -
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	6:3:1			6:12:1	6:2:1
REMARKS	rock sound at base of liner base clear with slight seepage of water permanent liner installed				rock sound at base of liner base clear with slight seepage of water permanent liner installed base sturdied	

Structure 31-32

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J 7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Miller

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 99

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 12/73				Dec 12/73	
DATE POURED	Dec 13/73				Dec 13/73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.4				252.4
CUT OFF ELEVATION	246.25				246.25	
TIP ELEVATION	230	231.9			230	231.8
TOP OF BEDROCK (EL.)	233	—			233	—
TOP OF SOUND BEDROCK (EL.)		above 233.0				above 232.9
CONCRETE LENGTH	16.5	14.5			16.5	14.6
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		1.1'				1.1'
PLUMBNESS (%) ALONG RAIL	42%	0.5%+			42%	0
PLUMBNESS (%) ACROSS RAIL						
BATTER	6.12:1	6.2:1			6.12:1	6.7:1
REMARKS	rock sound at bottom of liner base clean with slight seepage of water permanent liner installed				rock sound at bottom of liner base clean with slight seepage of water permanent liner installed	

*Station 37*

WILLIAM TROW ASSOCIATES LIMITED

JOB NO.: J 7403

CAISSON INSPECTION REPORT

INSPECTOR: *D. M. ...*

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 100

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	<i>Dec 12/73</i>				<i>Dec 13/73</i>	
DATE POURED	<i>Dec 14/73</i>				<i>Dec 14/73</i>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		<i>251.8</i>				<i>251.8</i>
CUT OFF ELEVATION	<i>246.00</i>				<i>246.00</i>	
TIP ELEVATION	<i>230</i>	<i>230.5</i>			<i>230</i>	<i>230.9</i>
TOP OF BEDROCK (EL.)	<i>233</i>	<i>—</i>			<i>233</i>	<i>—</i>
TOP OF SOUND BEDROCK (EL.)		<i>231.5</i>				<i>230.9</i>
CONCRETE LENGTH	<i>16.2</i>	<i>15.7</i>			<i>16.2</i>	<i>15.3</i>
CAISSON DIAMETER	<i>36"</i>	<i>36"</i>			<i>36"</i>	<i>36"</i>
SOCKET DEPTH		<i>2.2'</i>				<i>2.0'</i>
PLUMBNESS (%) ALONG RAIL	<i>&lt;2%</i>	<i>0.5%+</i>			<i>&lt;2%</i>	<i>0.27%+</i>
PLUMBNESS (%) ACROSS RAIL						
BATTER	<i>6:12:1</i>	<i>6:2:1</i>			<i>6:12:1</i>	<i>6:5:1</i>
REMARKS	<i>rock sound from 12" above base base clear with slight seepage of water permanent liner installed</i>				<i>rock sound from base down base clear with with slight seepage of water permanent liner installed</i>	

Structure 32

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J7803

CAISSON INSPECTION REPORT

INSPECTOR: D. Munn

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 101

DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 13 / 73				Dec 13 / 73	
DATE POURED	Dec 14 / 73				Dec 18 / 73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.1				252.1
CUT OFF ELEVATION	246.00				246.00	
TIP ELEVATION	230	229.4			230	230.8
TOP OF BEDROCK (EL.)	233	—			233	—
TOP OF SOUND BEDROCK (EL.)		231.4				231.8
CONCRETE LENGTH	16.2	16.8			16.2	15.4
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		3.3'				2.4'
PLUMBNESS (%) ALONG RAIL	< 2%	1.5%			< 2%	1.0%
PLUMBNESS (%) ACROSS RAIL						
BATTER	6:12:1	6:0:1			6:12:1	6:7:1
REMARKS	rock sound 24" above base base clean with some seepage of water permanent liner installed 18 #11 bars 8'-11" long installed in socket. base stirrilled				rock sound 12" above base base clean with some seepage of water permanent liner installed 18 #11 bars 8'-11" long installed in socket	

Structure 32

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : J7803

CAISSON INSPECTION REPORT

INSPECTOR: D. M. M.

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 102DESIGN LOAD (T.S.F.): 2

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	<u>Dec 14/73</u>				<u>Dec 14/73</u>	
DATE POURED	<u>Dec 18/73</u>				<u>Dec 18/73</u>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.3				252.3
CUT OFF ELEVATION	246.00				246.00	
TIP ELEVATION	230	229.3			230	229.1
TOP OF BEDROCK (EL.)	233	—			233	—
TOP OF SOUND BEDROCK (EL.)		231.3				230.7
CONCRETE LENGTH	16.2	16.9			16.2	17.1
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		2.9'				3.0'
PLUMBNESS (%) ALONG RAIL	42%	0.5%-			42%	0.5%-
PLUMBNESS (%) ACROSS RAIL						
BATTER	6.12:1	5.7:1			6.12:1	5.5:1
REMARKS	rock sound 24" above base base clean with some seepage of water permanent liner installed 18 # 11 bars 8'-11" long installed in socket				rock sound 14" above base base clean with some seepage of water permanent liner installed 18 # 11 bars 8'-11" long installed in socket	



Structure 32

WILLIAM TROW ASSOCIATES LIMITED

JOB NO.: 57803

CAISSON INSPECTION REPORT

INSPECTOR: D. M. M.

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 103DESIGN LOAD (T.S.F.): 29

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Dec 14 / 73				Dec 19 / 73	
DATE POURED	Dec 18 / 73				Dec 20 / 73	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		252.5				252.5
CUT OFF ELEVATION	246.25				246.25	
TIP ELEVATION	230	230.3			231	231.1
TOP OF BEDROCK (EL.)	233	—			233	—
TOP OF SOUND BEDROCK (EL.)		231.3				231.5
CONCRETE LENGTH	16.5	16.2			15.4	15.3
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		2.8'				1.6'
PLUMBNESS (%) ALONG RAIL	<2%	1.0% -			<2%	1.0% +
PLUMBNESS (%) ACROSS RAIL						
BATTER	6.12:1	6.0:1			6.12:1	5.9:1
REMARKS	rock sound 12" above base base clean with slight seepage of water permanent liner installed 18" 11 bars 8'-11" long installed in socket				rock sound 5" above base base clean with slight seepage of water permanent liner installed	

Structure B2

JOB NO.: J 7803

CAISSON INSPECTION REPORT

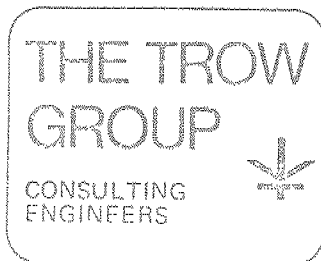
INSPECTOR: D. Mue

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 104

DESIGN LOAD (T.S.F.): 31

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	<u>Dec 19 / 73</u>				<u>Dec 19 / 73</u>	
DATE POURED	<u>Dec 20 / 73</u>				<u>Dec 20 / 73</u>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		<u>252.4</u>				<u>252.4</u>
CUT OFF ELEVATION	<u>246.25</u>				<u>246.25</u>	
TIP ELEVATION	<u>232</u>	<u>231.4</u>			<u>232</u>	<u>232.0</u>
TOP OF BEDROCK (EL.)	<u>234</u>	<u>—</u>			<u>234</u>	<u>—</u>
TOP OF SOUND BEDROCK (EL.)		<u>232.2</u>				<u>232.3</u>
CONCRETE LENGTH	<u>14.4</u>	<u>15.0</u>			<u>14.4</u>	<u>14.4</u>
CAISSON DIAMETER	<u>36"</u>	<u>36"</u>			<u>36"</u>	<u>36"</u>
SOCKET DEPTH		<u>2.0'</u>				<u>1.3'</u>
PLUMBNESS (%) ALONG RAIL	<u>&lt; 2%</u>	<u>0</u>			<u>&lt; 2%</u>	<u>0</u>
PLUMBNESS (%) ACROSS RAIL						
BATTER	<u>6.12:1</u>	<u>5.7:1</u>			<u>6.12:1</u>	<u>6.2:1</u>
REMARKS	<u>rock sound 10" above base base clean with slight seepage of water</u>				<u>rock sound 3" above base base clean with slight seepage of water permanent liner installed</u>	



WILLIAM TROW ASSOCIATES LIMITED

Soil Mechanics Consultants  
43 Baywood Road, Rexdale, Ontario M9V 3Y8  
749-1200

W.A. Trow, M.Sc., M.E.L.C., P.Eng.  
K. Penker, P.D., M.E.L.C., F.L.S.

Project: J 7803

September 24th, 1974

Canada Systems Group (E.S.T.) Limited,  
Western Entrance, C.N.E.  
Toronto, Ontario.  
M6K 1Y9.

Attention: Mr. W. Goddard

Caisson Installation  
C.N.E. Transit Demonstration System  
Toronto, Ontario

WP.  
97-72-01

Dear Sirs,

Please find enclosed our inspection reports for caissons installed from September 16th to 20th, 1974 inclusive.

These caissons have been satisfactorily installed into sound bedrock at safe bearing pressures indicated in the report. Caisson 68R was taken deeper into bedrock due to the presence of very weathered and fissured shale. The fissured and weathered shale appears to constitute part of the fault zone already encountered previously in caissons 67R and 69L.

Should you have any queries, please do not hesitate to contact this office.

Yours very truly,  
WILLIAM TROW ASSOCIATES LIMITED

R.S. Praser, P.Eng.

W.A. Trow, P.Eng.

RSP:EF  
Enc.

Dist: Canada Systems Group (E.S.T.) Ltd. (4)  
McCormick, Rankin & Assoc. Ltd. (2)  
Site Office  
Att: Mr. R. Spangler  
Anchor Shoring Limited (1)  
Construction Testing Services Ltd. (1)

copy to M.S. Devata-Oct.1/74

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : 7803

CAISSON INSPECTION REPORT

INSPECTOR: R. P. ...

PROJECT: ONE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 73

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Sept. 19, 1974					
DATE POURED	Sept. 19, 1974					
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		11252				
CUT OFF ELEVATION	249.5					
TIP ELEVATION	230.5	233.2				
TOP OF BEDROCK (EL.)	233	234*				
TOP OF SOUND BEDROCK (EL.)		233.7				
CONCRETE LENGTH	-	11.45				
CAISSON DIAMETER	36"	36"				
SOCKET DEPTH		0.8				
PLUMBNESS (%) ALONG RAIL	<2%	plumb				
PLUMBNESS (%) ACROSS RAIL	-	-				
BATTER	6:12:1	5:5:1				
REMARKS	Good clean base in sound shale; little concrete on only					
	* Actual tip obscured by liner; elevation estimated during liner driving					

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : 7803

CAISSON INSPECTION REPORT

INSPECTOR: R. Pearson

PROJECT: ONE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 74R

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED					Sept. 19, 1974	
DATE POURED					Sept. 19, 1974	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION						4253
CUT OFF ELEVATION					242.5	
TIP ELEVATION					230.5	231.7
TOP OF BEDROCK (EL.)					233	233.6
TOP OF SOUND BEDROCK (EL.)						232.7
CONCRETE LENGTH					-	11.0
CAISSON DIAMETER					36"	36"
SOCKET DEPTH						1.9
PLUMBNESS (%) ALONG RAIL					<2%	plumb
PLUMBNESS (%) ACROSS RAIL					-	-
BATTER					6:12:1	55:1
REMARKS					Sand shale at base. Some seepage. Caisson pumped out and poured.	

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : 7803

CAISSON INSPECTION REPORT

INSPECTOR: R. Power

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 75

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED					<u>Sept. 19, 1974</u>	
DATE POURED					<u>Sept. 20, 1974</u>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION						<u>225.3</u>
CUT OFF ELEVATION					<u>241.0</u>	
TIP ELEVATION					<u>230.5</u>	<u>231.1</u>
TOP OF BEDROCK (EL.)					<u>233</u>	<u>233</u>
TOP OF SOUND BEDROCK (EL.)						<u>232.5</u>
CONCRETE LENGTH					<u>-</u>	<u>10</u>
CAISSON DIAMETER					<u>36"</u>	<u>36"</u>
SOCKET DEPTH						<u>1.9</u>
PLUMBNESS (%) ALONG RAIL					<u>&lt;2%</u>	<u>-1.2%</u>
PLUMBNESS (%) ACROSS RAIL					<u>-</u>	<u>-</u>
BATTER					<u>6.0:1</u>	<u>6.5:1</u>
REMARKS						<p><i>Sand shell and clean base seen before. Pulled out and immediately poured.</i></p>

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : 7803

CAISSON INSPECTION REPORT

INSPECTOR: R. Fraser

PROJECT: ONE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 76

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Sept 20, 1974				Sept. 20, 1974	
DATE POURED	Sept. 20, 1974				Sept. 20, 1974	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION	4255				4255	
CUT OFF ELEVATION	241.0				241.0	
TIP ELEVATION	230.5	230.6			230.5	229.8
TOP OF BEDROCK (EL.)	233	232.5*			233	232.5*
TOP OF SOUND BEDROCK (EL.)		231				231
CONCRETE LENGTH	-	10.55			-	11.35
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		-				
PLUMBNESS (%) ALONG RAIL	<2%	-1.2%			<2%	plumb
PLUMBNESS (%) ACROSS RAIL	-	-			-	-
BATTER	6:12:1	6:7:1			6:12:1	5:5:1
REMARKS	Sand shale. Base clean and sound. Gas pipe cutting through for 3' or so in South-west side. Pier not yet and immediately removed. *observed by casing.				Sand and clean base. only minor gas pipe.  *observed by liner.	

WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : 7803

CAISSON INSPECTION REPORT

INSPECTOR: R. FRASER

PROJECT: CNE TRANSIT DEMONSTRATION SYSTEM

PIER NO: 68

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED	Sept 16 & 17, 1974				Sept 17 & 18, 1974	
DATE POURED	Sept. 19, 1974				Sept 19, 1974	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION		~ 251				~ 251
CUT OFF ELEVATION	245.0				245.0	
TIP ELEVATION	235.5	237.7		235.5	235.5	238.8
TOP OF BEDROCK (EL.)	238	239.5		238	238	~ 239.5
TOP OF SOUND BEDROCK (EL.)		238.2				229.5
CONCRETE LENGTH	-	7.4			-	16.4
CAISSON DIAMETER	36"	36"			36"	36"
SOCKET DEPTH		~ 1.8				10.7
PLUMBNESS (%) ALONG RAIL	< 2%	plumb			< 2%	plumb
PLUMBNESS (%) ACROSS RAIL	6:12:1	6:0:1			6:12:1	5:5:1
BATTER	6:12:1	6:0:1			6:12:1	5:5:1
REMARKS	Base ok. a. w. with only minor surface. Base star drilled and pushed to 3' out after discovery of water but not shale in adjacent. CAISSON 68R. Bedrock found to be sound.				CAISSON socket deepened due to weathered and fractured shale to weathered shale on Sept. 19, 1974. Same surface (~ 3-4 ft/hour). Pumped out and poured.	



