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GEOCRES No.

DEPARTMENT OF TRANSPORTATION
AND COMMUNICATIONS

SOIL SURVEY
WP 13-68-01

PROPOSED HIGHWAY 417

GLOUCESTER TWP. ONTARIO.

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Golder Associates

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REPORT

TO

DEPARTMENT OF TRANSPORTATION
AND COMMUNICATIONS

ON

SOIL SURVEY
WP 13-68-01

PROPOSED HIGHWAY 417

GLOUCESTER TWP. ONTARIO.

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May, 1972

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ABSTRACT

The results of a soil survey to determine the cut and subgrade conditions along a 1 mile section of the proposed Highway 417 link between Innes Road and WP 10-69-01 are reported and recommendations are made from a soils viewpoint for the construction of the proposed highway. The detailed soil conditions encountered in the augerholes together with recommended granular depths along various sections of the route are presented on the Soils Profile No.417K9-15, which is not bound into this report.

It was found that north of Green Creek the route is underlain by a stratum of silty sand and gravel and that south of Green Creek the route is generally underlain by an extensive deposit of silty sand. Near the southern limit of this section of the route, the E.B.L. encountered a swamp area underlain by dark brown fibrous peat generally 3 ft. thick, and extending about 100 ft. left and right of the centreline of this lane.

It is considered that adequate supplies of borrow material are available from Hugh M. Grant Ltd. property located just south of this section of the route and from commercial sources located 8 and 13 miles west and southwest of the project. Granular materials are available from the Francon Quarry east of Ottawa and the other commercial sources mentioned above. It is recommended that this contract be called as a Granular "A" base course contract for Deep Strength Asphalt design.

The recommended granular depths for various grade conditions along sections of the route are given in the report.

INTRODUCTION

H. Q. Golder & Associates Ltd., have been retained by the Department of Transportation and Communications, Ontario to carry out a soil survey along the northern 2 miles of the proposed Highway 417 link between Ramsayville and Ottawa, Ontario. The purpose of this investigation was to classify the cut and subgrade materials along the proposed route and, based on this classification, to provide engineering recommendations for the design of the proposed highway and cross road connection. The planning information for the Eastern Parkway connection north of the Ottawa Queensway, the Innes Road connection, and the main Highway 417 route between Innes Road and the Ottawa Queensway was not available at the time of this investigation and separate soils design reports will be issued for these sections.

Generally, this section of the proposed Highway 417 route crosses Greenbelt land presently being used for agricultural purposes. The proposed highway link is to be a divided four lane highway consisting of an open median and two-lane surface widths of 24 ft. The shoulder in the direction of traffic will be 10 feet wide and 6 feet wide along the median side, plus 3 foot rounding. The design is based on 12,000 AADT, 1973 with 11 percent truck traffic.

PROCEDURE

The field work for this soil survey was carried out between November 29, 1971 and April 20, 1972. During this

period, some 125 augerholes were put down to depths of generally from 4 to 6 ft. using a mobile "Sterling" power auger. Some holes were put down to depths of about 10 feet or to auger refusal along the cut sections of the proposed highway route. In addition, about 15 augerholes were put down with a bombardier towed auger machine to depths of from 4 to 6 feet, where the route was inaccessible by truck. The power auger machines were supplied and operated by the F. E. Johnston Drilling Co. Ltd., Ottawa. A field survey in the geographical area of the proposed highway was made in a search for available earth borrow and granular deposits. Several sand and gravel pits in the area were visited. Borings were put down in a potential earth borrow area at the intersection of Innes and Cyrville Roads. The field work was supervised throughout by a member of our engineering staff.

Representative soil samples from the augerholes were brought to our laboratory for detailed examination and testing. The results of the tests are given on the Soils Profile No.417K9-15 and on Figs. 2 to 7.

The elevations of the ground surface at the augerhole locations are referenced to the existing centerline grade along the proposed route.

SITE AND GEOLOGY

The section of proposed Highway 417 under investigation extends about 1 mile southeasterly towards Ramsayville, Ontario

from Innes Road, between Cyrville Road and Sheffield Road. The proposed route traverses relatively flat land which was formerly a river valley terrace. Active drainage courses have cut fairly steep sided valleys into this fairly flat area.

From available geological information it is known that this section of the proposed highway lies within the physiographic region known as the Ottawa Valley Clay Plains. The area is generally one of low relief characterized by flat clay plains interrupted by ridges of rock or sand. This lowlying flat area is believed to have been the old route of the Ottawa River; the Mer Bleue peat bog occupies a section of this old river bed beginning about 2 miles east of the proposed route. Along the southern and central portions of the route, bedrock consists of shales of the Carlsbad formation; the northern portion of the route is underlain by shale bedrock of the Billings formation. In general, bedrock is overlain by a relatively thin deposit of glacial till followed in most areas by variable thicknesses of silty sands. At the southern end of this section of the route, the glacial till is overlain by silty clay of variable thickness. Locally, minor surficial coverings of fluvial sands exist.

SOIL CONDITIONS

The detailed soil stratigraphy encountered in each augerhole is given on the Soils Profile No.417K9-15. The limits of the longitudinal extent of the subgrade soils are shown on Fig. 1. Following is a summarized account of the

soil stratigraphy along the route, proceeding from the southern limit to Innes Road.

Generally, a surficial covering of about 1 ft. of topsoil was encountered along the entire route.

Between stations 258+18 to 244+00 West Bound Lane and 248+11 to 242+00 East Bound Lane, the topsoil is underlain by a shallow deposit of fluvial silty sand. Due to the silt and very fine sand content of the material, this sand is generally considered to be frost susceptible and unacceptable for earth borrow. This sand is underlain by grey brown silty clay generally of a very stiff consistency. The measured moisture content of this clay ranged from 27 percent near the upper surface of the clay to 44 percent at a depth of 80 inches.

The East Bound Lane bisects a low swamp area between stations 241+00 and 234+00. A 50 ft. grid of augerholes was put down in this bog area as shown on the Soils Profile. Dark brown fibrous peat was encountered as far as 100 ft. to the left and right of the centerline of this lane and as deep as 5 ft. at station 238+50 E.B.L. Generally, the thickness of this organic material ranges between 0.5 ft. and 3 ft. The peat is underlain by 1 to 2 ft. of silty fine sand, the grading of which is shown on Fig. 2, followed by grey brown to grey silty clay generally of a very stiff to stiff consistency.

Northwesterly from stations 234+00 E.B.L. and 244+00 W.B.L. to Innes Road the subgrade soil under the topsoil consists of silty sand with a trace to some gravel and

occasional seams of clayey silt. Southeast of Green Creek this subgrade sand is generally unacceptable for earth fill due to the high silt and very fine sand content. The results of grading tests on samples of this material are shown on Fig. 3. Northwest of Green Creek, this sandy material contains more gravel and coarse sand. This section of the route is to be in cut and the 3 ft. of excavated material would be acceptable for earth fill on the project. Grading test results are shown on Figs. 4 and 5.

EARTH BORROW AND GRANULAR MATERIAL

A study was made of the available granular deposits in the area of the proposed highway. The locations of the areas and pits examined in the immediate area of the proposed route are shown on Fig. 1.

Near the southern end of the section of highway under investigation, two sand ridges flank the highway route on the east side. The more northerly sand ridge, consisting of silty sands, is owned for the most part by the Federal Government and it is not expected that this material will be made available to the contract.

The southern ridge also consists of silty sands. The eastern tip of this ridge (at the east end of Ridge Road) was formerly used as a sand pit. A sample of this sand was brought to our laboratory for testing and the results of this testing as shown on Fig. 6 indicate that this sand meets a modified D.T.C. Sand Cushion (Granular "C") specification. This land area was acquired by the National Capital Commission

about 10 years ago and it is assumed that the pit has not been used since that time. It is doubtful at this time that this sand pit would be made available to this contract. The haul distance, however, is about 4 miles.

Near the southern end of this section of the route, Hugh M. Grant Ltd. owns a 40 acre parcel of land on Hawthorne Road. This property is covered by about 1 foot of topsoil followed by about 3 feet of sandy silt till over shale bedrock of the Carlsbad formation. The glacial till deposit is a suitable earth fill material. In a test trench the underlying shale bedrock was found to be rippable using a large bulldozer. This rockfill would be acceptable fill for this project. The haul distance is about 2.5 to 3 miles.

On the south side of Innes Road near the intersection of Cyrville Road and between the hydro power line on the east and Green Creek on the west, private property exists that is owned by Messrs. Woodburn, Kehoe, and Lancaster. On this land, topsoil is generally underlain by 6 to 20 ft. of sand followed by sandy silt till to depths of from 12 to 29 ft. Samples of the granular material on this property were brought to our laboratory and tested. The results of this testing are shown on Fig. 7 and indicate that only the sandy material is acceptable for earth borrow fill; the sandy silt till is not acceptable for earth borrow fill due to its high silt content. A detailed log of the borings put down on Kehoe

property is given on the Record of Borehole sheets along with a sketch plan of the site in Appendix A, following the text of this report. It is estimated that about 175,000 cu.yds. of acceptable earth fill exist on these properties.

On the south side of the intersection of Innes Road and Sheffield Road private property owned for the most part by Sheffield Industrial Park Ltd. exists. Previous borings in this area indicate that surface topsoil is underlain by about 5 ft. of silty sand till followed by shale bedrock. The quantity of acceptable earth borrow material available on this property would be small and the owner may want to use it for site grading of industrial lots in the future. It is considered that this material would not be made available to this project.

The sources of earth borrow used in construction of the existing section of Highway 417 (southeast of Ramsayville) appear to be almost depleted. The remaining quantities of earth borrow material at these locations are so small that they are considered impractical as sources of material.

Presently, earth borrow and granular materials are being hauled from commercial sources on Hunt Club Road near the Rideau River (Dibblee and Foster pits) and various commercial sources in the South Gloucester area, south of Ottawa, (Spratt, Osgoode, Dibblee, Frazer-Duntile pits, etc). Enough earth borrow material exists within these sources to supply material to the whole project. Haul distances from

these sources are 8 and 13 miles respectively.

The National Capital Commission owns and operates a large gravel pit about 2.5 miles west of the project. Granular material could be supplied to the project from this source; however, it is doubtful that this material would be made available to the project. Hauling from this source is generally restricted to N.C.C. projects.

Granular material meeting D.T.C. Granular "A" specifications and asphalt aggregate material can be obtained from the Francon Quarry, just east of Ottawa. The haul distance from this location to the project is about 4 miles. The gravel pits in South Gloucester area may also be able to supply the Granular "A" needs of this contract. The Dibblee Quarry on McCarthy Road may be a possible source of Granular "A" material.