WILLIAM TROW ASSOCIATES LIMITED

JOB NO. : 7803

CAISSON INSPECTION REPORT

INSPECTOR: R. Prosser

PROJECT: ONE TRANSIT DEMONSTRATION SYSTEM

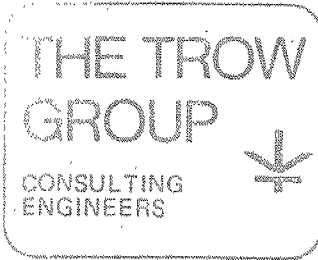
PIER NO: 69

DESIGN LOAD (T.S.F.): 25

CAISSON	LEFT		CENTRE		RIGHT	
DATE DRILLED					<u>Sept. 18 &amp; 19, 1974</u>	
DATE POURED					<u>Sept. 19, 1974</u>	
	DESIGN	ACTUAL	DESIGN	ACTUAL	DESIGN	ACTUAL
GROUND ELEVATION						<u>225.1</u>
CUT OFF ELEVATION					<u>245.0</u>	
TIP ELEVATION					<u>235.5</u>	<u>238.3</u>
TOP OF BEDROCK (EL.)					<u>238</u>	<u>239.5</u>
TOP OF SOUND BEDROCK (EL.)						<u>238.7</u>
CONCRETE LENGTH					<u>-</u>	<u>6.8</u>
CAISSON DIAMETER					<u>36"</u>	<u>36"</u>
SOCKET DEPTH						<u>1.2</u>
PLUMBNESS (%) ALONG RAIL					<u>&lt;2%</u>	<u>plumb</u>
PLUMBNESS (%) ACROSS RAIL					<u>-</u>	<u>-</u>
BATTER					<u>6.12.1</u>	<u>6.3.1</u>
REMARKS					<p>Base found shale and practically dry. 4' deep shot hole in base found, and shale found beam free and hard.</p>	

JUN 21 1974

W.P. 97-72-01



WILLIAM TROW ASSOCIATES LIMITED

Soil Mechanics Consultants  
43 Baywood Road, Rexdale, Ontario M9V 3Y8  
749-1290

W.A. Trow, M.Sc., M.E.I.C., P.Eng.  
K. Peaker, Ph.D., M.E.I.C., P.Eng.

Project: J 7803

June 20th, 1974

McCormick, Rankin & Associates Limited,  
8 Stavebank Road North,  
Port Credit, Ontario.  
L3G 2T4

Attention: Mr. J. Tuck

Raising of Reinforcing Cages  
C.N.E. Transit Demonstration System  
Toronto, Ontario

Dear Sirs,

This letter confirms our recent telephone conversation regarding caissons 29R and 128R. The steel cage in the former caisson is pulled up about 2 feet; in the latter caisson the upward movement was about 18 inches.

Caisson 29R bears on the footing of the adjacent retaining wall and is surrounded by dense sand backfill for most of its length except near the base, according to the boring done in this area. Caisson 128R is surrounded by dense till.

A small horizontal force may act on each of the caissons. Although we do not know the magnitude of the force we consider that the horizontal support provided by the dense sand backfill and the till to be considerable. The minor change in the level of the reinforcing, will not change the design condition since the force will be concentrated on the upper levels of the soil.

Yours very truly,

WILLIAM TROW ASSOCIATES LIMITED

*W.A. Trow*  
W.A. Trow, P.Eng.

WAT:SC

Dist: McCormick, Rankin & Assoc. Ltd. (1)  
Canada Systems Group (E.S.T.) Ltd. (4)  
Att: Mr. W. Goddard  
Anchor Shoring Ltd. (1)  
Construction Testing Serv. Ltd. (1)  
Mr. D. Mueller - on site (1)  
McCormick, Rankin & Assoc. Ltd. (1)  
Att: Mr. R. Spangler

copy to M.S. Devata-June 24/74



file

Mr. D.E. Thrasher,  
TDS Site Office,  
CNR Grounds.

Engineering Research and  
Development Branch.

June 20, 1974.

10931-21

Foundations for ABAM Section of Guideway.

Following my letter to Mr. A. Popoff dated June 12 on this subject, the following agreement has been reached with ABAM.

The caissons will be retained through to pier #57. However, as the caissons will be very short on piers #56 and #57, the caissons at these piers should be socketed at least 5 ft. into rock.

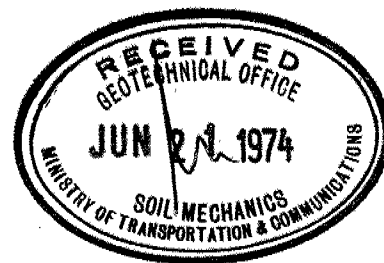
For all caissons where the liner is stopped off at rock level and the length of socket into the rock exceeds 3 ft., the reinforcing steel cage shall extend for the full length of the caisson.

ABAM have carried out a preliminary study on the use of spread footings at piers #58 to #62 inclusive, by deepening the footing thickness to rock level. This solution appears feasible with only minor changes to the present footing dimensions, and ABAM will carry on with the redesign and redrawing of these pier footings.

RAD/mg

R.A. Dorton,  
Research Officer.

c.c. Mr. F.G. Allen,  
Mr. A. Popoff,  
Mr. M. Devata. ✓





Ontario

W. 72-1101

WR 97-72-01

Ministry of  
Transportation  
and  
Communications

Engineering Research and  
Development Branch,  
1201 Wilson Avenue,  
Downsview, Ontario. M3M 1J8.

June 12, 1974.

Ref. 10931-21.

Mr. A. Popoff,  
Vice President,  
ABAM Engineers, Inc.,  
1127 Port of Tacoma Road,  
Tacoma, Wash. 98421, U.S.A.

Dear Mr. Popoff:

RE: Caissons for TDS Guideway.

A copy of a short supplementary soil report by William Trow Associates Limited is enclosed for your information. This report states that from Piers 56 to 62 the footing could be founded on the weathered shale. However, in order to have uniform foundation conditions throughout the length of the instrumented section we have decided to keep the caissons for Piers 56 and 57 even though the caissons will be very short. The required bearing pressure at the bottom of the caissons has generally been achieved with only 2 ft. depth into rock, rather than the 5 ft. shown on your drawings. Would you please confirm that this is satisfactory on the short caissons at Piers 56 and 57.

We are holding off work on Piers 58 to 62 inclusive, and would ask you to investigate the substitution of spread footings at these locations. We are seeking the most economical alternative, bearing in mind the unwatering problems to be expected in this area.

In addition to the cone penetration tests, the Ministry has carried out drilling at certain pier sites to confirm bedrock levels. These results are very similar to the cone penetration values, and are tabulated below.

Pier No.	Rock Elevation (ft.)
51	238.9
53	239.8
55	239.9
56	240.6
57	240.8
58	240.7
59	241.4
60	241.4
61	240.5
62	240.0
65	239.6



The only significant difference is at Pier 51, where the value from the cone penetration test was suspect.

As the caisson contractor is now working in the area of the ABAM designed section your early consideration of this matter would be appreciated.

Yours very truly,



R.A. Dorton.

RAD/em.  
Encls.

c.c. Messrs. D.E. Thrasher,  
F.G. Allen,  
M. Devata.

Telephone: (416) 248-3282.

Soil Mechanics Section,  
Geotechnical Office,  
1201 Wilson Avenue,  
DOWNSVIEW, Ontario. M3M 1J8

June 6th, 1974.

Dominion Soil Investigation Ltd.,  
104 Crockford Blvd.,  
SCARBOROUGH, Ontario. M1R 3C6

Dear Sirs:

This letter confirms our request of June 5th, 1974  
for the supply of a C.M.E. 750 Auger Machine, together  
with all necessary equipment, as specified under the terms  
of our Contract Agreement, at C.N.E. Grounds, Toronto.

Mobilization will be from your Toronto office.

Our Project Number is W.O. 72-11101.

W.P. 97-72-01

Yours truly,

M. Devata,  
Supervising Engineer.

MD/mj  
c.c. W.W. Fry  
(ATTN: Mrs. M. Porter)

Files  
Documents

File 72-11101

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. G. E. Boggis, (3) FROM: Geotechnical Office.  
Construction Manager, T.D.S.,  
C.N.E. Grounds.

ATTENTION: DATE: February 26, 1974.

OUR FILE REF. IN REPLY TO

SUBJECT: CAISSON INSPECTION REPORTS

We acknowledge receipt of the inspection reports for the caissons installed between December 3, 1973 and February 7, 1974 and the plans of caisson locations.


As indicated in these reports, all caissons have been satisfactorily installed into sound shale bedrock at the design bearing pressure. The bedrock elevations encountered during caisson installation, between Sta. 163 and Sta. 197 and in the Dufferin Station and Maintenance area, are in good agreement with the rock line as determined from our foundation investigation. However, between Sta. 210 and Sta. 222, the shale bedrock was encountered some 1.5 to 8 feet higher than the established rock line. Some of the caissons within this area were inspected by Mr. B. K. Glassford, Geologist of this Office, and his comments were presented in a memo of February 8, 1974, a copy of which is enclosed.

From Sta. 199 westerly to the existing GO Station (Sta. 222), the techniques used to advance the boreholes (augering), the large sampling intervals together with the poor recovery of split-spoon samples while the boreholes approaching the contact between overburden and bedrock made it very difficult to accurately determine the bedrock surface. In this area, the bedrock surface was estimated to be at a level below which positive evidence of the existence of bedrock is available (rock core samples or sufficient recovery of split-spoon samples which show the structure of the shale bedrock). As a result of this, the actual bedrock surface may be at a higher level within the transition zone (Glacial till with shale fragments), the upper boundary of which was defined by the dotted line as shown on Drawing No. 72-11101-1C of our foundation report No. 72-11101-1. This was proven to be the case between Sta. 210 and Sta. 222.

Based on the foregoing, it is our suggestion that between Sta. 199 and Sta. 210, the lengths of the caissons to be installed may be more accurately estimated by assuming the bedrock surface at the middle of the transition zone mentioned previously. However, careful inspection should be carried out

for every caisson to ensure that they are founded on SOUND shale bedrock.

Should you have further queries regarding this project, please contact this Office.

  
C. S. Poon,  
Project Foundations Engineer.

(per) M. Devata,  
Supervising Foundations  
Engineer.

CSP/sh

Encl.

C. C.      Files ✓  
Documents



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

To: Mr. M. Devata,  
Supervising Foundation Engineer,  
Geotechnical Office,  
West Building.

FROM: *BK. GLASSFORD*  
Geologist,

ATTENTION:

DATE: February 8, 1974.

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Investigation 72-11101  
Intermediate Capacity Transit System  
CNE Grounds - Toronto, Ontario

I have examined the rock cores from Drill Holes 31, 33, 144 and 145, all of which are in the vicinity of the "Go Station" adjacent to the Gardiner Expressway. I concur with Mr. Ken Ingham's logging of these cores and place bedrock elevations at the same locations that he has.

There is the possibility that sound bedrock exists above these elevations, but evidence of such has been destroyed in the augering process. From on site examinations and observations of the drilling for the caissons, I would place bedrock above that of the logging interpretation by 2 to 3 feet and would feel certain that such elevations would be fairly correct for the north line of drill holes on the project.

*BK Glassford*  
B. K. Glassford,  
Geologist.

BKG/sd



72-11101 ALS

Systems Research &  
Development Branch,  
East Building,  
1201 Wilson Avenue,  
Downsview, Ontario.  
M3M 1J8

May 28, 1973

The Canada Systems Group,  
2599 Speakman Drive,  
Sheridan Park,  
Mississauga, Ontario.

Gentlemen:

Re: T.D.S. Project, C.M.E.

With reference to your letter of May 18, 1973, this is to confirm that the Ministry approves your retaining William Trow Associates Limited to review and evaluate the Ministry's foundation findings and recommendations as requested.

It is understood that no further field work will be undertaken without consulting the Ministry and the estimated cost of the review will be 1,000 based on A.P.E.O. Scale 1 payment.

Yours truly,

D. Thrasher  
Assistant Project Director

DT:jl

cc: F. G. Allen  
M. Harmelink  
A. G. Stermac ✓



72-11-101

Mr. C.S. Poon,  
Project Foundations Engineer,  
Foundations Office,  
Design Services Branch,  
West Building, Downsview.

Insurance & Claims Section,  
Downsview, Ontario.

January 18th, 1974.

#346-72-GL.

Damage to Fire Hydrant at CNE.


Further to my telephone conversations with both yourself and Mr. Devata I am enclosing a copy of the letter dated December 29th from Master Soil Investigations Limited.

As you know, it is now over a year since this claim was submitted to us and in spite of the fact that Master Soil told us verbally they would pay the claim and were reminded by this office on four separate occasions the account remains still unpaid.

From the attached letter it is not clear what precisely the contractor wishes to do or who the "tenant of the CNE" is.

May we please be advised who it was that advised the Ministry that this claim would be paid by Master Soil in order that we may bring this matter to his attention.

WKD:lc  
Enc.

  
W.K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section.

cc: Mr. M. Devata, ✓  
Supervising Foundations Engineer.

**MASTER**  
**SOIL INVESTIGATIONS LIMITED**

TELEPHONE: 749-1062

104 KENHAR DRIVE  
WESTON, ONTARIO  
M9L 1N4

December 29th, 1973.

W. K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section,  
Ministry of Transportation & Communications,  
1201 Wilson Ave.,  
Downsview, Ontario.  
M3M 1J8.

Dear Sir,

Re: Damage to Fire Hydrant,  
CNE Grounds on Sept. 14, 1972.

We were not the only Drilling Company to use  
this hydrant during the testing at the C.N.E. Grounds.

We fail to see why we should absorb the whole  
cost.

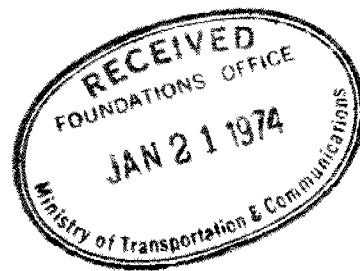
Actually, the Hydrant was broken by the Tenant  
of the C.N.E. when he turned it on.

Yours very truly,  
MASTER SOIL INVESTIGATION  
LIMITED.

*H. Dagenais*  
H. Dagenais,  
President.

3282

JAN



72-11101  
*file*

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: M.S. Devata,  
Supervising Foundations Eng.,  
Foundations Office.

FROM: G.E. Boggis.

ATTENTION:

DATE: February 5, 1974.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Caisson Inspection Reports

Further to our telephone conversation of this morning I am forwarding to you, for your information, copies of work sheets for each caisson constructed to-date. I am also sending you a plan of the caisson locations for reference purposes.

I would be interested in hearing from you if this information is useful to you, or if in fact, we could provide more information that we probably already have recorded.

GEB/bc  
Encls.

*G.E. Boggis*  
G.E. Boggis,  
Construction Manager - TDS.

72-11101

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. C.S. Poon,  
Project Foundations Engineer,  
Foundations Office,  
Design Services Branch,  
West Building, Downsview.

FROM: Insurance & Claims Section,  
Downsview, Ontario.

ATTENTION:

DATE: January 18th, 1974.

OUR FILE REF. #346-72-GL.

IN REPLY TO

SUBJECT: Damage to Fire Hydrant at CNE.

Further to my telephone conversations with both yourself and Mr. Devata I am enclosing a copy of the letter dated December 29th from Master Soil Investigations Limited.