GRADELINE

From a soils viewpoint, the proposed gradeline is as shown on the Soils Profile is generally satisfactory. The route is for the most part in shallow fill with a minor cut section at Innes Road. In general the cut material southeast of Green Creek will be unacceptable for use as earth borrow and there is no advantage in lowering the grade further as a means of achieving a better balance in cuts and fills.

ALIGNMENT

The horizontal alignment shown on the Soils Profile is acceptable from a soils viewpoint. Because this section of

the route traverses relatively flat land, there is no great advantage in a shift in horizontal alignment.

RECOMMENDATIONS AND CONSTRUCTION FEATURES

Granular Contract Type

1) Based on the availability of granular material in this area, it is recommended that the project be called as a Granular "A" base course contract for a Deep Strength Asphalt design.

2) In order to provide lateral drainage for the base course and to provide for future widening of the roadway, the granular material should be placed full width in both cuts and fills throughout the entire project.

Granular Depths

3) The recommended granular depth for the various grade conditions along the route are shown on the Soil Profile drawings and are summarized as follows.

a) Fill Conditions

It is expected that sandy fill will make up the earth borrow for this contract. It is recommended that a minimum of 6 inches of G.B.C. Class "A" material be placed over this acceptable earth borrow in fills.

b) At Grade or Cut Conditions

In cut sections in the silty sand and gravel at Innes Road, it is recommended that the route be excavated full width to 18 inches below top of pavement and brought up with 6 inches of G.B.C. Class "A" material followed by the asphalt. The old

road crossings along the route should be excavated to natural subgrade level to provide for a uniform fill condition.

Swamp Treatment

4) A swamp deposit consisting of soft dark brown fibrous peat was encountered along the East Bound Lane extending from station 234+00 to station 240+00. The thickness of this organic deposit varies from 1 ft. to 5 ft. and averages about 3 ft. Due to the relatively shallow thickness of this deposit, it is recommended that this peat be excavated and replaced with acceptable earth borrow material in order to avoid settlement of this section of the highway. To ensure stability of the side slopes, it is recommended that this peat deposit be excavated in accordance with a modified D.T.C. standard DD-407 which includes excavation of the peat deposit out to the toe of the embankment slopes.

Subgrade

5) Local silty pockets encountered below the topsoil should be excavated to 4 ft. depth below top of pavement and brought up with sandy earth fill, followed by 6 inches of G.B.C. Class "A" material and asphalt.

Grade Point and Transition Zone Treatment

6) All grade points and transition zones along the highway should be treated in accordance with standard DD-411-A to a minimum depth of 4 feet below profile grade. In this standard "d" should be taken as 48 inches and "t" as 18 inches.

Topsoil and Existing Ditches

7) For estimating purposes, the average depth of topsoil along the route may be taken as 12 inches. All topsoil on the roadway and all topsoil in ditches regardless of the depth of fill to be placed should be removed to avoid any differential settlement of the future roadbed. This requirement should be included in the contract.

Compaction Requirements

8) Because there is no rock excavation on this section of the project, it is assumed that payment for compaction will be included in the earth excavation and borrow items. If compaction is paid by equipment rental, the time should be allotted as 100% for wobble wheel type rollers.

Type of Backfill to Culverts and Structures

* 9) All backfill material to culverts and structures within the zone of frost penetration should be G.B.C. Class "A" material.

Drainage

10) Ditching should be designed to provide drainage to a minimum of 3½ feet below the shoulder of the road as measured from the midpoint of shoulder rounding.

In the cut section at Innes Road the groundwater level is near the proposed subgrade level. Green Creek intersects the highway route at southern end of this cut section. It is recommended in this case that the ditching along this section be modified to lower the groundwater level

in this relatively pervious granular subgrade material with ditches graded back towards Green Creek. This cut section should be excavated to provide for full width lateral drainage to the ditches.

Paving for Highway 417

11) In accordance with the decision of the Pavement Selection Committee, it is recommended that deep strength type "C" pavement, consisting of a total of 12 inches of asphalt surfacing, be provided for this roadway. The make-up of this asphalt should be as follows:

surface course - 1½" HL1
 upper binder course - 1½" HL8
 middle binder courses - 2 @ 2 3/4" HL8
 lower binder course - 1½" HL8

TOTAL - 12"

GSW/FJH/ml
 71818
 May, 1972.

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Golder Associates

APPENDIX A

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_u, 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 hydrometer¹
Q undrained triaxial²
R consolidated undrained triaxial²
S drained triaxial
U unconfined compression
V field vane test

NOTES:

¹Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.

²Undrained triaxial tests in which pore pressures are measured are shown as \bar{Q} or \bar{R} .

LIST OF SYMBOLS

I. GENERAL

π	3.1416
e	base of natural logarithms 2.7183
$\log_e a$ or $\ln a$	natural logarithm of a
$\log_{10} a$ or $\log a$	logarithm of a to base 10
t	time
g	acceleration due to gravity
V	volume
W	weight
M	moment
F	factor of safety

II. STRESS AND STRAIN

u	pore pressure
σ	normal stress
σ'	normal effective stress ($\bar{\sigma}$ is also used)
τ	shear stress
ϵ	linear strain
ϵ_{xy}	shear strain
ν	Poisson's ratio (μ is also used)
E	modulus of linear deformation (Young's modulus)
G	modulus of shear deformation
K	modulus of compressibility
η	coefficient of viscosity

III. SOIL PROPERTIES

(a) Unit weight

γ	unit weight of soil (bulk density)
γ_s	unit weight of solid particles
γ_w	unit weight of water
γ_d	unit dry weight of soil (dry density)
γ'	unit weight of submerged soil
G_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_c	coefficient of consolidation
T_v	time factor $= c_v t / d^2$ (d , drainage path)
U	degree of consolidation

(e) Shear strength

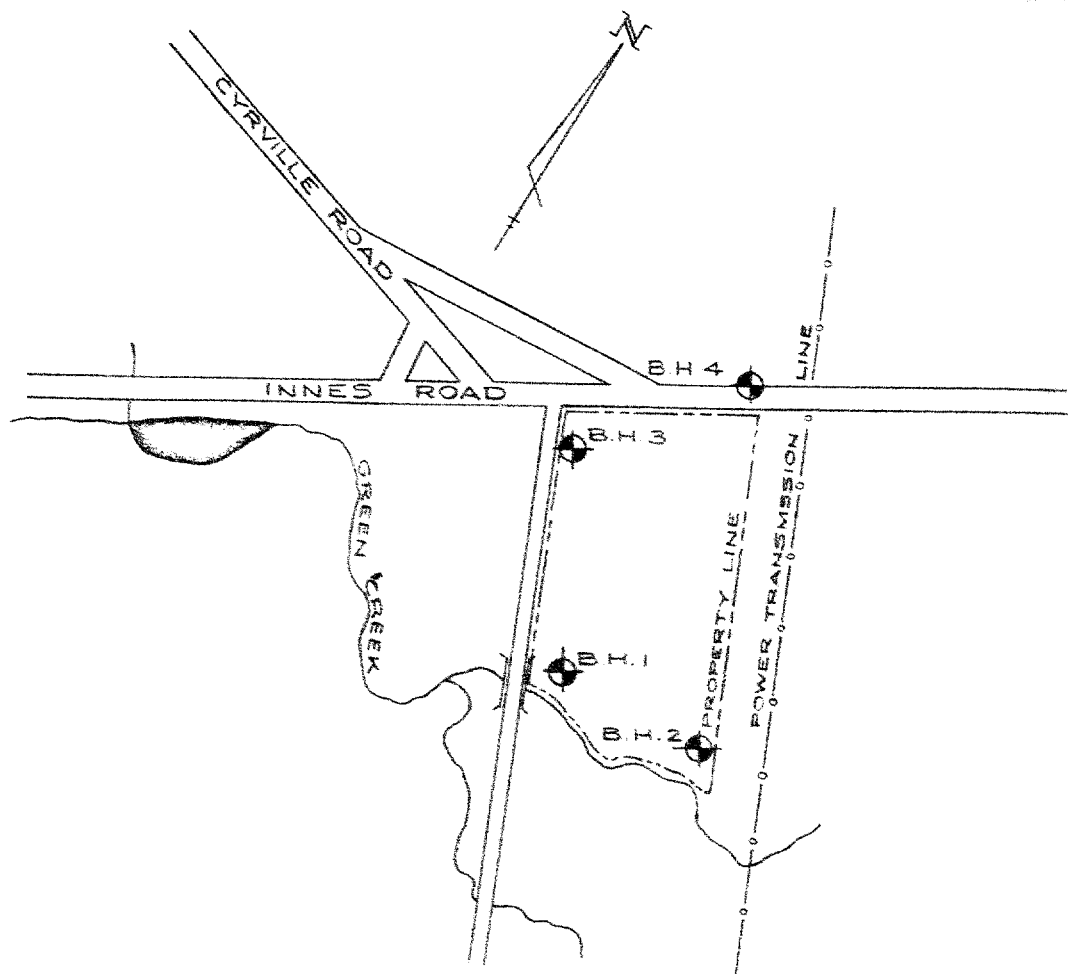
τ_f	shear strength
c'	effective cohesion
ϕ'	effective angle of shearing resistance, or friction
c_u	apparent cohesion*
ϕ_u	apparent angle of shearing resistance, or friction
μ	coefficient of friction
S_r	sensitivity

$$\left. \begin{array}{l} \text{in terms of effective stress} \\ \tau_f = c' + \sigma' \tan \phi' \end{array} \right\} \quad \left. \begin{array}{l} \text{in terms of total stress} \\ \tau_f = c_u + \sigma \tan \phi_u \end{array} \right\}$$

*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.

SKETCH PLAN

FIGURE A 1



SCALE: 1" TO 400' (APPROX.)

LEGEND



BOREHOLE IN PLAN

3165-93

GEOCRES No.

Date MAY 9, 1972

Golder Associates

Drawn *D.N.*
Chkd. *G.S.W.*
Appd. *[Signature]*

3165-93
GEOCREP No.