As you know, it is now over a year since this claim was submitted to us and in spite of the fact that Master Soil told us verbally they would pay the claim and were reminded by this office on four separate occasions the account remains still unpaid.

From the attached letter it is not clear what precisely the contractor wishes to do or who the "tenant of the CNE" is.

May we please be advised who it was that advised the Ministry that this claim would be paid by Master Soil in order that we may bring this matter to his attention.

WKD:lc  
Enc.

  
W.K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section.

cc: Mr. M. Devata,  
Supervising Foundations Engineer.

*Feb. 1. learnt that  
Master Soil paid the  
damage.*

*W.K. Dowd was advised  
by a letter Feb. 1*



# MASTER

---

## SOIL INVESTIGATIONS LIMITED

104 KENHAR DRIVE  
WESTON, ONTARIO  
M9L 1N4

December 29th, 1973.

W. K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section,  
Ministry of Transportation & Communications,  
1201 Wilson Ave.,  
Downsview, Ontario.  
M3M 1J8.

Dear Sir,

Re: Damage to Fire Hydrant,  
CNE Grounds on Sept. 14, 1972.

We were not the only Drilling Company to use  
this hydrant during the testing at the C.N.E. Grounds.

We fail to see why we should absorb the whole  
cost.

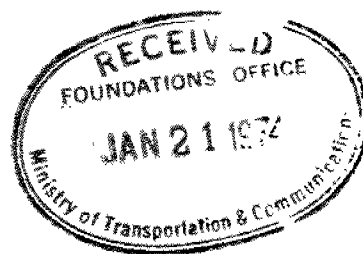
Actually, the Hydrant was broken by the Tenant  
of the C.N.E. when he turned it on.

Yours very truly,  
MASTER SOIL INVESTIGATION  
LIMITED.

*H. Dagenais*  
H. Dagenais, *ppw*  
President.

3282

JA 4





Ontario

## ACTION REQUEST

037 (2-72)

DATE

5/13 Feb/74

TO Mr A. Rytka  
 Manager, Geotechnical office.  
 FROM M. DEVATA  
 TO Supervising Foundation Engineer

TELEPHONE NO.

☐ — PLEASE CALL☐ — WISHES APPOINTMENT☐ — RETURNED YOUR CALL☐ — WILL CALL BACK☐ — NOTE AND FILE☐ — PROVIDE MORE DETAILS☐ — PLEASE ANSWER☐ — NOTE AND FORWARD☒ — FOR YOUR INFORMATION☐ — DRAFT REPLY FOR MY SIGNATURE☐ — NOTE AND RETURN☐ — FOR YOUR APPROVAL☐ — INVESTIGATE AND REPORT☐ — NOTE AND SEE ME☐ — FOR YOUR SIGNATURE☐ — TAKE APPROPRIATE ACTION☐ — RETURN WITH COMMENTS☐ — PER YOUR REQUEST

COMMENTS:

We are comparing the borehole data and geotechnical details to determine the bedrock variations at this site. This is a good feed back information.

CALL TAKEN BY:

TIME

72-11101  
file  
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: M.S. Devata,  
Supervising Foundations Eng.,  
Foundations Office.

FROM: G.E. Boggis.

ATTENTION:

DATE: February 5, 1974.

OUR FILE REF.

IN REPLY TO,

SUBJECT:

Caisson Inspection Reports

Further to our telephone conversation of this morning I am forwarding to you, for your information, copies of work sheets for each caisson constructed to-date. I am also sending you a plan of the caisson locations for reference purposes.

I would be interested in hearing from you if this information is useful to you, or if in fact, we could provide more information that we probably already have recorded.

GEB/bc  
Encls.

*[Handwritten signature]*  
G.E. Boggis,  
Construction Manager - TDS.

*Thank you much. Might get all the info you can.*  
*al*

72-11101

File  
ESP

1201 Wilson Avenue,  
Downsview, Ontario,  
M3M 1J8.

August 23, 1973,

Our File: #346-72-CL.

Master Soil Investigation Company,  
104 Kenhar Street,  
WOODBIDGE, Ontario.

Dear Sirs:

RE: Damage to Fire Hydrant -  
CNE Grounds - September 14/72.

We refer to previous correspondence to which regretfully we  
have not had any reply.

Would you please let us know whether or not this claim has been  
paid.

Yours very truly,

W.K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section.

WKD/lc

cc: Mr. C.S. Poon,  
Project Foundations Engineer.





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**Golder Associates**  
CONSULTING GEOTECHNICAL ENGINEERS

✕ 3151 WHARTON W. MISSISSAUGA (TORONTO), ONTARIO, CANADA.

• 1796 COURTWOOD CRESCENT, OTTAWA, ONTARIO. K2C 2B5

• 747 HYDE PARK ROAD, LONDON, ONTARIO. N6H 3S5

• 2479 HOWARD AVENUE, WINDSOR, ONTARIO. N8X 3V7

TRANSMITTAL FORM

CONSIGNEE: Ministry of Transportation and  
Communications,  
Designs Services Branch,  
Downsview 464, Ontario

DATE: May 29, 1973

72-11101

ATTENTION: Attn: Mr. M. Devata, P. Eng.

PROJECT No.: 73027

RE: C.N.E. Pilot Project

Sent by:-



MESSENGER



UNDER SEPARATE COVER



ENCLOSED

No. Copies	Item	Description
3	EXTRA COPIES OF REPORT	Pressuremeter Testing for, C.N.E. Pilot Project, Public Transit System.

*As per telephone request of Don Tomasko, arranged 3 copies of Golder Report and delivered to McEwen and Rankin on May 31/73*

Remarks:

*and Rankin on May 31/73*

*Mr. Devata  
May 30/73*

Per

*Alan Golder*

April 19, 1973

Ministry of Transportation and Communications  
Design Services Branch,  
1201 Wilson Avenue  
Downsview, Ontario  
M3M 1J8

Attention: Mr. M. Devata

Dear Sirs:

Re: Replacement of Diamond Tools  
Our Job No. 73-2-17  
Your W.O. 72-11101  
Rental of Drilling Equipment,  
CNE Grounds

Will you kindly supply us with diamond tools of equivalent carat content to replace the following tools used on the above project and handed over to your representative, Mr. Devata.

<u>Part</u>	<u>Carat Content</u>
2 NXL core bits	13.9 each
2 NXL reaming shells	10.35 each

Yours very truly,  
DOMINION SOIL INVESTIGATION LIMITED

  
James Park, P.Eng.  
Vice President.

JP:eh

} Rec'd.  
29 May '73  
J Park





## ONTARIO

MINISTRY  
OF  
TRANSPORTATION AND COMMUNICATIONS

**LOCAL PURCHASE  
ORDER**

SEND INVOICE IN DUPLICATE  
AS INDICATED BELOW AND SHOW  
THIS NUMBER.

**Q 09831**

QUOTATION INFORMATION	NUMBER RECEIVED
BY TELEPHONE	
IN WRITING	
NONE REQUESTED AND REASON	

TO Mr. M. J. Halovanic  
District Office Supervisor  
District No. 6 (Toronto)

DATE March 2, 1973

PLEASE SUPPLY AND DELIVER TO:  
MINISTRY  
OF  
TRANSPORTATION AND COMMUNICATIONS, ONTARIO

**SEND INVOICE IN DUPLICATE TO:**  
**MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO**

C/O Accounting and Administration

ADDRESS Seaside Downview

Att'n: Mr. J. L. Van der Velden

ATTENTION OF

SHIP VIA

QTY. RECEIVED	QTY. ORDERED	DESCRIPTION	UNIT VALUE	REMARKS
		Backfill approximately forty Berchdes (~ 7'4") and repair asphalt pavement, tire ruts on grass, etc. in Canadian <sup>(National)</sup> Exhibition Grounds in Toronto.		
FEDERAL SALES TAX	ONT. RETAIL SALES TAX	TERMS	F.O.B. POINT	DELIVERY
				INQUIRY REFERENCE NO.

REQUIRED FOR

REQUEST OR W.O. NUMBER

RECOMMENDED BY

GOODS AT THE RISK OF SELLER UNTIL INSPECTED AND  
APPROVED BY THE MINISTRY AT THE ABOVE SITE.

I CERTIFY THAT THE GOODS BEING PURCHASED/IMPORTED BY  
MINISTRY  
OF

**TRANSPORTATION AND COMMUNICATIONS, ONTARIO**  
ARE BEING PURCHASED WITH CROWN FUNDS, AND ARE FOR A PURPOSE OTHER THAN FOR RESALE, FOR USE IN CONNECTION WITH THE MANUFACTURE OR PRODUCTION OF GOODS OR TO BE USED FOR OTHER COMMERCIAL OR MERCANTILE PURPOSES AND THEREFORE NOT SUBJECT TO FEDERAL SALES OR EXCISE TAX. ONTARIO RETAIL SALES TAX TO BE ADDED.

**SIGNATURE**

DISTRICT ENGINEER OR AUTHORIZED EMPLOYEE

THIS COPY TO DISTRICT

72-11101

MEMORANDUM

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

FROM: Structural Office,  
West Bldg., DOWNSVIEW.

ATTENTION:

DATE: February 5th, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

N.I.C.T.S.E.S. - Structural Aspects  
C.N.E. Project - W.P.#97-72.

You should by now have a copy of my letter to Cole, Sherman & Associates and McCormick & Rankin intended to advise you when further work is likely to be required at the above site.

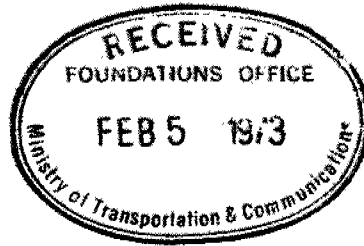
It seems probable that one requirement will be to conduct a load test on a caisson to establish horizontal resistance. A meeting on this subject would probably be called at short notice and some preliminary study might be helpful.

*B.S. Richardson*

BSR:dp

B.S. Richardson,  
Reg. Structural Design Engineer.

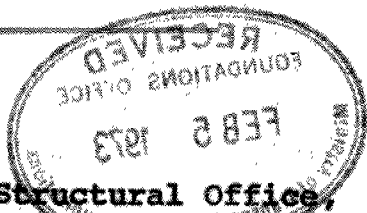
cc. M. Harmelink.



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of

A. STERMAC



Structural Office,  
West Building,  
1201 Wilson Avenue,  
DOWNSVIEW, Ontario.

Tel. 248-3516

February 2nd, 1973.

McCormick & Rankin Associates Ltd.,  
Consulting Engineers,  
8 Stavebank Road N.,  
PORT CREDIT, Ontario.

Attn. R. Nairn.

Dear Sir:

RE: N.I.C.T.S.E.S. - Structural Aspects  
W.P.#97-72

Our Foundations Office should begin work shortly on the final foundation investigation for this project. Some changes in alignment will necessitate additional site exploration. Preliminary design work has no doubt prompted an appraisal of the recommendations made in the preliminary Foundation Investigation Report and suggested other possibilities that should be investigated.

We would appreciate your comments on this topic. The requirements of both developers will be met to avoid waiting until after a selection has been made. It is expected that we shall be able to review the requirements fairly early in February and begin site exploration about February 15th.

Yours truly,

B. S. Richardson, P. Eng.,  
Reg. Structural Design Engineer.

BSR:dp

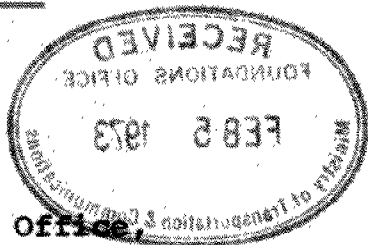
cc. A. Stermac,  
M. Harmelink,  
Dr. Domandl.



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of

A. STERMAC



Structural Office,  
West Building,  
1201 Wilson Avenue,  
DOWNSVIEW, Ontario.

Tel. 248-3516

February 2nd, 1973.

Cole, Sherman & Associates Limited,  
Consultants,  
2025 Sheppard Avenue East,  
WILLOWDALE, Ontario.

Attn. R. Kruk

Dear Sir:

RE: N.I.C.T.S.E.S. - Structural Aspects  
w.p.#97-72

Our Foundations Office should begin work shortly on the final foundation investigation for this project. Some changes in alignment will necessitate additional site exploration. Preliminary design work has no doubt prompted an appraisal of the recommendations made in the preliminary Foundation Investigation Report and suggested other possibilities that should be investigated.

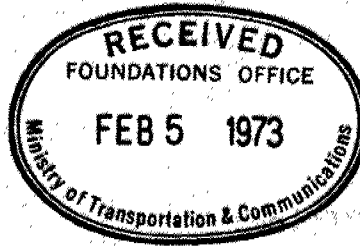
We would appreciate your comments on this topic. The requirements of both developers will be met to avoid waiting until after a selection has been made. It is expected that we shall be able to review the requirements fairly early in February and begin site exploration about February 15th.

Yours truly,

B. S. Richardson, P.Eng.,  
Reg. Structural Design Engineer.

BSR:dp

cc. A. Stermac,  
M. Harmelink.



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**COLE, SHERMAN & ASSOCIATES LIMITED**

**CONSULTANTS**

**2025 SHEPPARD AVENUE EAST  
WILLOWDALE, ONTARIO**

**RON KRUK  
ASSOCIATE**

**491-4503**



M.D.  
CSO  
File  
72-11101

February 26, 1973

Meeting with the C.N.E. Task Force

Time: February 21, 1973, at 2:15 p.m.  
Place: City Hall, 19th Floor, East Tower  
Subject: N.I.C.T.S.E.S., C.N.E. Demonstration Project  
(W.P. 97-72-01)

Attendance: Mrs X. Zepic Metro Planning Board  
Messrs D. Twaits Metro Planning Board  
C. Roberts Metro Parks Dept.  
A. French Metro Roads & Traffic  
E. Swabey C.N.E. Works Dept.  
C. Purves Ontario Place Corp.  
D. Farren Ministry of Trans. & Com.  
B. Richardson Ministry of Trans. & Com.  
G. Celmins Ministry of Trans. & Com.

Main Points of Discussion:

1. Photo montages of the guideway were presented and reviewed, particularly those showing the two schemes at the Ontario Place West Plaza. A unanimous preference was given to the scheme which shows both the station and the through alignment passing south of the west plaza. The other scheme that features the through track overpassing the approach mound to the north was unfavourable to all at the meeting and should be considered as

abandoned.

Mrs Zepic and Mr Purves requested prints of the favoured scheme.

2. A short span-slender column proposal at the same location was reviewed against a long span-heavier column proposal, the former receiving a general preference. The M.T.C. representatives stressed the point that long spans will have to be used at certain locations, such as existing roadway crossings.

Alongside the Gardiner Expressway, the guideway spans will match in length the existing elevated expressway spans.