RECORD OF BOREHOLE 1

LOCATION See Figure A1

BORING DATE APRIL 25, 1972

DATUM

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. PLT	NUMBER	TYPE	BLOWS/FT.		SHEAR STRENGTH Cu., LB./SQ. FT.				WATER CONTENT, PERCENT					
								20	40	60	80	1x10	1x10	1x10	1x10		
POWER AUGER 4" DIAM (UNCASED)	0.0	GROUND SURFACE															
		COMPACT BROWN SAND, TRACE GRAVEL		2		23											
				2		17											
				3		14											
				4		21											
				5		24											
	16.0	DENSE GREY FINE SAND, TRACE SILT															
	19.0	VERY DENSE GREY SANDY SILT TILL		6		95											
				7		100											
	28.9	END OF HOLE REFUSAL PROBABLY BEDROCK															

W.L. IN OPEN HOLE
APRIL 25, 1972
AT 13' DEPTH

RECORD OF BOREHOLE 2 + 3

365-93

LOCATION See Figure A 1

BORING DATE APRIL 25, 1972

DATUM

GEOCRE No.

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.				WATER CONTENT, PERCENT					
POWER AUGER 4 1/2" DIAM (UNCASED)		GROUND SURFACE															
	0.0	TOPSOIL															
	0.6	COMPACT TO VERY DENSE BROWN SILTY FINE SAND		1	2"	15											
	6.0	BROWN COURSE SAND AND GRAVEL		2	"	11											
	10.0	VERY DENSE GREY SANDY SILT TILL		3	"	97											
	16.1	END OF HOLE REFUSAL PROBABLY BEDROCK		4	"	>100											
POWER AUGER 4 1/2" DIAM (UNCASED)		GROUND SURFACE															
	0.0	TOPSOIL															
	0.4	COMPACT GREY BROWN SAND		1	2"	15											
	5.0	COMPACT SAND AND GRAVEL SOME ORGANICS		2	"	12											
	8.0	VERY DENSE GREY SANDY SILT TILL		3	"	>100											
	28.4	END OF HOLE REFUSAL PROBABLY BEDROCK		4	AS												
				5	AS												

BH 2

MH

W.L. IN OPEN HOLE APRIL 25, 1972 AT 102' DEPTH

BH 3

W.L. IN OPEN HOLE APRIL 25, 1972 AT 2' DEPTH

RECORD OF BOREHOLE 4

LOCATION See Figure A1

BORING DATE APRIL 26, 1972

DATUM

3165-93

GEOCREP No.

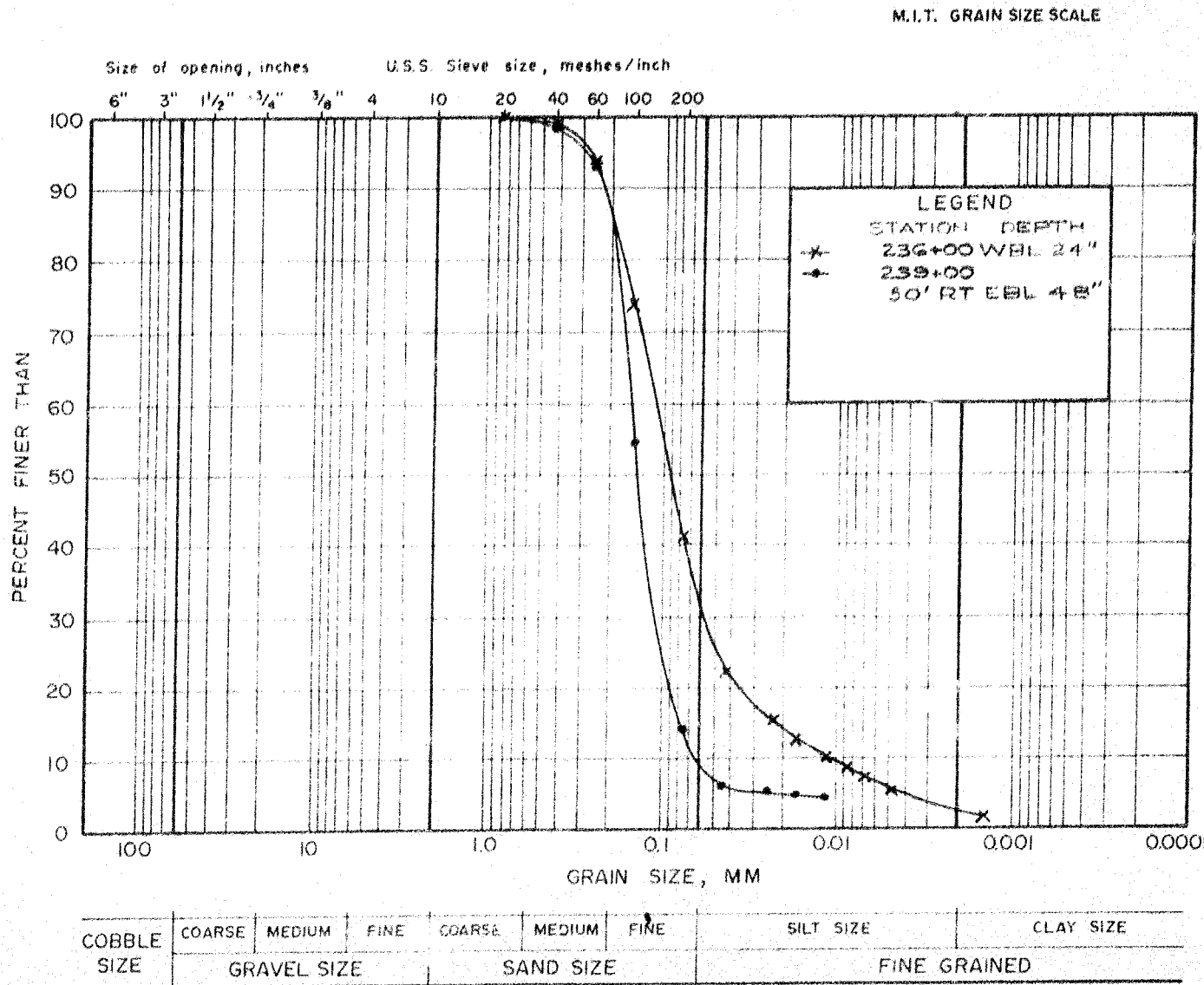
SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN.

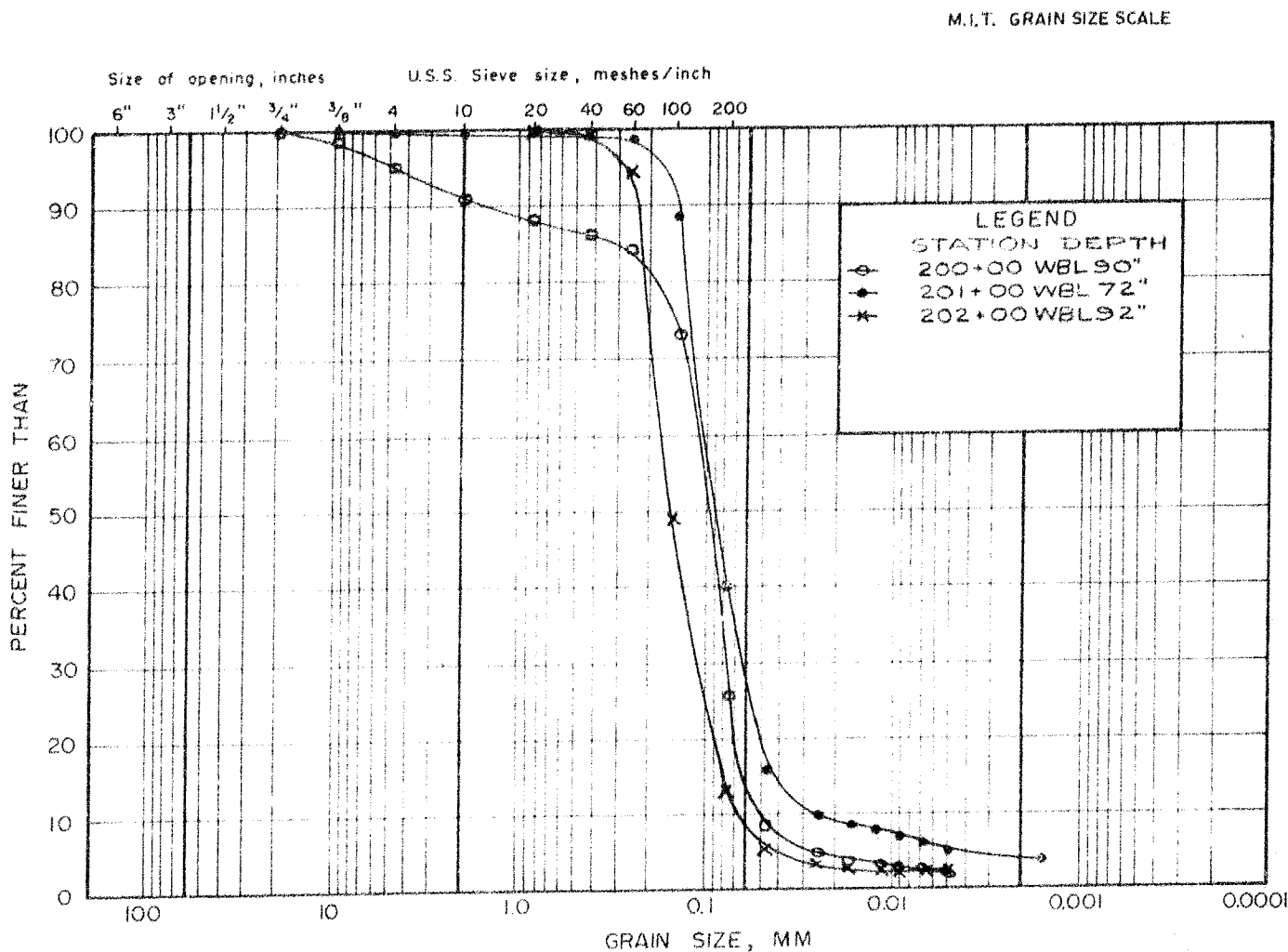
PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT.		COEFFICIENT OF PERMEABILITY, K_v , 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		
POWER AUGER 4 1/2" DIAM (UNCASED)	0.0	GROUND SURFACE													
		BROWN SAND AND GRAVEL (ROADWAY FILL)													
	5.9	DENSE TO VERY DENSE SANDY SILT TILL		1	2"	30									
			2	"	86										
	12.1	END OF HOLE REFUSAL PROBABLY BEDROCK													

HOLE DRY
APRIL 26, 1972

MH





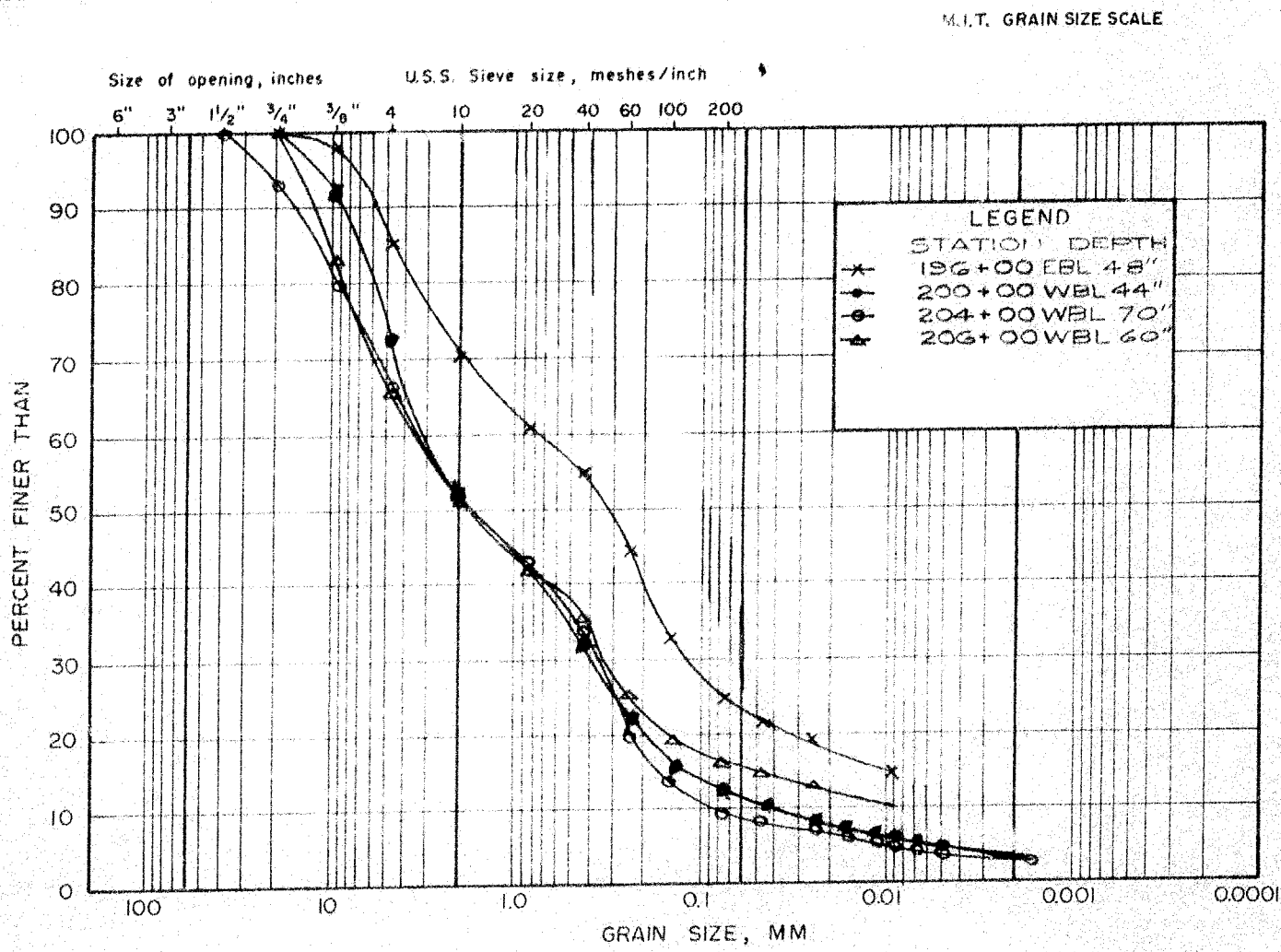
COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE		CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED		

SILTY SAND

GRAIN SIZE DISTRIBUTION

FIGURE 3

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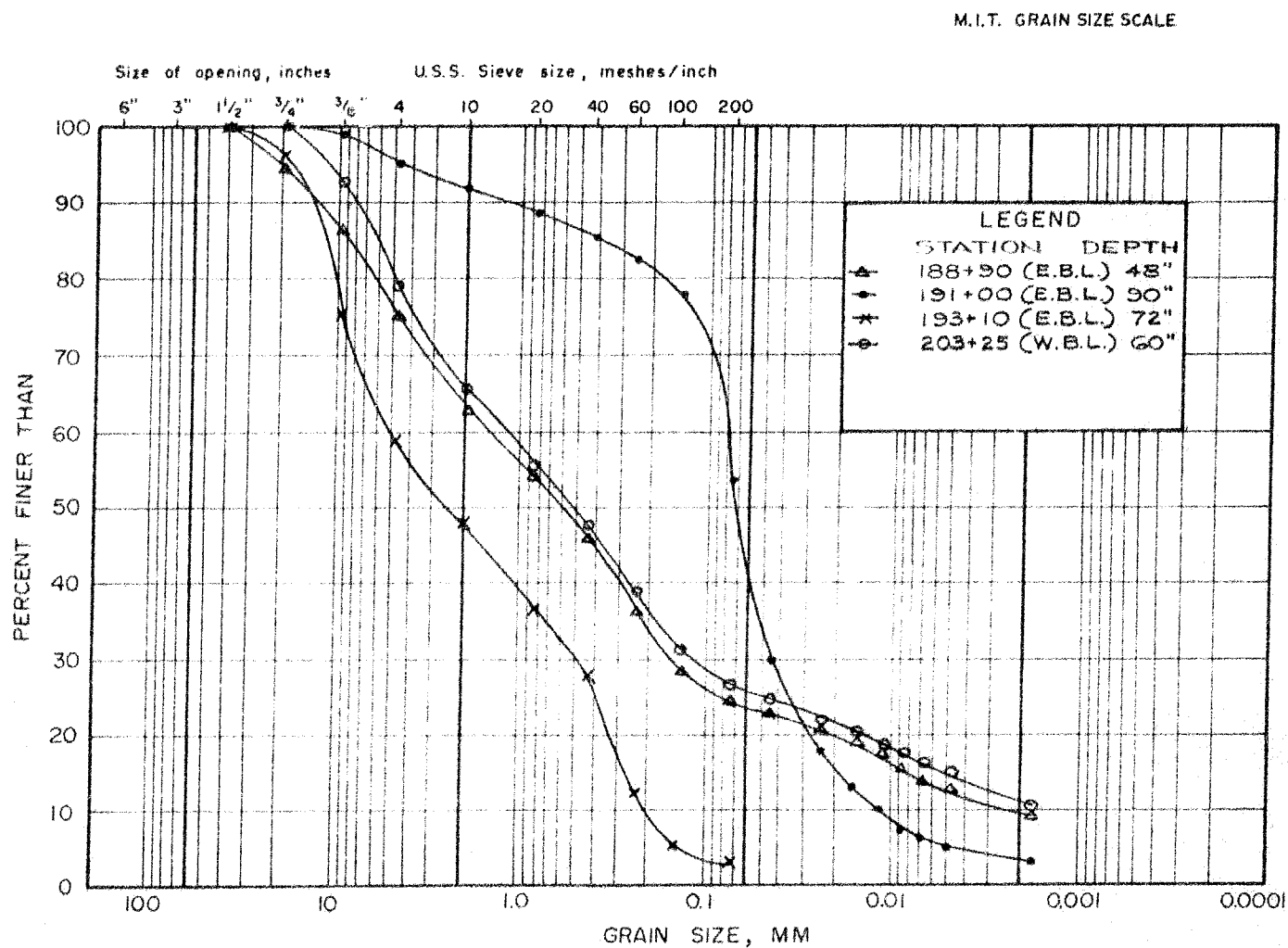