3. The architectural design of stations was questioned by Mrs Zepic as to their differential or uniformity. The M.T.C. would prefer a uniform architectural treatment of all stations. This was generally acceptable, provided that the Princes Gate and Ontario Place stations will receive proper consideration in matching their surroundings.
4. The Task Force representatives repeated their earlier requirement for an unrestricted pedestrian flow across Connaught Road at the GO station. Mrs Zepic will contact Mr W. Howard or Mr H. Clelland regarding any

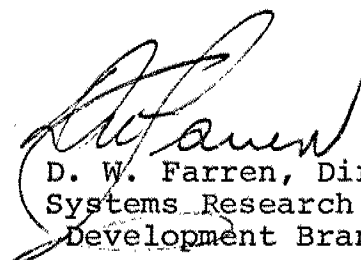
future proposals for the GO station access.

5. The question of escalators or elevators at stations was brought up. The M.T.C. stated that only one of the proposed four stations is being considered in this regard, the other three stations will have stairways only. Station layout details will be available after April 1, 1973.
6. On-site office (minimum 500 sq. ft.) for Ministry's staff was discussed. A possible location is in the basement of the Ontario Government Building according to Mr E. Swabey. Heated trailers could be available through Mr C. Purves. The M.T.C. Project Construction Manager, Mr D. Thrasher, will contact Messrs Swabey, and Purves to resolve this problem.
7. Office accommodation for Developer's staff, due to the scarcity of suitable space on the grounds, should be resolved by the Developer on his own initiative.
8. Mr Swabey stated that the Arts Building will be removed during March 1973.
9. Connaught Road relocation in the area of the Hydro Substation was discussed in connection with the proposed scheme that features a raised median in the roadway to allow shorter spans and avoidance of conflict with

the Hydro underground duct. The median is acceptable in principle to Metro Parks and Road Departments, but further details will have to be studied, including traffic detouring arrangements during the guideway construction.

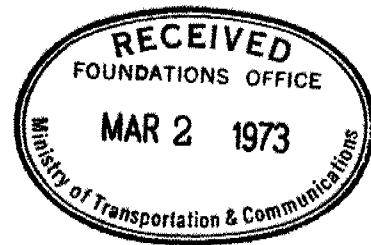
10. In response to questions by Mr C. Roberts, the M.T.C. representatives stated that the survey stakes will be removed after soils investigation is completed and that the bore-holes will be properly backfilled.

The meeting adjourned at 4:30 p.m.

  
D. W. Farren, Director  
Systems Research and  
Development Branch

Copies to: All Present

Messrs M. Harmelink  
D. Thrasher  
W. Howard  
M. Devata  
D. Garrick (C.N.E.)  
I. McLennan (Ont. Place)  
I. Campbell  
K. Foley



Design Services Branch,  
1201 Wilson Avenue,  
Downsview, Ontario,  
M3H 1T8

February 23, 1973.  
Telephone: 248-3282.

Master Soils Investigation Ltd.,  
104 Kenhar Drive,  
Woodbridge, Ontario.

Dear Sirs

This letter confirms our request of February 19, 1973,  
for the supply of a C.M.H. 55 with hollow stem auger machine  
together with all necessary equipment, as specified under the  
terms of our Contract Agreement, at C.M.H. grounds in Toronto  
on February 21, 1973.

Notification will be from your yard in Toronto.

Our Project Number is W.C. 73-11101. ✓

Yours truly,

MD/ao

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

For:

*M. Devata*  
M. Devata,  
Supervising Foundations Engineer,  
B. C. Sternad,  
Principal Foundations Engineer.

Foundations Files  
Documents

*Extra* 72-11101  
Design Services Branch,  
1201 Wilson Avenue,  
Downsview, Ontario.  
M3M 1J8

February 22, 1973.

Telephone: 248-3282.

H. Q. Golder & Associates Ltd.,  
3151 Wharton Way,  
Mississauga, Ontario.

Attention: Mr. D. L. Townsend, P. Eng.

Re: Provision of Menard Pressuremeter  
For Field Testing

Dear Sirs:

Please consider this your authorization to carry out measurements with the Menard Pressuremeter in a number of boreholes at the grounds of the Canadian National Exhibition in Toronto. The locations and number of tests are to be given to your representative by our Mr. M. Devata. The field testing at this site is to be conducted under the supervision of your qualified technician and the results computed and evaluated in the Office by one of your senior engineers.

Charges for services rendered are to be in accordance with your letter of February 20, 1973.

Upon completion of this assignment you are requested to submit to our accounting office your invoice in triplicate. On the invoice reference should be made to our project number W.O. 72-11101.

Yours truly,

*AGS*

AGS/ao

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.

Foundations Files  
Documents





**Golder Associates**  
CONSULTING GEOTECHNICAL ENGINEERS

February 20, 1973

Principal Foundations Engineer,  
Design Office,  
Ontario Ministry of Transportation and  
Communications,  
Downsview 464, Ontario.

Attention: Mr. A. G. Stermac, P.Eng.

RE: PROVISION OF MENARD PRESSUREMETER  
FOR FIELD TESTING

Dear Sirs:

Further to our recent telephone conversation, we are pleased to outline for you our experience with the Menard Pressuremeter, and to submit our proposal for carrying out field tests on your behalf.

Golder Associates have owned and operated a Menard Pressuremeter for over a year, and during this time our staff have used the equipment for a variety of projects including geotechnical studies for building and tower foundations in the Hamilton area, near Nanticoke and in Thunder Bay. In addition we have used the equipment to assess the geotechnical properties of relatively dense or stiff till soils for two conservation dam projects in the Toronto area.

During this period of time, we have developed our own field manual for guidance in operating the equipment, and we have trained each of our senior technicians in the operation of the apparatus. In addition, we have translated various reference articles related to the engineering interpretation of pressuremeter results, and a list of these references is attached.

While we are prepared to rent the pressuremeter



apparatus separately on a per diem basis without the services of a technician, we do not recommend this procedure as we have found that the apparatus is extremely sensitive. It usually takes a new operator approximately one week to become familiar with the equipment and the procedures for field operation and repairs. In addition, we recommend that the technician be on site during the drilling operations so that close supervision can be provided to the driller. Normally, only one technician is sufficient as he can supervise the drilling, log and care for samples, and carry out the pressuremeter testing as the work progresses. Reduction of the field readings is carried out by a member of our engineering staff.

In cases where you would only require the services of our technical staff to supervise the field testing, compensation for our services would be as follows:

Rental of the Menard Pressuremeter complete with necessary boxes, etc.	\$ 75.00 per day
Provision of a senior technician to carry out field testing, supervise drilling operations, log and care for all samples (Mr. V. Katic)	\$ 96.00 per day
Provision of a qualified senior engineer to advise your staff and to compute pressuremeter results (Mr. R. C. Butler, P.Eng.)	\$ 144.00 per day

Additional services, such as transportation to and from the site, preparation of drawings would be in accordance with the attached Schedule of Charges which is based upon the minimum fee scale as recommended by the Association of Professional Engineers of Ontario.

Should you have further queries concerning the use of this equipment, please do not hesitate to call us.

Yours truly,

H. Q. GOLDER & ASSOCIATES LTD.

  
D. L. Townsend, P.Eng.

DLT:jb  
641-E-311

Encl:           Schedule of Charges  
                  Appendix 1

SCHEDULE OF CHARGES

5/72

**Golder Associates**

## INTRODUCTION

The firm of H. Q. Golder & Associates Ltd. provides a consulting engineering service specializing in the fields of soil and rock mechanics, foundations, earthworks, construction dewatering, construction inspection and materials testing. These services are provided in Ontario through offices in Toronto, London, Ottawa and Windsor.

The principals of the firm are:

H. Q. Golder, D.Eng., P.Eng.  
V. Milligan, B.Sc., M.Sc., P.Eng.  
J. L. Seychuk, B.Sc., D.I.C., P.Eng.  
C. O. Brawner, B.Sc., M.Sc., P.Eng.  
D. L. Townsend, B.Eng., M.Eng., D.I.C., P.Eng.

Associates of the firm are:

F. J. Heffernan, B.Eng., D.I.C., P.Eng. ....	Ottawa
B. E. W. Dowse, B.A.I., M.Sc., P.Eng. ....	London
J. B. Davis, B.E.Sc., M.E.Sc., P.Eng. ....	Toronto
J. F. Capps, M.I.C.E., P.Eng. ....	Windsor

They are assisted by a staff of experienced soils and materials engineers and technicians. Most of the engineers have done post-graduate work in soil mechanics, foundation or materials engineering, and have had experience in the field on construction inspection and testing. The technical staff have been trained to carry out all phases of geotechnical investigations using both traditional and advanced geotechnical testing equipment.

The firm maintains fully equipped soils and materials laboratories at all office locations to supplement its engineering services. As an organization of consulting professional engineers, the firm does not maintain contract drilling equipment but where needed the services are retained of approved specialized drilling contractors who are fully equipped for any investigation.

SCHEDULE OF CHARGES

The Association of Professional Engineers of Ontario have indicated in their current 'Scale of Fees and Guide for the Engagement of Consulting Engineering Services' that soil and foundation surveys are defined as 'Additional and Special Services'

Soils or foundation surveys and sub-soil investigations are included in the category of pre-design services which consists of services to establish the requirements for design involving investigation, exploration, survey and soil investigation, and analysis of conditions and of several possible plans ..... as a basis for conclusions and recommendations on the undertaking of a suggested project.

In keeping with this category of service, the Association of Professional Engineers of Ontario recommend that reimbursement for professional services should be according to Scale 1. Under this scale, the Engineer shall be reimbursed for the services of his staff actually engaged on the project on the basis of payroll costs multiplied by a factor of not less than two plus reimbursement for defined expenses.

In accordance with the above Schedule of Fees, the fees for the services of H. Q. Golder & Associates Ltd., when carrying out geotechnical work have been established as follows:

1. a. Reimbursement for engineering staff, technicians and draughtsmen will be on the basis of payroll costs multiplied by a factor of two (2).
- b. When necessary for the scope of the work, reimbursement for principals and senior engineers will be charged at the per diem rate established by the Association.
2. Laboratory tests will be in accordance with the attached Schedule of Charges.
3. All disbursement and expenses properly incurred in the performance of these services will be passed on to the client at cost.

LABORATORY TESTS

2. The charges for laboratory tests are set out below:

INDEX PROPERTIES	\$
Natural water content	1.50
Liquid and plastic limits	15.00
Shrinkage limit	10.00
Specific gravity	10.00
Organic content	7.00
Unit weight, sample of regular shape	2.50
Unit weight, sample of irregular shape	7.50
GRAIN SIZE ANALYSIS	
Sieve (up to 10 lb. of material)	10.00
Hydrometer	15.00
Sieve and hydrometer	25.00
Sieve, wash (more than 10 lb. of material)	40.00
TRIAXIAL COMPRESSION	
Unconfined (U)	10.00
Undrained (Q)	15.00
Consolidated undrained (R)	30.00
Consolidated drained (S)	100.00
Consolidated undrained with measurement of pore water pressure ( $\bar{R}$ )	100.00
DIRECT SHEAR	
Undrained	15.00
Consolidated undrained	25.00
Consolidated drained	100.00
CONSOLIDATION TESTS	
Loading and unloading, standard test	100.00
Extra rebounding cycle	10.00
COMPACTION TESTS	
Standard Proctor (Standard AASHO)	50.00
Modified Proctor (Modified AASHO)	50.00
Harvard miniature	50.00
Relative density of sands	25.00
C.B.R.	25.00
PERMEABILITY TESTS	
Falling head or constant head	50.00

Tests other than those listed above will be carried out by arrangement.

EXPENSES

3. Expenses, properly incurred in the course of work, such as: transportation costs for engineering personnel by automobile at a rate of twelve cents per mile, or by public carrier; long distance communications charges; living expenses on site, where applicable; drawing and photographic reproductions; shipping charges for samples where required, and the costs of the provision and operation of drilling and sampling equipment by an approved drilling contractor will be charged at cost.



McCORMICK, RANKIN & ASSOCIATES  
LIMITED  
CONSULTING ENGINEERS

8 STAVEBANK ROAD  
PORT CREDIT, ONTARIO  
TELEPHONE 274-3477

February 20, 1973

Systems Research Branch,  
Ministry of Transportation  
and Communications,  
DOWNSVIEW, Ontario  
M3M 1J8

Attention: Mr. M.D. Harmelink, P. Eng.

RE: C.N.E. Transit Demonstration System  
Our File: W.O. 709-73

Dear Sir:

We are delivering herewith, one set of plans for the above-noted project showing the locations for additional boreholes to cover the area of the proposed stations and maintenance building.

Nearby boreholes from the original soils survey have also been plotted.

Yours very truly,

McCORMICK, RANKIN & ASSOCIATES LIMITED

  
J. L. Malcolm, P. Eng.

JLM:lc  
Encl.  
cc: Mr. M. Schulmeister

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: MEMO TO FILE

FROM:

ATTENTION:

DATE:

OUR FILE REF.

IN REPLY TO

SUBJECT:

*CAISSON LOAD TEST*  
*Intermediate Capacity Transit System, C.N.E.*  
W.O. 72-11101 -- W.P. 97-72

The following information was obtained from a Caisson Contractor by Mr. M. Devata.

- 1) Supply all necessary equipment L.S. \$6,000
- 2) Install concrete caisson (3,000 p.s.i.) (Price per lineal foot)

	<u>Diameter</u>				
	18"	24"	30"	36"	48"
In Overburden	8.00	9.00	18.00	24.00	33.00
In Rock	12.00	15.00	28.00	36.00	50.00

- 3) Reinforcing steel (supply, fabricate and install)  
 17¢ per lb.
- 4) Temporary protective liner.

	18"	24"	36"	48"
Diameter	18"	24"	36"	48"
Thickness	0.312"	0.312"	3/8"	1/2"
Cost/ft.	\$10	\$12	\$30	\$40

Note: For caisson with diameter of 18" and 24", liner should be left in place.

CSP/ao



C. S. Poon,  
 Project Foundations Engineer.



Design Services Branch,  
1201 Wilson Avenue,  
Downsview, Ontario.  
M3M 1J8

Telephone: 248-3282

February 21, 1973.

Dominion Soil Investigation Ltd.,  
104 Crockford Blvd.,  
Scarborough, Ontario.

Dear Sirs:

This letter confirms our request of February 16, 1973,  
for the supply of two C.M.E. 750 machines together with  
all necessary equipment, as specified under the terms of  
our Contract Agreement, at C.N.E. grounds, Metro Toronto, on  
February 20, 1973.

Mobilization will be from your yard in Scarborough, Ontario.