SILTY SAND AND GRAVEL

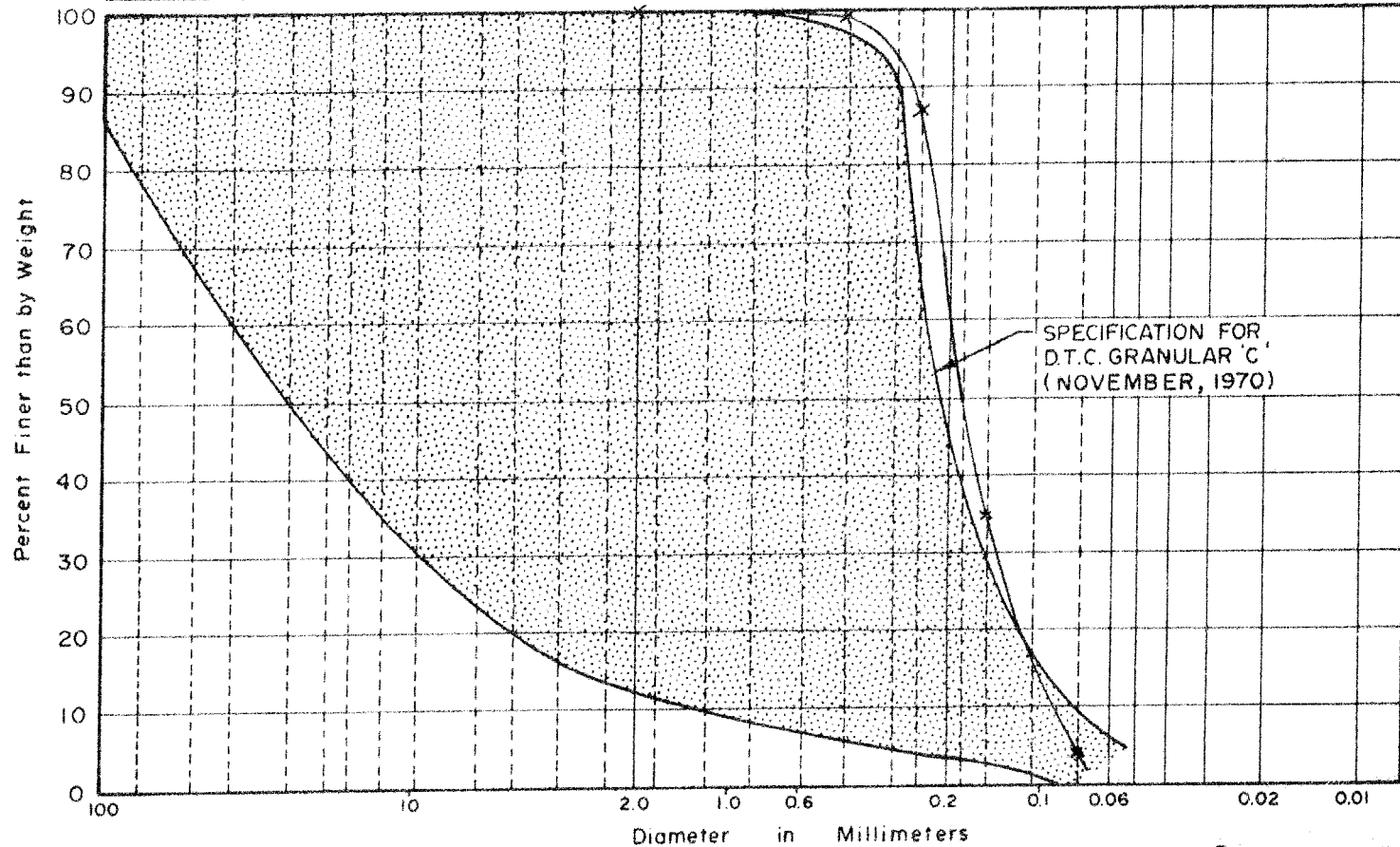
GRAIN SIZE DISTRIBUTION

FIGURE 4

Golder Associates



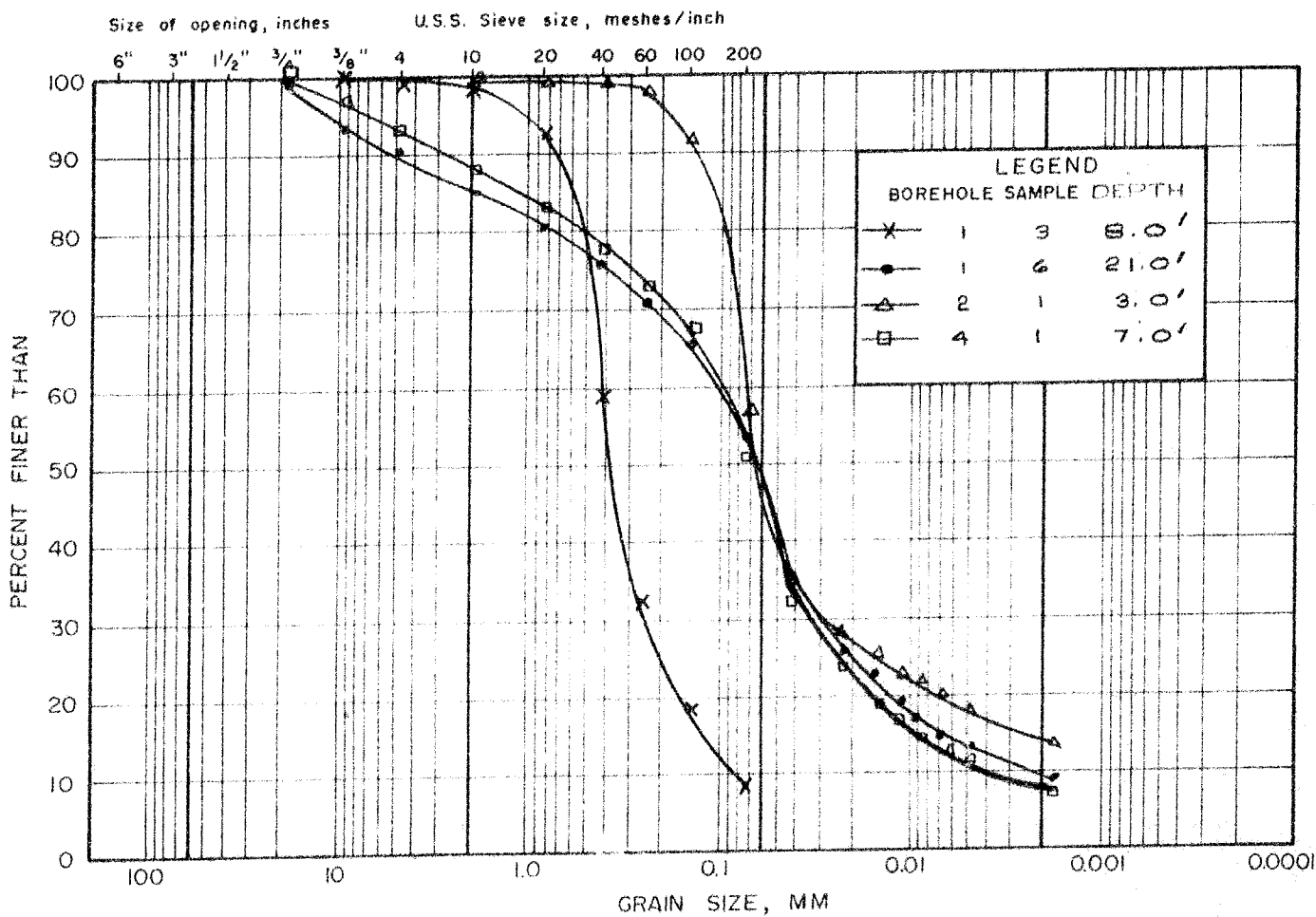
Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 6

M.I.T. GRAIN SIZE SCALE



SAND AND SANDY SILT TILL

GRAIN SIZE DISTRIBUTION

FIGURE 7

Golder Associates

COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE		CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED		

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. T. C. Kingsland, (2)
Regional Structural Planning Engineer,
Eastern Region,
Kingston, Ontario.

FROM: Geotechnical Office,
Engineering Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: January 31, 1974.

OUR FILE REF.

IN REPLY TO

FEB 12 1974

SUBJECT:

3165-93

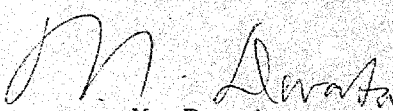
FOUNDATION INVESTIGATION REPORT
For
The Proposed High Mast Illumination
For Hwy. No. 417 Between
Queensway and South of Innes Rd.
Township of Gloucester
Regional Municipality of Ottawa-Carleton
District No. 9 (Ottawa)
W.O. 73-11096 -- W.P. 13-68-01 & -02

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

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

MD/ao
Attch.

C.C. E. J. Orr
B. R. Davis
A. Rutka
A. J. Percy
J. M. Childs
B. J. Giroux
E. R. Saint
G. A. Wrong
B. A. Singh
DeLeuw, Cather & Co. Ltd.


M. Devata,
SUPERVISING FOUNDATIONS ENGINEER.

Files
Documents

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 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
The Proposed High Mast Illumination
For Hwy. No. 417 Between
Queensway and South of Innes Rd.
Township of Gloucester
Regional Municipality of Ottawa-Carleton
District No. 9 (Ottawa)
W.O. 73-11096 -- W.P. 13-68-01 & -12

1. INTRODUCTION:

The Foundations Office was requested to carry out a subsurface investigation for the High Mast Illumination for proposed Hwy. No. 417 extending from the Ottawa Queensway to south of Innes Rd. The request was contained in a memo from the Eastern Region, Structural Planning Office (Mr. T. C. Kingsland, Regional Structural Planning Engineer), dated November 27, 1973. An investigation was subsequently carried out by the Foundations Office to determine the subsoil, bedrock and groundwater conditions at the site.

This report contains the results of the investigation, together with recommendations pertaining to the foundations of the proposed High Mast Illumination.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located along the proposed Hwy. No. 417 between the Ottawa Queensway and south of Innes Rd. in the Township of Gloucester, Regional Municipality of Ottawa-Carleton. The terrain is flat to gently undulating in relief. The land is being used for farming purposes.

The present physical features of the region are of varied origins and are the result of erosion and deposition by various agencies. During a long period of time, previous to Pleistocene or Glacial time, the region was above sea level. During this time the major features of the bedrock topography were formed by processes of weathering and stream erosion. During Pleistocene time the region was invaded by one or more ice sheets advancing from the north. The pre-Glacial land surface was modified by glacial erosion and by deposition in places, of material eroded by the ice sheet. Near the close of Pleistocene times when the ice sheet began to retire, the area was, in large part, below sea level so that as the ice retired or melted back, the sea entered and overspread the Ottawa Valley to a depth, in places, of several hundred feet. In this arm of the sea, known as the Champlain Sea, thick deposits of sand, silt and clay were laid down. As the ice retired still further, uplift took place, the land gradually emerged from the sea. This area is now commonly called "The Ottawa Valley Clay Plain." Here extensive sensitive clay deposits are interrupted by ridges of sand and/or bedrock. The clay is generally underlain by glacial till which is in turn followed by Collingwood and Gloucester shale of the Billings Formation, Ordovician period.

3. FIELD AND LABORATORY WORK:

Seventeen sampled boreholes were put down during the course of the field investigation. In addition, twelve boreholes from previous foundation investigations in this area were incorporated. The borings were advanced by means of a C.M.E. machine (with Hollow Stem Augers) adapted for soil sampling purposes.

Samples were obtained by means of a 2" O.D. split spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. In-situ vane tests were carried out within the cohesive stratum

to determine the undrained shear strength and the sensitivity of the clay.

The groundwater level conditions across the site were determined by recording the water levels in the open boreholes during the course of the investigations.

The locations and elevations of all the boreholes are shown on Drawings No. 73-11096A & B. Estimated stratigraphical sections are also presented on respective drawings. The surveying was carried out by personnel from the Kingston Region, Engineering Surveys Office. All elevations are referenced to Geodetic datum.

All the samples were subjected to careful visual examination both in the field and in the laboratory. Laboratory tests were performed on selected samples to determine the engineering properties of the various soil types; namely,

Natural Moisture Contents

Grain-Size Distributions

Atterberg Limits

The results of the laboratory testing are plotted on the Record of Borehole sheets and summarized on Figure No. 1 to 4, all of which are contained in the Appendix 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 southern part of this region (between Cyrville Road and C.P.R. tracks) is composed of a loose to dense silty sand or sandy silt, which is generally underlain by shale bedrock. At several isolated locations the granular deposit is followed by a thin glacial till deposit which in turn is underlain by shale bedrock.

In the northern part of the site, the predominant stratum is a heterogeneous mixture of clayey silt, sand and gravel (glacial till), which is followed by shale bedrock. The glacial till is generally overlain by a granular deposit, ranging from silty sand to sand and gravel. At certain locations a thin surficial deposit consisting of organic silt or clayey

silt was found. At one boring location near the existing roadway a layer of fill material exists.

The boundaries of the various deposits, as determined in the boreholes, are shown on the individual Record of Borehole sheets as well as on Drawings No. 73-11096A & B. From ground surface downward, the various soil and bedrock types encountered are described in the subsections to follow.

4.2) Surficial Deposit:

4.2.1) Fill Material:

At B.H. #23 which was put down along existing roadway (Ottawa Queensway), fill material consisting of sand and gravel was encountered. The thickness of the fill material is 4.5 ft. (1.5 m). Only one standard penetration test was carried out within the fill material, which gave a 'N' value of 15 blows/ft. (0.3 m). Based on this value, it is estimated that the fill material has been subjected to a moderate degree of compaction.

4.2.2) Organic Silt:

This deposit was encountered immediately beneath the ground surface in Borehole #1, #4, #19 & #20. The thickness of this organic material is 1 ft. (B.H. #20) to 3 ft. (B.H. #4) (0.3 to 1 m).

In situ undrained shear strength testing carried out within this organic material gave values of 480 and 720 p.s.f. (23 to 35 kN/m²). Based on these values, it is estimated that the consistency of the organic deposit ranges from soft to firm.

4.2.3) Clayey Silt, Some Sand:

This deposit was encountered at B.H.'s #22 & #24. It is composed of clayey silt with some sand. The thickness of this stratum ranges from 2.5 feet (0.8 m) (B.H. #24) to 4.5 feet (1.5 m) (B.H. #22). The consistency of this cohesive deposit was found to be ranging from stiff to very stiff.

4.3) Silty Sand to Sandy Silt, Trace of Gravel:

Directly beneath a nominal cover of topsoil at several boring locations or the surficial deposit is a stratum of silty sand to sandy silt, with trace of gravel. The thickness of this granular deposit varies from 3 ft. (1 m) at B.H. #16 to 36 ft. (11 m) at B.H. #30. Occasional seams of clayey silt were found to exist between elevation 211 and elevation 209 in B.H. #11 and between elevation 212 and elevation 207 in B.H. #10. Grain-size distribution curves for representative samples of this granular deposit are in envelope form on Fig. No. 3.

The Standard Penetration Tests, carried out within the granular stratum are plotted on the Record of Borehole sheets.

This testing gave 'N' values which ranged from 2 blows/ft. (0.3 m) to 79 blows/ft. (0.3 m). Based on these values, it is estimated that the relative density of the deposit ranges from very loose to dense.

4.4) Sand, Some Gravel and Trace of Silt:

This granular deposit was found directly beneath a nominal cover of topsoil at about four boring locations in the northern part of the site. It is composed of sand, some gravel and trace of silt. The thickness of this granular stratum varies from 3 ft. (1 m) (B.H. #4) to 10.5 ft. (3.2 m) (B.H. #20).

Grain-size distribution curves for representative samples of this granular deposit are plotted on Figure No. 4 in an envelope form.

The Standard Penetration Tests, carried out within this deposit are plotted on the Record of Borehole sheets. This testing gave 'N' values which ranged from 11 to 60 blows/ft. (0.3 m). Based on these values, it is estimated that the relative density of the deposit ranges from compact to very dense.

4.5) Heterogeneous Mixture of Silt to Clayey Silt, Sand & Gravel (Glacial Till):

This deposit was found overlying the bedrock surface at most of the borings put down at the northern portion of the site. The thickness of the glacial till ranges from 1 ft.

(0.3 m) (B.H. #22) to 14 ft. (4.3 m) (B.H. #13).

The material in the stratum consists of a heterogeneous mixture of silt to clayey silt, sand and gravel (CL-ML). The glacial till is basically cohesive, however, at several locations it is non-plastic.

Laboratory tests carried out on a number of samples indicate the following physical properties:

	<u>Min.-Max.</u>	<u>Average</u>
Natural Moisture Content W (%)	7 - 20	11
Liquid Limit W_L (%)	19 - 32	23
Plastic Limit W_p (%)	12 - 21	16

The Atterberg limit test results, given in the table, are also summarized on the Plasticity Chart, Fig. No. 1 in the Appendix. The test results indicate that the cohesive soil is inorganic with the plasticity in the low range (CL-ML).

Grain-size distribution curves are included in the Appendix of this report (Fig. 2).

Standard penetration testing was carried out within this deposit. The results indicate that the 'N' values vary between 6 and 34 blows/ft. (0.3 m).

The consistency of the overall deposit is estimated to range from firm to hard. For the non-plastic portion of the glacial till, the relative density ranges from dense to very dense.

4.6) Shale Bedrock:

Although bedrock was not proven in any of the borings put down during the course of this foundation investigation, it can be concluded from previous borings (B.H.'s #19 to #30) in the immediate vicinity, that the bedrock is composed of grey calcareous shale.

The upper portion (1.5 to 5 feet) (0.5 to 1.5 m) of the shale is in a weathered and fractured state.

At those boreholes where bedrock was not proven, it is assumed that the bedrock surface is at the level where the

power-driven auger met refusal. The elevations of the bedrock surface are shown on Drawings No. 73-11096A & B.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during the period of the field investigation (December 1973) in open boreholes. The observed water levels are presented on the individual Record of Borehole sheets as well as on Drawing Nos. 73-11096A & B. The results indicate that the groundwater level varies between elevation 195 (B.H. #28) and elevation 231 (B.H. #13) which correspond to levels ranging from 2 to 10 ft. (0.6 to 3 m) below the existing ground surface.

B.H. #29 was put down on the valley floor of Greek Creek. At this location, artesian groundwater pressure was encountered when the boring penetrated into the lower granular stratum. The water rose instantaneously in the casing stabilizing itself at about elevation 205, which corresponds to 2.5 feet (0.8 m) above the ground surface.

6. DISCUSSIONS AND RECOMMENDATIONS:

6.1) General:

The Ministry has undertaken a study to determine the most appropriate illumination requirements for the urban portion of Hwy. #417 extending from the C.P.R. tracks south of Innes Road to the Ottawa Queensway. This study concluded that a High Mast extending some 100 to 115 ft. (30.5 to 35 m) above the ground surface would be the most suitable scheme. Due to the height of the steel poles, the foundations will be subjected to large lateral shear forces and overturning moments. In addition, any lateral or rotational movement of the foundation of the poles will affect the performance of the lowering device and the appearance of the poles. Therefore, the foundations should be designed as rigid as possible.

The subsoil across the site varies considerably from a glacial till matrix in the vicinity of the Ottawa Queensway to silty sand to the south of Innes Rd.

In the subsections to follow, recommendations pertaining to the foundation design of the illumination poles will be given.

6.2) Spread Footings (Pole Nos. 1 to 4 incl., 15 to 20 incl., 24 to 32 incl, 35 and 36):

According to available information (Exhibit 5, High Mast Lighting Steel Pole Spread Foundation, by DeLeuw Cather), the spread footing will be 10' x 10' (3 m x 3 m) in plan in order to withstand the anticipated high lateral shear forces and overturning moments. In addition, the bottom of the footing will be some 7 feet (2.1 m) below the finish grade.

In the area where the above-mentioned poles are located, the subsoil consists of a thin deposit of glacial origin which is underlain by shale bedrock. At several locations, the glacial till is covered by a granular deposit of silty sand or sandy silt or sand and gravel. In all cases, the shale bedrock is generally less than 9 feet (2.7 m) below the finish grade. It is, therefore, recommended that the spread footing be founded on the shale bedrock. Footings founded as recommended may be designed using an allowable bearing pressure of up to 5 t.s.f. (480 kN/m²). To compute the lateral resistance of the footings, a coefficient of friction between the shale bedrock and rough concrete surface of 0.7 may be used, provided that the shale is not softened by groundwater seepage or surface runoff. In this regard, it may be advantageous to cover the shale bedrock with a lean concrete working mat immediately after the foundation excavation is completed.

The foundation excavations will be made through the surficial granular deposit and the glacial till. The groundwater table within the overburden as established during the course of the field investigation is well above the bottom of the excavations. Groundwater seepage into the excavations can be anticipated. This is particularly true at the locations of Pole Nos. 26 to 32 inclusive (between Cyrville Road and Innes Road). However, it is believed that this can be handled

by pumping from perimetric sumps.

6.3) Deep Foundations (Pole Nos. 5 to 14 incl., 21 to 23 incl., 33, 34 and 37 to 46 incl.):

At these locations, the shale bedrock is overlain by a variable thickness of granular deposit, ranging from silty sand or sandy silt to sand and gravel. It is estimated that the shale bedrock is from 12 feet (3.6 m) to 70 feet (21.3 m) below the finish grade.

The poles may be supported on cast in place concrete caissons of sufficient length to withstand the lateral loads and overturning moment. In designing the caissons, the modulus of subgrade reaction for various soil and bedrock types given in the following table may be used.

Modulus of Horizontal Subgrade Reaction (k_h)
For Caisson With 4 Ft. Diameter

<u>Soil and Bedrock Type</u>	<u>k_h in Tons/ft.²/ft. (MN/m²/m)</u>	
Fill Material	5	(1.6)
Silty Sand or Sand and Gravel	20	(6.3)
Glacial Till	30	(9.4)
Shale	240	(75.4)

At certain locations where the shale bedrock is at shallow depth it may be necessary to socket the caisson into the bedrock.

On order to minimize the dewatering problems, the caissons should be constructed with a temporary liner. This is particularly true in the vicinity of the Green Creek Valley where an artesian pressure head exists within the lower granular deposit. It should be noted that the shale bedrock is generally fractured and groundwater may readily percolate into the linear from the base of the caisson. In such a case, a tremie concrete seal will be necessary at the base of the caisson.

Alternatively, the poles may be supported on end-

bearing battered piles driven to the shale bedrock, especially for those poles south of the Innes Road structure, where up to 35 feet of fill will be placed above the existing ground. The batter of the piles should be determined by the magnitude of the lateral loads. The design load of the pile driven to bedrock will depend on the type and size of pile chosen. In all cases, the maximum allowable load of the pile may be used. The underside of the pile cap should be at least 4 feet below the finish grade in order to fulfill frost protection requirements. Recommendations regarding dewatering will be similar to those discussed in Subsection 6.2).

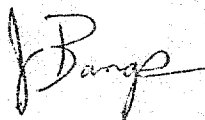
7. MISCELLANEOUS:

The field work was carried out between December 10, 1973, and December 13, 1973, under the supervision of Mr. J. T. Bangs, Project Foundations Engineer.

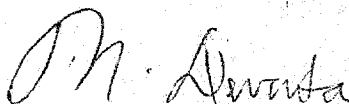
The equipment was owned and operated by F. E. Johnston Ltd. (Ottawa).

This report was written by Messrs. J. T. Bangs and C.S. Poon, Project Foundations Engineers.

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

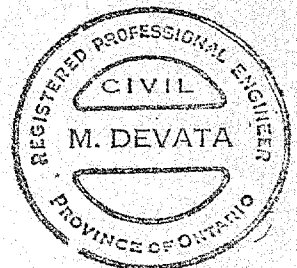


J. T. Bangs, P. Eng.



M. Devata, P. Eng.

JTB/ao
Jan. 30, 1974.



APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 73-11096

LOCATION Co-ords. 16,508,670 N; 1,226,333 E.