Our Project Number is W.O. 72-11101. ✓

Yours truly,



M. Devata,  
Supervising Foundations Engineer,  
For: A.G. Stermac,  
Principal Foundations Engineer.

MD/so

c.c. W. W. P.  
(Attn: Mrs. M. Andrews)

Foundations Files  
Documents



**COLE, SHERMAN & ASSOCIATES LIMITED**

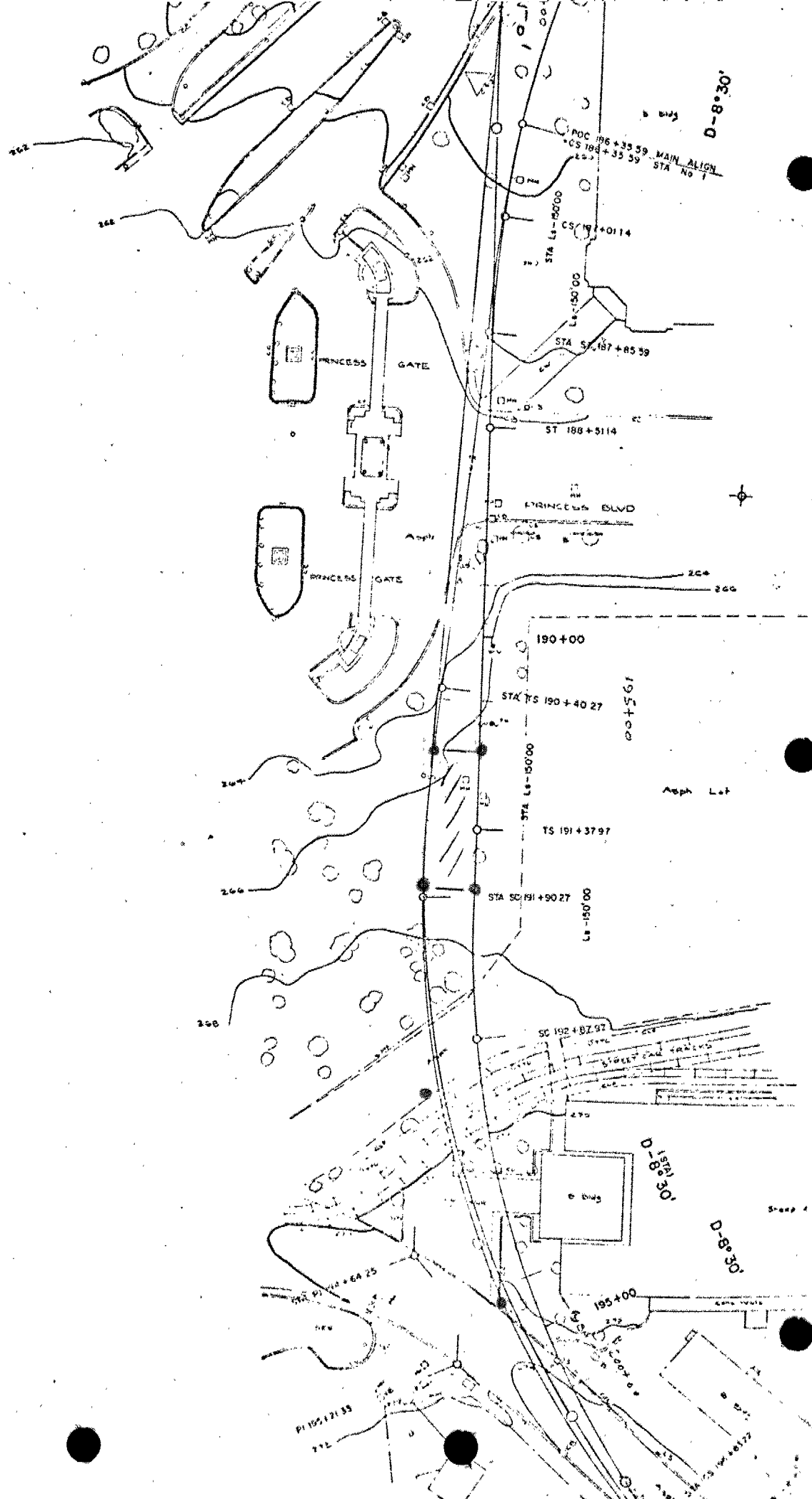
**CONSULTING ENGINEERS**

**2025 SHEPPARD AVENUE EAST  
WILLOWDALE, ONTARIO**

**C. S. LEPPER  
ASSOCIATE**

**491-4508**

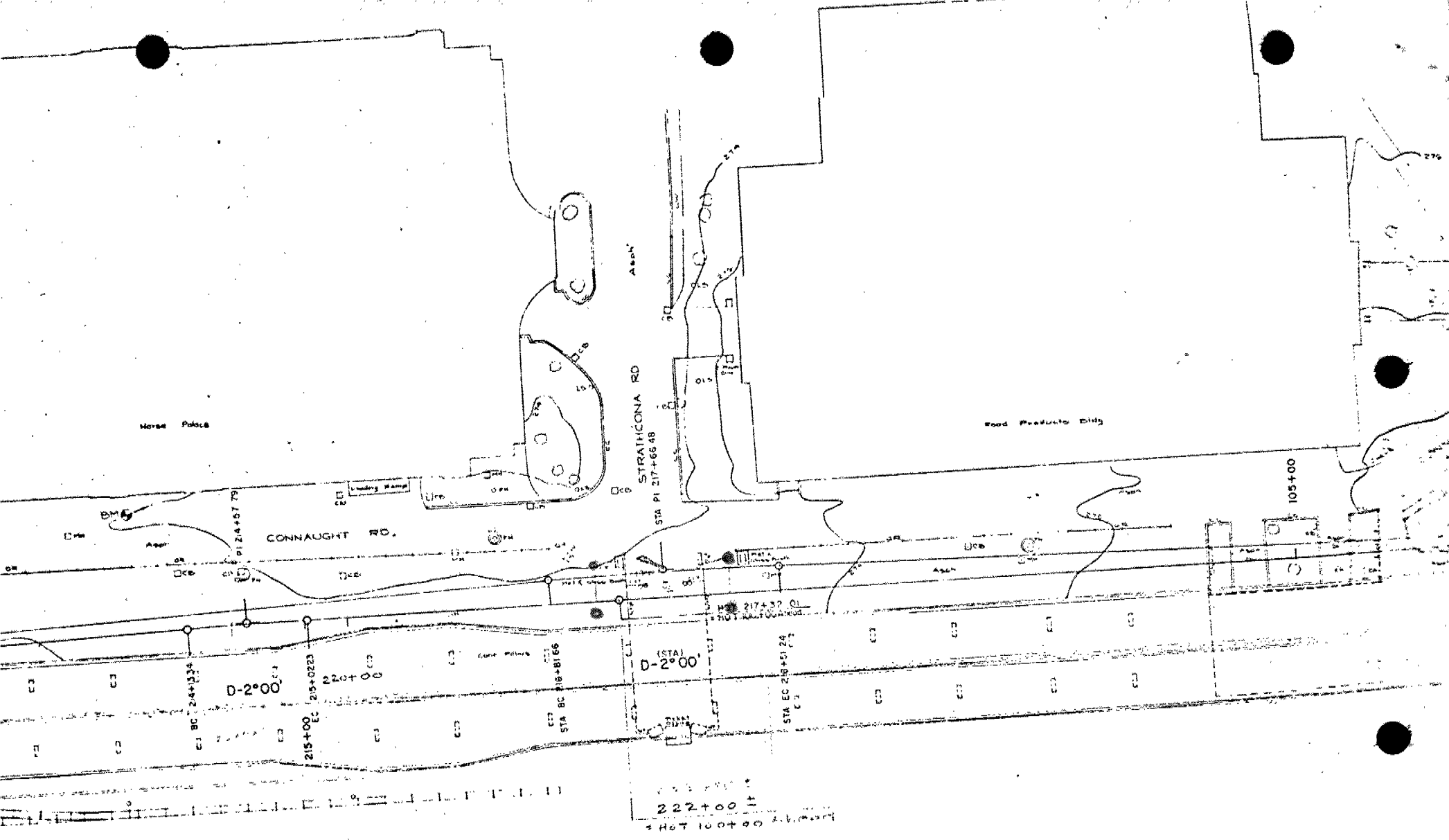


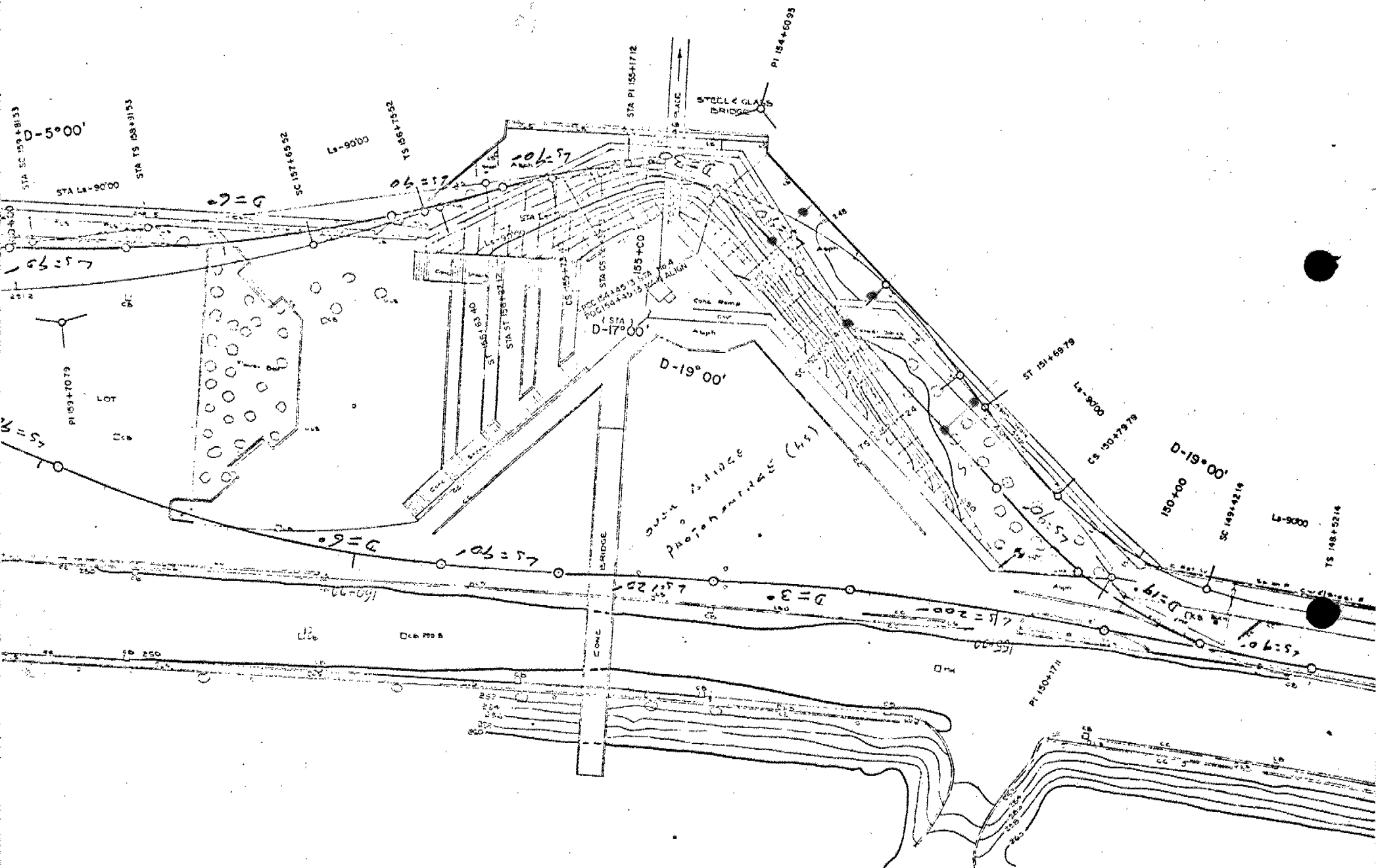


COMMUNICATIONS  
NCH  
ICE

STUDY

ON





$$\begin{array}{r} 25 \overline{) 6000} \\ \underline{250} \phantom{0} \\ 3500 \\ \underline{3000} \phantom{0} \\ 500 \phantom{0} \\ \underline{500} \phantom{0} \\ 0 \phantom{0} \end{array}$$

(40)

$$\begin{array}{r} 25 \overline{) 6000} \\ \underline{250} \phantom{0} \\ 3500 \\ \underline{3000} \phantom{0} \\ 500 \phantom{0} \\ \underline{500} \phantom{0} \\ 0 \phantom{0} \end{array}$$

(40)

Copy to MR Bellata

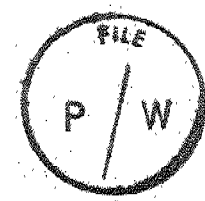


MEMBER  
ASSOCIATION OF CONSULTING  
ENGINEERS OF CANADA

McCORMICK, RANKIN & ASSOCIATES  
LIMITED  
CONSULTING ENGINEERS

8 STAVEBANK ROAD  
PORT CREDIT, ONTARIO  
TELEPHONE 274-3477

February 13, 1973



Mr. B.S. Richardson, P. Eng.,  
Systems Research Branch,  
Ministry of Transportation  
and Communications,  
DOWNSVIEW 464, Ontario

RE: C.N.E. Transit Demonstration System  
Our File: W.O. 709-73

Dear Sir:

As requested, we have reviewed our requirements with regard to the Foundation Investigation for the above-noted project and our comments are as follows:

1. Additional boreholes will be required along the alignment, at an interval of approximately 150 to 200 feet depending on the consistency of the subsoil, in those areas where the alignment differs from the original proposal.
2. Additional boreholes will be required at the location of the proposed stations and maintenance area.
3. Caisson load tests will be required in order to determine the design parameters for the Caissons. Predominantly the site is comprised of two main areas of subsoil conditions, namely;
  - a) the northern part of the site
  - b) the southern part of the site in the reclaimed area.

.....



-2-

Mr. B. S. Richardson, P. Eng.

We will require recommendations regarding the ability of the subsoil to provide support for the lateral movement of the caissons, recommendations regarding anchoring the caissons into bedrock, as well as recommendations regarding the allowable vertical and horizontal loads on the caissons. This information is required by April 1, 1973.

If there are any further questions in this regard, please do not hesitate to telephone.

Yours very truly,

MCCORMICK, RANKIN & ASSOCIATES LIMITED



J. W. Tuck, P. Eng.

JWT:lc

cc: Mr. M. Schulmeister  
Mr. M. Harmelink



COLE, SHERMAN & ASSOCIATES LIMITED

CONSULTANTS

February 13, 1973  
Our Ref: 5072.1.1.1

Ministry of Transportation  
and Communications  
West Building  
Structural Office  
1201 Wilson Avenue  
Downsview, Ontario

Attention: Mr. B.S. Richardson, P.Eng.  
Regional Structural Design Engineer

Dear Sirs:

Re: N.I.C. T.S. E.S. - Structural  
Aspects - W.P. 97-72

Further to your letter of February 2, 1973, we have the following comments on the Foundation Investigation Report.

Since the new alignment is only partly studied, we restrict our comments to the revisions in general terms only.

1. Additional boreholes are required:

- 1.1 On new alignment about 200' apart.
- 1.2 Behind retaining wall adjacent to Dufferin Street.
- 1.3 Directly under foundations for main crossings of Lakeshore Blvd.
- ✓ 1.4 In area of Maintenance Building and Maintenance Loop.
- ✓ 1.5 On each side of stations to obtain profile of subsoil conditions perpendicular to the main line, thus providing data for the station ramps.
- 1.6 Any further requirements for the new Ontario Place alignment based on the finalization and selection of the alignment possibly necessitating the investigation of soil offshore.

2. Load Tests:

- 2.1 Vertical load test on shale.
- 2.2 Pull out test to evaluate skin friction of socketed caisson in shale.

Continued.../2

2.3 Tests to indicate shear strength of shale. This could be used as an aid in evaluating the capacity of the shale to resist the forces of a caisson embedded in the shale and subject to bending moments.

3. Construction:

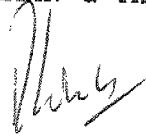
3.1 A comprehensive discussion with recommendations on caisson construction, liner installation, dewatering, tremic concrete and inspection.

3.2 Type and magnitude of short and long term settlements expected under the design loads applied to the glacial till.

We will be pleased to discuss any of the above requirements in further detail with you at your convenience.

Yours very truly,

COLE, SHERMAN & ASSOCIATES LIMITED



R. Kruk, P.Eng.

RK:njc

cc: Mr. K.G. Miles  
Mr. C.S. Lepper

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of A. Stermac

D. Farren,  
Director,  
Systems Research, East Bldg.

Structural Office,  
West Bldg., Downsview.

February 16th, 1973.

M.I.C.T.S.R.S. - Structural Aspects  
W.P.#97-72 - C.E.E. Project

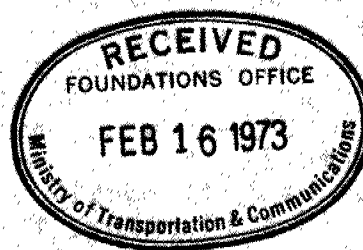
The civil consultants working for the developers have, from time to time, expressed an interest in the computer program facilities of the Ministry for use in the design phase of this project. I have assumed that this service would be extended to the developers but have made no commitment. It appears, however, that the developer's consultants are expecting to get such services from the Ministry and I doubt if they could satisfactorily complete the work without the computer service. At this point, the consultants should know whether or not the facilities will be available to them and a statement should be issued. The statement should contain appropriate disclaimers to avoid our assuming undesirable and avoidable responsibilities. This might be made more general, to extend to other services such as advice on foundations, alignment, surveys, utilities, etc.

Finally, the statement would form part of the contract with the successful developer, but our intentions should be made known now.

BSR:dp

B.S. Richardson,  
Reg. Structural Design Engineer.

cc. C.R. Wilmot,  
M. Harnelink,  
G. Celmins,  
A. Stermac. ✓





## THE MUNICIPALITY OF METROPOLITAN TORONTO

### PARKS DEPARTMENT

Planning Division 367-8177

File No. 91-C-2

February 6, 19 73

Date

#### APPLICATION FOR CONSTRUCTION

Foundations Office,  
Design Services Branch,

Ministry of Transportation & Communications, 401 & Keele, Downsview, 248-3282.

Name of Applicant

Address

Telephone

Description of Proposed Construction: Size, Type, Length, etc.  
Field survey to confirm alignment and additional boreholes relative to  
pier locations & foundations.

Attach Plan - Show location of proposed construction, working area required and  
access route.

February 9, 1973

Date of Commencement

March 30, 1973.

Date of Completion

Ministry of Transportation & Communications, 401 & Keele, Downsview,

Name of Contractor

Address

248-3282.

Telephone

#### CN APPROVAL OF APPLICATION THE APPLICANT AGREES, AT HIS EXPENSE:

1. To obtain any permit or approval necessary from and comply with all statutes, by-law, ordinances and regulations of any municipal or other body which may be necessary for the lawful execution of the work.
2. To indemnify and save harmless the Metropolitan Corporation, its successors and assigns from any claims, actions, loss, costs or damages arising out of the use by the applicant of the land of the Metropolitan Corporation.
3. To restore the work site area to its original condition, or as approved, leaving no undrained depressions, no litter, and no undue mud or dirt on grass, roads and walks.
4. Pay for loss of any trees to be replaced by the Parks Department.
5. To repair damaged services and facilities whether shown on plan or not.
6. To repair roadway cuts conforming to specification (a) for asphalt surfaced roads or (b) for crushed stone surfaced roads.
7. To notify this Department immediately on completion of the work for an inspection and to supply an 'as built' plan of the work. The applicant further agrees that the Metropolitan Parks Commissioner shall be the sole and only judge of the adequacy of any restoration and replacement.
8. To erect and maintain adequate hoarding around work area.

Crossing or diversion of any water course to be approved by the M.T.R.C.A.  
Storm sewer outfall structural design must be approved by the M.T.R.C.A.  
Connections made to services other than the applicant's must be approved by the owner of such service.

C.S. Poon Proj. Foundation Engr.  
Signature of Applicant

T.W. Thompson  
Metropolitan Parks Commissioner

#### FOR DEPARTMENTAL USE ONLY

Remarks



Mr. W. K. Dowd,  
Claim Supervisor,  
Insurance & Claims Section,  
East Bldg., Downsview.

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


February 1, 1973.

Damage to Fire Hydrant (Your File #346-72-GL)  
C.N.E. Grounds      W.O. 72-11101 - W.P. 97-72-01

This will acknowledge receipt of your memo dated January 30, 1973. Attached are copies of Authorization Letter and Restoration Permit obtained from the Metro Park Commission.

Should additional information be required, please feel free to contact this Office.

CSP/ao  
Attch.

  
C. S. Poon,  
Project Foundations Engineer,  
For: M. Devata,  
Supervising Foundations Engineer.



MEMORANDUM

TO: Foundations Office,  
West Building, Downsview

FROM: Insurance & Claims Section,  
Downsview

*M. Devata*

ATTENTION: Mr. ~~K. G. Selby~~, Supervising  
Foundations Engineer

DATE: January 30, 1973

OUR FILE REF. 346-72-GL

IN REPLY TO

SUBJECT: Damage to Fire Hydrant at CNE

Thank you for your memo of January 3.

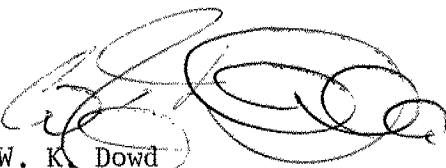
As you know we wrote to The Municipality of Metropolitan Toronto on January 15th and we have now received a letter from them dated January 24, a copy of which is attached.

The Municipality contends that an official of our Design Branch completed an agreement assuming complete liability for damaged services.

Presumably that agreement is available and I would ask that you submit a copy of it so that we might determine exactly what obligations we assumed. The Municipality also states that any connections made to services had to be approved by the owner and that in this case our contractor did not have this approval.

Depending on the terms of the agreement it would appear that we cannot hold the contractor responsible and it may well be that we may have to consider paying this claim ourselves.

I shall look forward to hearing from you at your earliest convenience.

  
W. K. Dowd  
Claims Supervisor  
Insurance & Claims Section

WKD: dg

Att.

THOMAS W. THOMPSON, B.S.A.  
PARKS COMMISSIONER



CITY HALL  
100 QUEEN STREET WEST  
TORONTO 100, ONTARIO

367-8171.

## THE MUNICIPALITY OF METROPOLITAN TORONTO

### PARKS DEPARTMENT

January 24, 1973.

Mr. W. K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section,  
Ministry of Transportation and Communications,  
Downsview, Ontario.

Dear Sir:

In reply to your letter of January 15, your File No. 346-72-GL, an official of your Design Services Branch completed an application for construction in the name of the Ministry assuming complete liability for damaged services. The application also clearly states that connections made to services other than the applicant's must be approved by the owner of such service. Your contractor had no such approval.

Your application makes you responsible and I shall look to you for the cost of repairs and any charge for water consumed by this unauthorized use by your contractor.

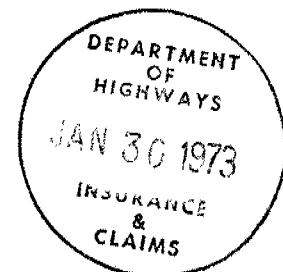
Invoices for water used at Exhibition Park are issued by the Canadian National Exhibition Association.

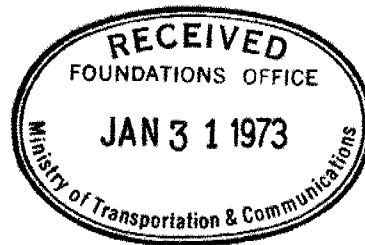
Yours very truly,

Metropolitan Parks Commissioner.

SAS:mm

cc: Mr. L. Bowman.  
Mr. Walter,  
Treasurer,  
Canadian National Exhibition Association.





72-11101

Downsview, Ontario

January 15, 1973

Our File # 346-72-GL

The Municipality of Metropolitan Toronto  
Parks Department  
City Hall  
TORONTO 100, Ontario

Dear Sirs:

RE: Damage to Fire Hydrant at CNE.

We refer to our letter of January 2 and wish to advise you that we have now received a report from our Project Foundations Engineer.

The fire hydrant in question was used for diamond drilling on September 14, 1972 by our drilling contractor, Master Soil Investigation Co., Toronto. Our Contractor operates as an independent entity and not as a servant or agent of the Crown, and would be responsible for his own actions. From the information available to us surrounding the circumstances of the accident, the damage was not due to any negligence on the part of the Ministry or contractor's personnel, but could be attributed to the hydrant's internal mechanical problems or worn out parts.

However we have referred the matter to Master Soil Investigation Co. together with a copy of your invoice in the sum of \$115.00, and you will no doubt be hearing from them in the very near future.

Yours very truly,

W. K. Dowd  
Claims Supervisor  
Insurance & Claims Section

WKD:dd

c.c. - Master Soil Investigation Co.  
104 Kenhar St.  
Woodbridge, Ontario

b.c.c. - Mr. C. S. Poon  
Proj. Foundations Eng.  
Foundations Office  
Design Services Branch, West. Bldg.



Downsview, Ontario

January 15, 1973

Our File # 346-72-GL

Master Soil Investigation Co.  
104 Kenhar Street  
WOODBIDGE, Ontario

Dear Sirs:

RE: Damage to Fire Hydrant - CNE Grounds @ September 14, 1972.

We are enclosing for your attention an invoice in the sum of \$115.00 which we have received from the Municipality of Metropolitan Toronto, with regard to damages to a fire hydrant at the CNE.

We have been advised by our Foundations Engineer, Mr. C. S. Poon, that the hydrant was used for diamond drilling on the above date and that because it was not possible to switch off the hydro at the end of the work, damage resulted.

We have written to the Municipality of Metropolitan Toronto as per copy of our letter attached and advised them of our views on the matter. However, as the work in question was undertaken by your company and as you operate as an independant entity and not as a servant or agent of the Crown, we would be obliged if you would please make your own investigation of the incident and arrange to contact the Municipality so that this matter can be resolved.

Yours very truly,

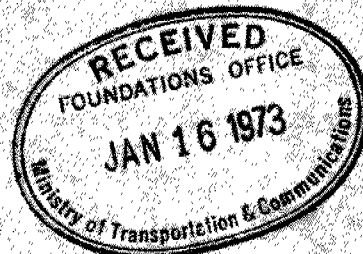
W. K. Dowd  
Claims Supervisor  
Insurance & Claims Section

WKD:dd  
Encl.

b.c.c. - The Municipality of Metropolitan Toronto

- Mr. C. S. Poon, Foundations Engineer





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Mr. W. K. Dowd,  
Claims Supervisor,  
Insurance & Claims Section,  
East Building

Foundations Office,  
Design Services Branch,  
West Building.

January 3, 1973.

Damage to Fire Hydrant, (File #346-72-GL)

C.N.E. Grounds

W.O. 72--1101

W.P. 72-72-01

The above-mentioned fire hydrant was used for diamond drilling on September 14th, 1972 by our Drilling Contractor, Master Soil Investigation Co., Toronto. Prior to this, necessary permission was obtained from the Work Dept. of C.N.E. Grounds. At the end of the day, it was not possible to switch off the hydrant and immediately this incident was reported to the Work Department of C.N.E. Grounds. As instructed by Work Department personnel hydrant water was shut off by closing the hydrant adapter valve. The hydrant water was only used on September 14th, 1972, and during this period extreme care was exercised by our drilling contractor in opening and closing the hydrant valve. To our knowledge the damage was not due to the negligence on the part of the Ministry or contractor personnels. We believe that the damage may be attributed to some internal mechanical problems or worn out parts of the hydrant.

Should you require any additional information regarding the above problem please feel free to contact our Office.

*C.S. Poon*

C. S. Poon,  
Project Foundations Engr.,  
M. Devata,  
Supervising Foundations Engr.

CSP/ck

For:

c.c. Foundations Files ✓  
Documents.

PROPERTY DAMAGE REPORT

REGION: Central

DATE: Jan. 2/1973

IDENTIFICATION OF:



OWNER



TENANT

NAME: Parks Department, Municipality of Metropolitan Toronto

POST OFFICE ADDRESS: City Hall, Toronto 100.

LOCATION: Metro Toronto

DISTRICT 6

HIGHWAY —

TOWNSHIP, LOT AND CONCESSION ETC.

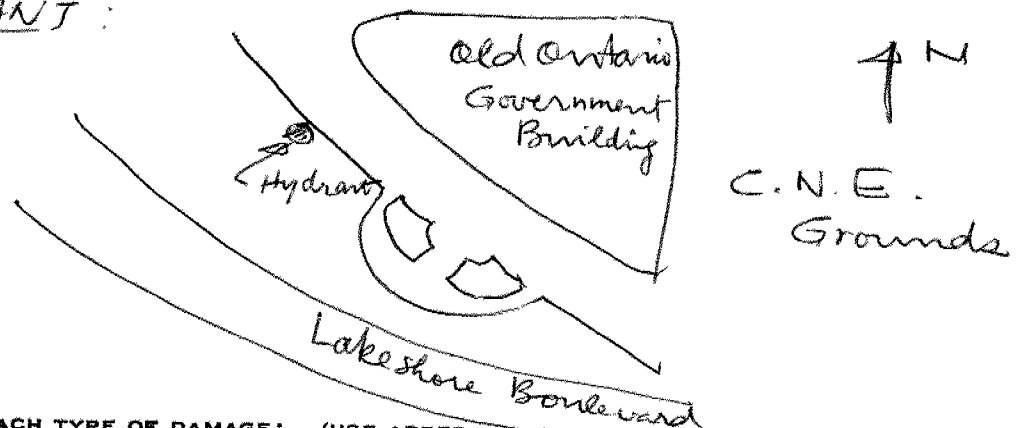
C.N.E. Grounds  
(south of Old Ontario Government Building &  
north of Lakeshore Boulevard)

DETAIL OF DAMAGE:

DATE DAMAGE DONE: Sept. 14/1972

TYPE(S) OF DAMAGE: (CROP, TREES, FENCES, LAWNS, FLOWER BEDS, ORNAMENTAL PLANTINGS ETC.)