ORIGINATED BY JS

W.P. 13-68-01

BORING DATE December 10, 1973

COMPILED BY JS

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Augers

CHECKED BY

SOIL PROFILE			SAMPLES			P.T. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3)			LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L			BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 20 40 60				
70.1	230.0	Ground Level												
0.0	0.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)												
			1	SS	16									
			2	SS	20									
67.1	220.0	Very Stiff Grey	3	SS	15	220								
66.6	218.4	Weathered Shale. Grey	4	SS	36	67								
3.5	11.6	End of Borehole												
						210 64								

OFFICE REPORT ON SOIL EXPLORATION

ORIGINATED BY JB

COMPILED BY JB

CHECKED BY

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 73-11096

LOCATION Co-ords. 16,507,577 N; 1,226,852 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 11, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

CHECKED BY

SOIL PROFILE		SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY Y	REMARK
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT (0.3 m)	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				Wp — W — WL WATER CONTENT % 20 40 60			
m 66.6	218.6	Ground Level												
0.0	0.0	Organic silt												GR SA SL
65.7	215.6	Soft Brown												217.6 66.3
0.9	3.0	Sand and gravel.		1	SS	30	"							
	213.1	Compact Grey		2	SS	17								
	5.5	Het. mix. clayey silt.												40 46 (1)
63.9	209.6	Sa. & Grav. (Giac. Till)												
63.4	208.0	Stiff to Hard. Grey		3	SS	51	210 61							
		Weathered Shale. Grey												
3.2	10.6	End of Borehole												
							200 61							

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5

JOB 73-11096

LOCATION Co-ords. 16,506,950 N; 1,227,370 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 11, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE ft. m	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				w_p	w	w_L		
68.8	225.8	Ground Level													
0.0	0.0	Sand, trace of silt and gravel.	1	SS	1	220 67									2 93 (5) 217.3 66.2 6 79 (15)
		Brown	2	SS	10										
65.6	215.3	Loose to Compact	3	SS	9										
65.2	213.8	Probable gravel	4	SS	7/6										
3.6	12.0	Probable Bedrock refusal End of Borehole				210 64									

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 7

JOB 73-11096 LOCATION Co-ords. 16,505,147 N; 1,227,948 E.
 W.P. 13-68-01 BORING DATE December 11, 1973
 DATUM Geodetic BOREHOLE TYPE CME - Hollow Stem Auger

ORIGINATED BY JB
 COMPILED BY JB
 CHECKED BY JB

		SOIL PROFILE		SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ	REMARKS
m	ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0-3)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % 20 40 60				
63.5	208.2	Ground Level														
0.0	0.0	Het. mix. of clayey silt, sand & gravel (Glacial Till)	1	SS	6										WL not established	
61.2	200.7	Firm to Very Stiff Gray	2	SS	10										18 57 22 3	
2.3	7.5	Probable Bedrock refusal End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 8

JOB 73-11096

LOCATION Co-ords. 16,504,212 N; 1,227,889 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 11, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CMB - Hollow Stem Auger

CHECKED BY *JB*

SOIL PROFILE			SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (C-3)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			W_P — W — W_L WATER CONTENT % 20 40 60				
m 67.3	220.9	Ground Level				220 07								GR SA SI CL
0.0	0.0	Silty sand, trace of clay & gravel.	1	SS	16									9 51 31 9
65.2	213.9	Compact to Dense. Grey Weathered Shale	2	SS	3h									WL not established
2.1	7.0	End of Borehole				210 6L								

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 9

JOB 73-11096

LOCATION Co-ords. 16,504,211 N; 1,329,761 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 11, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

CHECKED BY LD

SOIL PROFILE		SAMPLES			Ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— w _L	PLASTIC LIMIT ——— w _p	WATER CONTENT ——— w	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PILOT	NUMBER	TYPE		BLOWS/FOOT (0-10)	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT % w _p ——— w ——— w _L 20 40 60			
63.6	208.5	Ground Level									
0.0	0.0										
		Brown Grey	1	SS	10	200 61					
		Silty sand, some gravel.	2	SS	2						
			3	SS	7						
			4	AS	-						
		Very Loose to Loose Grey				190 58					
57.6	188.5										
6.0	20.0	End of Borehole				180 55					

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 73-11096

LOCATION Co-ords. 16,503,222N; 1,231,240 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE Dec. 12/73

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - HOLLOW STEM AUGER

CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION		NUMBER	TYPE	BLOWS/FOOT (0.3 m)			SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
66.1	216.8	Ground Level										
0.0	0.0	Silty sand to sandy silt.										
64.7	212.3	Loose Brown	1	SS	6							
1.4	4.5	Clayey silt with seams of silt & sand.	2	SS	1	210						
63.2	207.3	Very Soft Grey				61						
2.9	9.5	Silty sand	3	AS	-							
			4	SS	6	200						
		Loose	5	AS	-	61						
		Grey				190						
56.9	186.8					58						
9.2	30.0	End of Borehole										
						180						
						55						

OFFICE REPORT ON SOIL EXPLORATION

ORIGINATED BY JR

COMPILED BY JB

CHECKED BY

15 $\frac{20}{10}$ 5 % STRAIN AT FAILURE

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 12

JOB 73-11096

LOCATION Co-ords. 16,507,140 N; 1,223,219 E.

W.P. 13-68-01

BORING DATE Dec. 10, 1973

ORIGINATED BY JB

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

CHECKED BY *JB*

SOIL PROFILE			SAMPLES			ft. 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 % 20 40 60			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0-30)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								
m 71.4 0.0	234.4 0.0	Ground Level													
		Met. mix. of clayey silt, sand & gravel.		1	SS	6	230								8 42 39 11
69.0	226.3	Firm to very stiff (Glac. Till) Grey		2	SS	28	70								WL not established
2.4	8.1	Probable Bedrock (refusal) End of Borehole		3	SS	10/1									8 50 33 19
							220								
							67								

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 13

JOB 73-11096

LOCATION Co-ords. 16,507,408 N; 1,224,056 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 10, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	NUMBER	TYPE			PLASTIC LIMIT — w_p	WATER CONTENT — w	WATER CONTENT %		
71.8 0.0	Ground Level									
0.0	Het. mix. of clayey silt, sand & gravel	1	SS	14						17 50 25 8
	Firm to Very Stiff (Glacial Till)	2	SS	17						230.7
		3	SS	14						67.2
67.6	Grey	4	SS	7						18 50 24 8
4.2	Probable Bedrock refusal	5	SS	19/71						
14.0	End of Borehole									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 14

JOB 73-11096

LOCATION Co-ords. 16,504,763 N; 1,228,296 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 13, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ft. 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 γ P.C.F.	REMARKS
ELEV DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 20 40 60				
m 65.8	215.9	Ground Level												
0.0	0.0	Silty sand, trace of gravel.				210 64								
			1	SS	15									
			2	SS	18									
			3	SS	5									
		Loose to Compact												
			4	SS	7									
		Brown												
61.5	201.9	Probable Bedrock				200 61								
4.3	14.0	End of Borehole												
											</			

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 14

JOB 73-11096

LOCATION Co-ords. 16,504,763 N; 1,228,296 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 13, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CMB - Hollow Stem Auger

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (10, 20, 30)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % w_p — w — w_L 20 40 60				
m 65.8	215.9	Ground Level											P.C.F.	GR. SA. SI. CL.
0.0	0.0	Silty sand, trace of gravel.		1	SS	15								
				2	SS	18	210							209.9
				3	SS	5	64							64
		Loose to Compact		4	SS	7								2 78 (20)
61.5	201.9	Brown												
4.3	14.0	Probable Bedrock End of Borehole					200							
							61							

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 15

FOUNDATIONS OFFICE

JOB 73-11096

LOCATION Co-ords. 16,509,694 N; 1,227, 785 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 10, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

 CHECKED BY *JB*

SOIL PROFILE			SAMPLES			ft. in.	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 in)			BLOWS / FOOT			PLASTIC LIMIT w_p				
								SHEAR STRENGTH P.S.F.			w_p — w — w_L				
								○ UNCONFINED + FIELD VANE			WATER CONTENT %				
								● QUICK TRIAXIAL × LAB VANE			20 40 60				
71.7	235.3	Ground Level													
0.0	0.0	Ret. mix. of clayey silt, sand & gravel													WL not established
70.0	229.6	Glacial Till Stiff to Very Stiff. Grey													27 43 25 5
1.7	5.7	Probable Bedrock End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 16

JOB 73-11096

LOCATION Co-ords. 16,504,370 N; 1,228,239 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 13, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - Hollow Stem Auger

CHECKED BY JB

SOIL PROFILE			SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % w_p — w — w_L 20 40 60				
66.7	218.9	Ground Level													
0.0	0.0	Silty sand													
65.8	215.9	Brown	1	SS	6										
0.9	3.0	Glacial Till	2	SS	7										
		Silty sand	3	SS	12	210									
63.6	208.5	Het. mix. of clayey silt, sand & gravel firm to stiff, Gray	4	SS		61									6 45 27 10
3.1	10.4	Probable Bedrock													
		End of Borehole													
						200 61									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 17

JOB 73-11096

LOCATION Co-ords. 16,506,072 N. 1,227,564 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 13, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - 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 γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT % 20 40 60					
m 65.0	213.2	Ground Level														
0.0	0.0	Silty sand, with gravel.													WL not established	
63.5	208.2	Compact Brown	1	SS	17	210 61						0				
1.5	5.0	Probable Bedrock refusal End of Borehole														
						200 61										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 18

JOB 73-11096

LOCATION Co-ords. 16,507,314 N; 1,227,150 E.