FIRE HYDRANT:



DETAILED DESCRIPTION OF EACH TYPE OF DAMAGE: (USE ADDED SHEETS IF REQUIRED)

The above-mentioned fire hydrant was used on Sept. 14/1972 for diamond drilling. (Driller's name: G. Segenais of Master Soil Investigation Co. Toronto) It was unable to switch off the hydrant at the end of the day. This was reported to Work Department of C.N.E. Grounds. ~~It was instructed to leave the hydrant open.~~ Water was shut off by means of closing the valve of hydrant adaptor. ~~It is my opinion that this damage was caused by worn out part(s) of the hydrant.~~ <sup>It is my opinion that this damage was caused by worn out part(s) of the hydrant.</sup>

PROPERTY REQUEST

PARTY CHIEF

C.S. Poon

WORK ORDER

72-11101

SECTION

Foundations Office



72-11101

## MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

## MEMORANDUM

TO: *M. DEVATA*  
Mr. ~~K. G. Selby~~  
Supervising Foundations Eng  
Foundations Office  
West Building, Downsview

FROM: Insurance & Claims Section  
Downsview

ATTENTION:

DATE: January 2, 1973

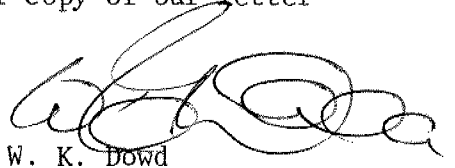
OUR FILE REF. 346-72-GL

IN REPLY TO

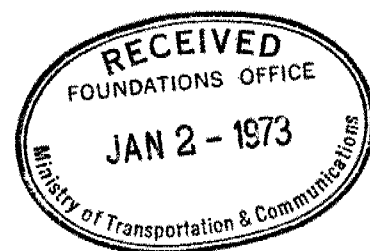
SUBJECT: RE: Damage to Fire Hydrant at CNE.

I wish to confirm my telephone conversation with Mr. Poon last week when I inquired in regard to damage to a fire hydrant at the CNE. I am enclosing a copy of an account which we have received from the Municipality of Metropolitan Toronto in the amount of \$115.00. The account, as you will observe, states that the damage to the fire hydrant was caused by our contractor engaged in soil investigations. May we please have a complete report from your section with regard to this damage, and please advise the name of the contractor involved and the contract number. In the meantime we have acknowledged the account as per copy of our letter attached.

WKD:dd  
Encl

  
W. K. Dowd  
Claims Supervisor  
Insurance & Claims Section

3127



72-11-101



TELEPHONE  
367-8180

CITY HALL  
TORONTO 100, CANADA

## THE MUNICIPALITY OF METROPOLITAN TORONTO

### PARKS DEPARTMENT

TO Ministry of Transport and Communications,  
Design Service Branch,  
401 and Keele Street,  
Danforth.

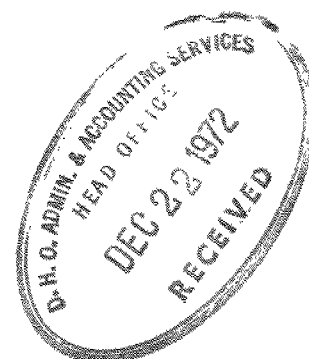
INVOICE NO. 423

TORONTO December 20th., 19 72

YOUR ORDER NO.

DATE	PARTICULARS	AMOUNT	TOTAL
	<u>Re: Damages to a fire hydrant at the Canadian National Exhibition (south of the old Ontario Government Building &amp; north of Lakeshore Boulevard) by your contractor engaged on soil investigations.</u>		
	<u>TOTAL COSTS of repairs to damaged hydrant as per</u>		
	Silvio Construction Ltd. invoice 155 - Voucher 3246 =	100 00	
	Plus 15% overhead charges (supervision & administration)	<u>15 00</u>	<u>\$ 115 00</u>

Please return one copy of this invoice with your remittance made payable to the MUNICIPALITY OF METROPOLITAN TORONTO.



72-11-101

Downsview, Ontario

January 2, 1973

Our File # 346-72-GL

The Municipality of Metropolitan Toronto  
Parks Department  
City Hall  
Toronto 100, Ontario

Dear Sirs:

RE: Damage to Fire Hydrant at CNE.

We acknowledge receipt of your invoice no 423 dated December 20, 1972 in regard to the above matter.

We are looking into the situation and will be in touch with you in the near future.

Yours very truly,

  
W. K. Dowd  
Claims Supervisor  
Insurance & Claims Section

WKD:dd

b.c.c - Mr K G Selby  
Foundations Office

72-11101

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

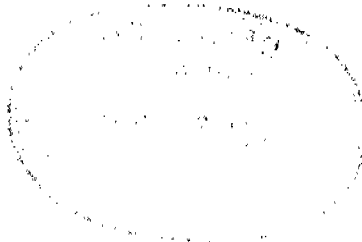
TO: Mr A. G. Stermac  
Principal Foundations Engineer  
Foundations Office  
Design Services Branch  
ATTENTION: West Building

FROM: M. D. Harmelink, Head  
Urban Systems Research

DATE: October 6, 1972

OUR FILE REF. IN REPLY TO

SUBJECT:



I should like to express my thanks and appreciation, somewhat belatedly, to you and your staff for the cooperation and speed with which you have provided us a report on field tests of the soil conditions on the proposed CNE site for the experimental transit system. The report looks very good and we have already forwarded them on to each of the three developers. Again, many thanks.

*M D Harmelink*

M. D. Harmelink

Mr. A. Stermac,  
Pr. Foundation Engineer.

K. W. Ingham

September 20, 1972

Foundation Investigation - 7211101  
Experimental Rapid Transit Line  
C.N.E. Grounds, Toronto

A series of rock cores and soil samples were examined from 29 boreholes out of a total of 67 drilled at the site. The bedrock intersected in each hole was found to be typical of the Dundas formation, which is itself the characteristic bedrock found in subcrop within the Toronto area.

The rock is predominantly a platy bedded dark grey shale with interbeds of silty limestone and limestone ranging in size from 0.05 ft. to 0.5 ft. The latter constitute only 20 percent or less of the formation but may locally form as much as 30 to 40 percent of the section.

Generally the upper layers of the shale are weathered and moderately to badly fragmented and grade through a thin transition zone of shaly till into the overlying till material. The harder bands of silty limestone and limestone are generally moderately fragmented within this zone which is rarely more than 2 to 4 ft. thick. At some locations there is a partially weathered zone overlying the fresh bedrock in which incipient weathering is present along certain layers, however, for foundation purposes this is considered to be the same as the fresh bedrock.

A brief description of each rock core is given below together with the appropriate bedrock elevation.

Hole No. 1

Bedrock at 234.9

15.5 - 18.0      Dark grey shale; weathered.

18.0 - 23.0      Dark grey shale; frequent thin  
layers of silty limestone and  
limestone.

Hole No. 3

Bedrock at 232.3

16.0 - 24.2      Dark grey shale; occasional  
thin beds of silty limestone and  
limestone, partially weathered  
layers throughout.

Hole No. 5

Bedrock at 237.9

13.0 - 23.0

Dark grey shale, occasional beds of silty limestone and limestone 0.3 ft. to 0.5 ft. in thickness, partially weathered layers throughout.

Hole No. 9

Bedrock at 235.9

16.1 - 24.0

Dark grey shale; thin limestone bands, weathered.

24.0 - 34.0

Dark grey shale; frequent thin bands of silty limestone and limestone.

Hole No. 11

Bedrock at 234.3

18.0 - 27.0

Dark grey shale; occasional thin beds of silty limestone and limestone, partially weathered sections throughout.

Hole No. 13

Bedrock at 233.3

18.5 - 24.0

Dark grey shale, minor thin beds of limestone and silty limestone, weathered.

24.0 - 29.0

Dark grey shale; occasional beds of silty limestone and limestone 0.2 to 0.6 ft. in thickness.

Hole No. 15

Bedrock at 237.5

15.0 - 15.5

Dark grey shale; weathered.

15.5 - 20.5

Dark grey shale.

Hole No. 17

Bedrock at 239.8

18.5 - 22.0

Dark grey shale; thin beds of limestone, weathered.

22.0 - 29.0

Dark grey shale; minor thin beds of silty limestone and limestone.



<u>Hole No. 19</u>	Bedrock at 241.1
24.0 - 25.0	Dark grey shale; weathered.
25.0 - 30.0	Dark grey shale; occasional thin beds of silty limestone and limestone.
<u>Hole No. 23</u>	Bedrock at 242.8
31.5 - 36.5	Dark grey shale; minor thin limestone beds.
<u>Hole No. 25</u>	Bedrock at 250.4
24.0 - 33.0	Dark grey shale; minor thin limestone beds, weathered.
33.0 - 38.0	Dark grey shale; minor thin limestone beds.
<u>Hole No. 27</u>	Bedrock at 246.0
28.0 - 33.5	Dark grey shale; occasional thin beds of silty limestone and limestone, partially weathered throughout.
33.5 - 38.5	Dark grey shale; occasional beds of silty limestone.
<u>Hole No. 29</u>	Bedrock at 246.6
29.0 - 30.0	Dark grey shale; minor thin beds of limestone and silty limestone, weathered.
30.0 - 35.2	Dark grey shale; occasional beds of silty limestone and limestone 0.2 ft. to 0.5 ft. in thickness.
<u>Hole No. 31</u>	Bedrock at 252.8
21.0 - 24.0	Dark grey shale; weathered.
24.0 - 29.0	Dark grey shale; occasional thin beds of silty limestone and limestone.



Hole No. 33

Bedrock at 257.7

18.5 - 20.0 Dark grey shale; weathered.

20.0 - 25.0 Dark grey shale; frequent beds of silty limestone and limestone 0.1 ft. to 0.6 ft. in thickness.

Hole No. 35

Bedrock at 253.7

27.0 - 29.0 Dark grey shale; weathered.

29.0 - 34.0 Dark grey shale; occasional beds of limestone and silty limestone.

Hole No. 37

Bedrock at 256.5

32.0 - 33.7 Dark grey shale; weathered.

33.7 - 38.5 Dark grey shale; frequent beds of silty limestone 0.2 ft. to 0.5 ft. in thickness, minor thin beds of limestone.

Hole No. 39

Bedrock at 257.9

27.0 - 30.0 Dark grey shale; weathered.

30.0 - 35.0 Dark grey shale; occasional thin beds of silty limestone and limestone.

Hole No. 41

Bedrock at 257.4

28.0 - 37.5 Dark grey shale; frequent beds of silty limestone and limestone 0.1 ft. to 0.4 ft. in thickness.

Hole No. 43

Bedrock at 260.3

27.5 - 28.0 Dark grey shale; weathered.

28.0 - 33.2 Dark grey shale; minor thin limestone beds.

Hole No. 45

Bedrock at 259.5

18.5 - 21.0 Dark grey shale; weathered, may include part of transition zone from overlying till.

21.0 - 27.2 Dark grey shale; frequent beds of silty limestone, minor thin beds of limestone.

Hole No. 47

Bedrock at 256.0

15.0 - 18.0

Dark grey shale; weathered.

18.0 - 23.1

Dark grey shale; occasional beds of silty limestone, minor thin beds of limestone.

Hole No. 49

Bedrock at 248.7

16.0 - 18.2

Dark grey shale; minor thin limestone bands, weathered.

18.2 - 19.9

Silty limestone and limestone in beds 0.3 ft. to 0.8 ft. in thickness.

19.9 - 22.4

Dark grey shale; occasional beds of limestone, minor thin beds of silty limestone.

Hole No. 51

Bedrock at 243.3

17.5 - 21.8

Dark grey shale; minor thin beds of limestone and silty limestone, partially weathered throughout.

Hole No. 53

Bedrock at 242.7

18.7 - 21.1

Silty limestone; minor thin beds of limestone and shale.

21.1 - 28.7

Dark grey shale; minor beds of silty limestone and limestone, occasional partially weathered sections.

Hole No. 55

Bedrock at 240.6

19.5 - 26.3

Dark grey shale; occasional beds of silty limestone and limestone, partially weathered throughout.

Hole No. 57

Bedrock at 242.3

9.5 - 12.5

Dark grey shale; minor thin beds of silty limestone and limestone, weathered in the top 2.0 ft. partially weathered in the lower 1.0 ft.

Hole No. 59

Bedrock at 237.4

12.6 - 13.6

Dark grey shale; minor beds of silty limestone and limestone, partially weathered throughout.

13.6 - 17.8

Dark grey shale; minor thin beds of limestone.



K. W. Ingham,  
Geologist.

KWI:mv

Design Services Branch,  
Downsview, Ontario.  
September 11, 1972.

Telephone: 248-3282.

Dominion Soil Investigation Ltd.,  
104 Crockford Blvd.,  
Scarborough, Ontario.

Dear Sirs:

This letter confirms our request of August 25, 1972, for the supply of two auger machines (CME 750 & CME 55) together with all necessary equipment, as specified under the terms of our Contract Agreement, at CNE grounds, Toronto on September 5, 1972.

Mobilization will be from your yard in Scarborough, Ontario.

Our Project Number is W.O. 72-11101.

Yours truly,



M. Devata,  
Supervising Foundations Engineer,  
A. G. Stermac,  
Principal Foundations Engineer.

MD/ao

For:

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

Foundations Files ✓  
Documents

Design Services Branch,  
Downsview, Ontario.  
September 11, 1972.

Telephone: 248-3282.

H. Q. Golder & Associates,  
3151 Wharton Way,  
Mississauga, Ontario.

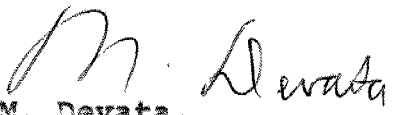
Dear Sirs:

This letter confirms our request of August 25, 1972, for two qualified field supervisors to supervise soil boring operations on our project at CNE grounds starting from September 5, 1972.

Charges will be in accordance with your letter of November 1, 1971.

Our Project Number is W.O. 72-11101.

Yours truly,

  
M. Devata,  
Supervising Foundations Eng.,  
A. G. Stermac,  
Principal Foundations Eng.

MD/ao

For:

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

Foundations Files ✓  
Documents

Design Services Branch,  
Downsview, Ontario.  
September 11, 1972.

Telephone: 248-3282.

Master Soil Investigation,  
104 Kenhar Drive,  
Woodbridge, Ontario.

Dear Sirs:

This letter confirms our request of August 28, 1972, for the supply of two bombardier mounted drilling machines together with all necessary equipment, as specified under the terms of our Contract Agreement, at CNE grounds on September 5, 1972.

Mobilization will be from your yard in Toronto.

Our Project Number is W.O. 72-11101.

Yours truly,



M. Devata,  
Supervising Foundations Engineer,  
A. G. Stermac,  
Principal Foundations Engineer.

MD/ao

For:

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

Foundations Files ✓  
Documents

Design Services Branch,  
Downsview, Ontario.  
September 11, 1972.

Telephone: 248-3282.

Master Soil Investigation,  
104 Kenhar Drive,  
Woodbridge, Ontario.

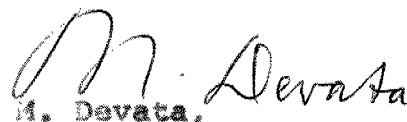
Dear Sirs:

This letter confirms our request of August 15, 1972,  
for the supply of bombardier mounted auger machine together  
with all necessary equipment, as specified under the terms  
of our Contract Agreement, at Belfield & Martingrove Rd. on  
August 23, 1972, in Toronto.

Mobilization will be from yard in Toronto.

Our Project Number is W.O. 72-11100.

Yours truly,

  
M. Devata,

Supervising Foundations Engineer,  
For: A. G. Stermac,  
Principal Foundations Engineer.

MD/ao

cc: W. W. Fry  
(Attn: Mrs. M. Andrews)

Foundations Files ✓  
Documents



# THE MUNICIPALITY OF METROPOLITAN TORONTO

PARKS DEPARTMENT

Planning Division 367-8177

File No. 91-C

## APPLICATION FOR CONSTRUCTION

September 1, 19 72,  
Date

Foundations Office,  
Design Services Branch,  
Ministry of Transportation & Communications, 401 & Keele, Downsview, 248-3282.  
Name of Applicant Address Telephone

Description of Proposed Construction: Size, Type, Length, etc.

Drilling approximately 50 (fifty) 3" diameter holes.

(attached Plan Fig. 2.1)

Attach Plan - Show location of proposed construction, working area required and access route.

September 5, 1972

September 15, 1972.

	Date of Commencement	Date of Completion
1) Master Soil Investigation Ltd.,	104 Kenhar, Woodbridge	749-1062.
2) Dominion Soil Investigation Ltd.,	104 Crockford, Scarborough	751-6565.
3) Canadian Longyear Ltd.	35 Brydon Dr., Rexdale,	743-4540.
Name of Contractor	Address	Telephone

CN APPROVAL OF APPLICATION THE APPLICANT AGREES, AT HIS EXPENSE:

1. To obtain any permit or approval necessary from and comply with all statutes, by-law, ordinances and regulations of any municipal or other body which may be necessary for the lawful execution of the work.
2. To indemnify and save harmless the Metropolitan Corporation, its successors and assigns from any claims, actions, loss, costs or damages arising out of the use by the applicant of the land of the Metropolitan Corporation.
3. To restore the work site area to its original condition, or as approved, leaving no undrained depressions, no litter, and no undue mud or dirt on grass, roads and walks.
4. Pay for loss of any trees to be replaced by the Parks Department.
5. To repair damaged services and facilities whether shown on plan or not.
6. To repair roadway cuts conforming to specification (a) for asphalt surfaced roads or (b) for crushed stone surfaced roads.
7. To notify this Department immediately on completion of the work for an inspection and to supply an 'as built' plan of the work. The applicant further agrees that the Metropolitan Parks Commissioner shall be the sole and only judge of the adequacy of any restoration and replacement.
8. To erect and maintain adequate hoarding around work area.

Crossing or diversion of any water course to be approved by the M.T.R.C.A.  
Storm sewer outfall structural design must be approved by the M.T.R.C.A.  
Connections made to services other than the applicant's must be approved by the owner of such service.

E. S. Poon Project Foundations Engineer  
Signature of Applicant

T. W. Thompson  
Metropolitan Parks Commissioner

### FOR DEPARTMENTAL USE ONLY

Remarks



THE MINISTRY OF TRANSPORTATION & COMMUNICATIONS

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THOMAS W. THOMPSON, B.S.A.  
PARKS COMMISSIONER



22-11101  
CITY HALL  
100 QUEEN STREET WEST  
TORONTO 100, ONTARIO  
367.8177.

THE MUNICIPALITY OF METROPOLITAN TORONTO  
PARKS DEPARTMENT

August 30, 1972.

Mr. M. Devata,  
Supervising Foundations Engineer,  
Ministry of Transportation and Communications,  
Design Services Branch,  
Downsview 464, Ontario.

Dear Sir:

Re: Foundation Investigation; Exhibition Park.

Further to your letter of August 29, 1972, this will authorize your entry onto the above park site commencing on September 5, 1972, for the purpose of drilling approximately 40 boreholes.

Please note that each hole is to be backfilled to the surface immediately on completion. You should obtain a restoration permit for the work from Mr. J. Ponzo of this office (367-8179) as quickly as possible, and all required restoration is to be at your expense.

During the first few days of your work there may be some conflict north of the Pure Food Building, the Horse Palace and Coliseum areas. In such cases, please take your instructions from Mr. Sheffield of the Exhibition staff. You will arrange for the appropriate stakeouts by all public utility agencies.

Yours very truly,

*T. W. Thompson*  
Metropolitan Parks Commissioner.

CR  
CR:mm

cc: Mr. J. Ponzo.

Mr. D. Garrick-Encl.

Mr. Bill Sheffield.

Mr. L. Bowman.

PLEASE WALK ON THE GRASS

THOMAS W. THOMPSON, B.S.A.  
PARKS COMMISSIONER



72-11101  
CITY HALL  
100 QUEEN STREET WEST  
TORONTO 100, ONTARIO  
367-8177.

THE MUNICIPALITY OF METROPOLITAN TORONTO  
PARKS DEPARTMENT

August 30, 1972.

Mr. M. Devata,  
Supervising Foundations Engineer,  
Ministry of Transportation and Communications,  
Design Services Branch,  
Downsview 464, Ontario.

Dear Sir:

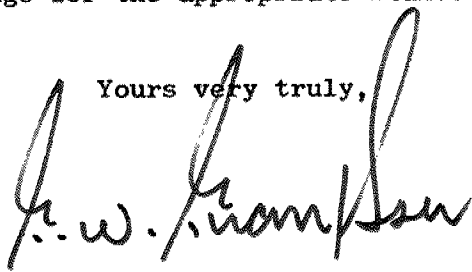
Re: Foundation Investigation; Exhibition Park.

Further to your letter of August 29, 1972, this will authorize your entry onto the above park site commencing on September 5, 1972, for the purpose of drilling approximately 40 boreholes.

Please note that each hole is to be backfilled to the surface immediately on completion. You should obtain a restoration permit for the work from Mr. J. Ponzio of this office (367-8179) as quickly as possible, and all required restoration is to be at your expense.

During the first few days of your work there may be some conflict north of the Pure Food Building, the Horse Palace and Coliseum areas. In such cases, please take your instructions from Mr. Sheffield of the Exhibition staff. You will arrange for the appropriate stakeouts by all public utility agencies.

Yours very truly,

  
Metropolitan Parks Commissioner.

CR

CR:mm

cc: Mr. J. Ponzio.

Mr. D. Garrick-Encl.

Mr. Bill Sheffield.

Mr. L. Bowman.



Design Services Branch,  
Downsview 464, Ontario.  
August 29, 1972.

Telephone: 248-3282.

Mr. C. Roberts,  
Metro Toronto Parks Department,  
10th Floor, East Tower,  
City Hall,  
Toronto, Ontario.

Dear Sir:

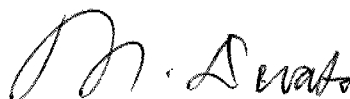
The Ministry of Transportation and Communications is planning to carry out a foundation investigation on CNE grounds for a new intermediate capacity transit system. Our employees may find it necessary to enter your property to obtain engineering information.

Ministry personnel have explicit instructions to exercise extreme care when working on private property. If any damage is done, you may be assured that compensation will be paid.

We respectfully request your co-operation so our work can proceed without delay on September 5, 1972.

If you require further information, please write or telephone.

Yours truly,



M. Devata,

MD/ao

cc: Foundations Office      SUPERVISING FOUNDATIONS ENGINEER.  
Documents

FOUNDATION INVESTIGATION ON CNE  
 GROUNDS FOR AN INTERMEDIATE  
 CAPACITY PUBLIC TRANSIT SYSTEM  
 W.O 72-11101.

- 1) Contacted Mr Robinson (Central Region R/O/W) and discussed about property damage problems.
- 2) Discussed with Mr Barrie, Maintenance Engineer, Dist #6 with regard to possible repairs for any damages to the property during drilling operations.
- 3) Obtained approval to enter CNE grounds by discussing the foundation Investigation Programme with the following  
 Mr Cris Roberto - Metro Parks and Recreation Dept  
 10th floor East Tower  
 367-8177.

Mr Joe Ponzio

" " 367-8179

(given him a print of our proposed system layout).

Mr Sheffield

- CNE grounds 366-7551

Approval granted - Request our Engineers to meet him on 5th Sept/72

- 4) Obtained approval to carry out borings in the vicinity of Ontario Place from the following

Mr Craig Purvis 965-4255

Mr John de Domenico 965-7591 local 6.8

(Chief Administrator)

Mr Mc Keon 965-<sup>7893</sup>~~7583~~

Maintenance Supervisor

## MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

## MEMORANDUM

TO: A. G. Stermac  
Principal Foundations Engineer  
Foundations Office

FROM: M. D. Harmelink, Head  
Urban Systems Research

ATTENTION: M. Devata  
Supervising Foundations Engineer

DATE: August 25, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT:

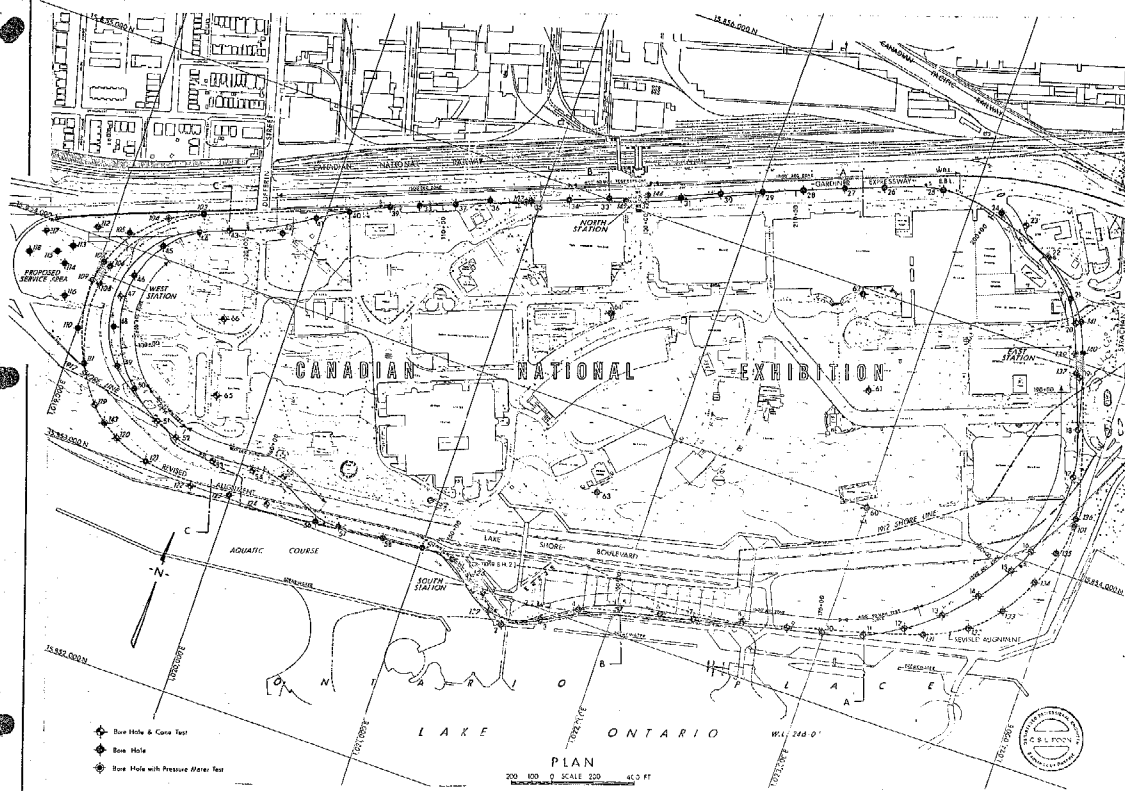
Foundation Investigation on CNE Grounds for an  
Intermediate Capacity Public Transit System

Further to our discussion regarding the Ministry's evaluation of new intermediate capacity transit systems with the objective of selecting the most promising system for a pilot scale testing on CNE grounds in 1973-1974, would you please conduct a basic foundation investigation in order to obtain sufficient data for a preliminary design and cost estimate of the guideway? The proposed horizontal and vertical alignment and location of stations are shown on the plans given you this morning. As you know, our schedule is very tight, and I would appreciate anything you can do to provide us the information as soon as possible.

Thank you for your co-operation.

*M. D. Harmelink*

M. D. Harmelink



BORE HOLE ELEVATIONS & LOCATIONS

NO.	ELEVATION	NO.	ELEVATION
1	12.832	101	12.832
2	12.832	102	12.832
3	12.832	103	12.832
4	12.832	104	12.832
5	12.832	105	12.832
6	12.832	106	12.832
7	12.832	107	12.832
8	12.832	108	12.832
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NOTE: BORE HOLES NOT TO SCALE ARE INDICATED BY A SMALL CIRCLE IN THE 1942 AND 1943 REVISIONS. A TYPICAL BORE HOLE AREA.

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

PROPOSED ELEVATED RAPID TRANSIT SYSTEM  
(INTERMEDIATE CAPACITY)

HIGHWAY NO. \_\_\_\_\_ DIST. NO. 6  
CO. \_\_\_\_\_ METROPOLITAN TORONTO  
EXP. \_\_\_\_\_ LTD. \_\_\_\_\_

BORE HOLE LOCATION PLAN

SHEET NO. 72 OF 72 DRAWING NO. 72-11101-1A  
DATE 22 OCT 1973 SITE NO. \_\_\_\_\_  
APPROVED BY \_\_\_\_\_


BY \_\_\_\_\_



## BORING PLAN

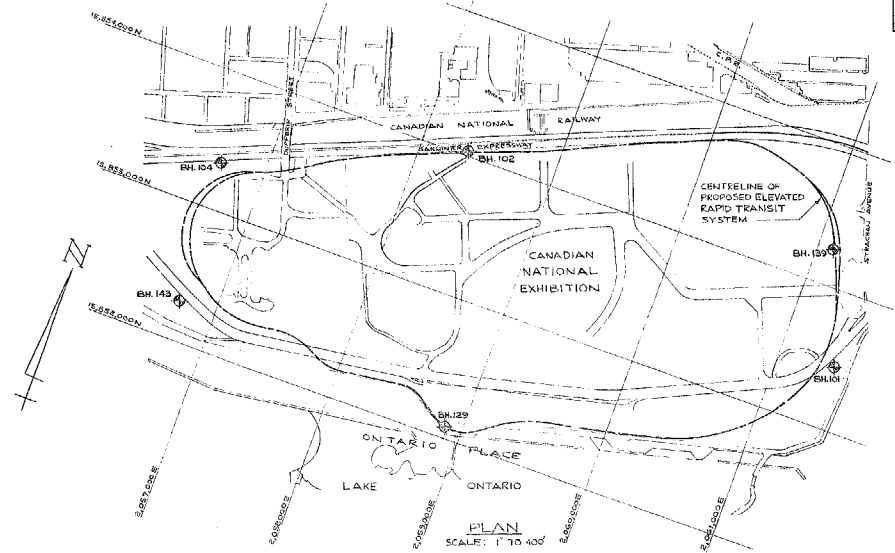
FIGURE 1

## LEGEND

 BOREHOLE LOCATION IN PLAN

## REFERENCE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS,  
ONTARIO, DRAWING "PROPOSED ELEVATED RAPID  
TRANSIT SYSTEM (INTERMEDIATE CAPACITY), TORONTO.  
DRAWING No. 72-11101A, DATED SEPT. 22, 1972.



DATE: MAR. 15, 1973

Golder Associates

Drawn: J. H. H.  
Checked: J. H. H.  
Approved: J. H. H.