ORIGINATED BY JB

W.P. 13-68-01

BORING DATE December 13, 1973

COMPILED BY JB

DATUM Geodetic

BOREHOLE TYPE CME - 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 γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT (0-3 in)	ELEV. SCALE		
67.3	0.0	Ground Level							
65.0	2.3	Net mix. of clayey silt, sand & gravel Very Stiff to Hard (Glacial Till)		1	SS	23			
65.0	2.3	Probable Bedrock Refusal End of Borehole		2	SS	34			
		</							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 19 (B.H. 1 - 72-11083)

JOB 73-11096

LOCATION Co-ords. 16,508,046 N; 1,226,328 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE August 1, 1972

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Flight Auger. BXL Rock Core: Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w	BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)					
66.8	219.1	Ground Level								
0.0	0.0	Organic silt, Black								
66.0	216.6	Soft to Firm								
0.8	2.5	Sand and gravel, trace of fines	1	SS	12					
			2	SS	46					
63.3	207.6	Grey Compact to Dense	3	S	22					
3.5	11.5	Sound		RC						
61.8	202.6	Shale Bedrock Grey	4	BXL	100%					
5.0	16.5	End of Borehole								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 20 (BH. 3 - 72-11083)

JOB 73-11096

LOCATION Co-ords. 16,508,094 N; 1,226,126 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE July 28 & 31, 1972

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Washboring, BXL Rock Core: Cone Test

CHECKED BY

SOIL PROFILE		SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3m)				LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	W _P	W	W _L	
67.1	220.2	Ground Level												
66.8	219.2	Organic Matter, black												
0.3	1.0	Sand and gravel, trace of fines	1	SS	60									
		Compact to Very Dense	2	SS	11									
63.6	208.7		3	SS	13									
3.5	11.5	Sound Bedrock		RC										
62.0	203.5	Shale Grey	4	BXL	100%									
5.1	16.7	End of Borehole												

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 21 (BE.5 - 72-11083)

JOB 73-11096

LOCATION Co-ords. 16,507,995 N; 1,225,889 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE July 28, 1972

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Rock Core; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE ft. m	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w			BULK DENSITY γ	REMARKS	
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT (0.3 m)			SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT % 20 40 60
67.8 0.0	222.6 0.0	Ground Level				220 67							
65.1 2.7	213.6 9.0	Sand, some gravel, occasional clayey silt seams.	1	SS	19								4 88 (8)
		Compact Grey	2	SS	27								$\nabla 215.3$ 65.6
		Glac. Till. V. Dense	3	SS	100/80								37 43 14 6
63.7 4.1	209.3 13.3	Bouldery Zone fractured	4	EX	25%	210 64							
		Shale Bedrock	6	BX	70%								
61.9 5.9	203.1 19.5	Sound	7	BX	95%								
		End of Borehole				200 61							

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 22 (BH.6 - 72-11083)

JOB 73-11096

LOCATION Co-ords. 16,508,115 N; 1,225,651 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE July 27, 1972

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Rock Core: Cone Test

CHECKED BY

SOIL PROFILE				SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS, FOOT (0.3 m)		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)	ELEV. SCALE	SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000		WATER CONTENT % 20 40 60			
68.6	Ground Level										P.C.F.	GR. SA. SI. CL.
0.0	Clayey silt, some sand											0 11 66 23
67.2	Stiff		1	SS	12	220						γ 218.1
1.4	Silty sand with gravel.		2	SS	70	67						July 27/72
			3	SS	22							8 89 (3)
64.0	Compact to Very Dense		4	SS	33	210						
4.6	Shale Bedrock		5	SS	CO%	64						18 52 25 5
4.9	Weathered		6	BX	30%							
	Sound		7	BX	70%							
60.7	Grey		8	BX	100%	200						
7.9	End of Borehole					61						
						190						
						58						
								50	100			
								KN/m ²				

15 ϕ 5 % STRAIN AT FAILURE

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 23 (BH.7 - 72-11083)

JOB 73-11096

LOCATION Co-ords. 16,508,195 N; 1,225,535 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE July 27, 1972

COMPILED BY ECB

DATUM Geodetic

BOREHOLE TYPE Washboring, BXL Rock Core; Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			Ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (10.3 m)				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (10.3 m)		20	40	60	80	100	W_p	W	W_L	
m 69.4	227.8	Ground Level													
0.0	0.0	Fill material-silty sand with gravel, trace of clay. Compact													
68.0	223.3		1	SS	15										38 35 22 5
1.4	4.5	Silty sand, trace of gravel.	2	SS	11	220									55% org.
			3	SS	11	67									221.8
			4	SS	9										67.6
		Loose to Dense	5	SS	38	210									In open BH
63.9	209.8		6	SS	171	61									July 28/72
5.5	18.0	Het. mix. of silt, sand & gravel, trace of clay.	7	SS	111										8 74 (18)
62.4	204.7	Glac. Till. V. Dense													
7.0	23.1	Bedrock Shale	8	RC	95%	200									39 42 13 6
60.7	199.2	Sound Grey		BXL		61									
8.7	28.6	End of Borehole													
						190									
						58									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 24 (B.F. 11 - 72-11083)

JOB 73-11096

LOCATION Co-ords. 16,507,799 N; 1,225,502 E.

ORIGINATED BY JC

W.P. 13-68-01

BORING DATE Oct. 26, 1972

COMPILED BY JC

DATUM Geodetic

BOREHOLE TYPE Flight Auger and BXL Rock Core

CHECKED BY Lo

SOIL PROFILE				SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)				LIQUID LIM T — w_L PLASTIC LI. — w_p WATER CONTENT — w				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT % w_p — w — w_L 20 40 60							
68.1	223.3	Ground Level															
0.0	0.0	Clayey silt.		1	SS	18	220										
67.2	220.3	Very Stiff		2	SS	24	67										
0.9	3.0	Sand and gravel.		3	SS	24										$\nabla 216.3$ $= 65.9$	
64.1	210.3	Compact		4	SS	28	210										
4.0	13.0	Het. mix. of sand, grav.		5	SS	100	64										
63.1	206.8	silt, tr. of clay (Glac. Till) Very Dense		6	BXL	100										49 31 16 L	
5.0	16.5	Shale Bedrock		7	BXL	100											
61.2	200.8	Numerous fissures throughout. Sound															
6.9	22.5	End of Borehole					200 61										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 25 (BH. 4 - 72-11109)

JOB 73-11096

LOCATION Co-ords. 16,506,291 N; 1,227,514 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE Sept. 21, 1972

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger-BX Casing, BXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)					LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			BULK DENSITY γ	REMARKS
ELEV. DEPTH m ft.	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)		20	40	60	80	100	W _P	W	W _L		
67.7	222.2															
0.0	0.0					220										
			1	SS	12	57										
			2	SS	66											
65.3	214.1		3	SS	100											
2.4	8.0															
60.3	211.1		4	BXL	50	210										
3.6	11.0		5	BXL	80	64										
3.7	12.0		6	BXL	90											
62.4	204.9															
5.3	17.5					200										
						61										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 26 (BH.1 - 71-11127)

73-11096

LOCATION Co-ords. 16,504,750 N; 1,228,523 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE November 29, 1971

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Washboring - NX Casing

CHECKED BY

SOIL PROFILE		STRAT. PLT	SAMPLES		BLOWS/FOOT (0.3 m)	ELEV. SCALE ft.	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE			20	40	60	80	100	w_p	w	w_L		
63.9 0.0	Ground Level															
59.9 4.0	0.8 Sandy silt with trace of gravel, seams of clayey silt.		1	SS	14											
			2	SS	17											
	Compact to Very Dense Brown-Grey		3	SS	14	200 61										
			4	SS	66	10"										
58.2 4.0	13.3 Calcareous Shale															
	Sound Grey		5	RC	99	100/9"										
57.7 5.7	18.6 End of Borehole					190 58										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 27 (BH.3 - 71-11127)

JOB 73-11096

LOCATION Co-ords. 16,504,625 N; 1,228,484 E.

ORIGINATED BY SAA

W.P. 13-68-01

BORING DATE November 29, 1971

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Washboring - NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m) 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 γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)					
65.1	213.7	Ground Level								
0.0	0.0	Topsoil	1	SS	29	210				
	0.8	Silty sand with some gravel, occ. silt to clayey silt seams	2	SS	10	64				
			3	SS	17					
			4	SS	7					
		Loose to V. y Dense	5	SS	79	200				
			6	RC	50	61				
60.0	196.9	Brown to grey								
5.1	16.8	Calcareous								
58.4	191.7	Sound - Grey	7	RC	97.5%					
6.7	22.0	End of Borehole				190 58				

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 28 (B.H. - 72-11067)

JOB 73-11096

LOCATION Co-ords. 16,504,781 N; 1,229,223 E.

ORIGINATED BY SA

W.P. 13-68-01

BORING DATE June 13, 1972

COMPILED BY: SA

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and Cone Test

CHECKED BY

SOIL PROFILE				SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)	LIQUID LIMIT ——— w _L	BULK DENSITY	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m)	WATER CONTENT ——— w	P.C.F.	GR.SA.SI.CL	
61.3	Ground Level					SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT ——— w _p WATER CONTENT % w _p w w _L 10 20 30		
0.0	0.0	Silty sand, with some gravel, occ. clayey silt seams.	1	SS	2				▽ 195.5
		Very Loose to Compact	2	SS	7				= 59.6
57.1	189.0	Brown - Grey	3	SS	15				24 53 18 5
3.6	12.0	Bedrock Shale	4	SS	60/10				
55.8	183.0	Sound Grey	5	RC EX	90%				
5.5	18.0	End of Borehole	6	RC EX	100%				

OFFICE REPORT ON SOIL EXPLORATION

15 $\frac{20}{10}$ 5 % STRAIN AT FAILURE

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 29 (BH.7 - 72-11067)

JOB 73-11096

LOCATION Co-ords. 16,504,331 N; 1,229,225 E.

ORIGINATED BY SA

W.P. 13-68-01

BORING DATE June 15, 1972

COMPILED BY SR

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and Cone Test

CHECKED BY

SOIL PROFILE		SAMPLES			ft. ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLAT	NUM. BER	TYPE		20	40	60	80	100	W_P	W	W_L	
61.7	0.0	Ground Level			200									
58.2	3.5	Silty sand with some gravel. Loose to Dense Grey	1	SS	61									1.05% org.
			2	SS	19									0.77% org.
			3	SS	45									14.50 28.0
56.8	11.5	Bedrock Shale	4	RC	58									∇ 193.1
		Sound Grey		EX	100%									58.9
4.9	16.0	End of Borehole			180									Art. water encountered
					55									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 30 (BH.2 - 71-11126)

FOUNDATIONS OFFICE

JOB 73-11096

LOCATION Co-ords. 1,503,878 N; 1,230,571 E.

ORIGINATED BY WH

W.P. 13-68-01

BORING DATE November 15, 1971

COMPILED BY SAA

DATUM Geodetic

BOREHOLE TYPE Washboring - BX & BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)					LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _P	W	W _L		
64.1	210.3															
0.0	0.0															
	Silty sand with some gravel, trace of clayey silt — Brown Grey		1	SS	33											
			2	SS	15											
			3	SS	15											
	Compact to Dense		4	SS	16											
			5	SS	28											
	Boulders up to 8" in thickness		6	SS	18											
			7	SS	55											
			8	BX	27%											
53.1	174.3															
11.0	35.0															
52.1	170.9															
12.0	39.4															
	Shale Bedrock Fractured Grey		9	BX	22%											
	Shale Bedrock															
50.4	165.3															
13.7	45.0															
	Sound Grey		10	BX	100%											
	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

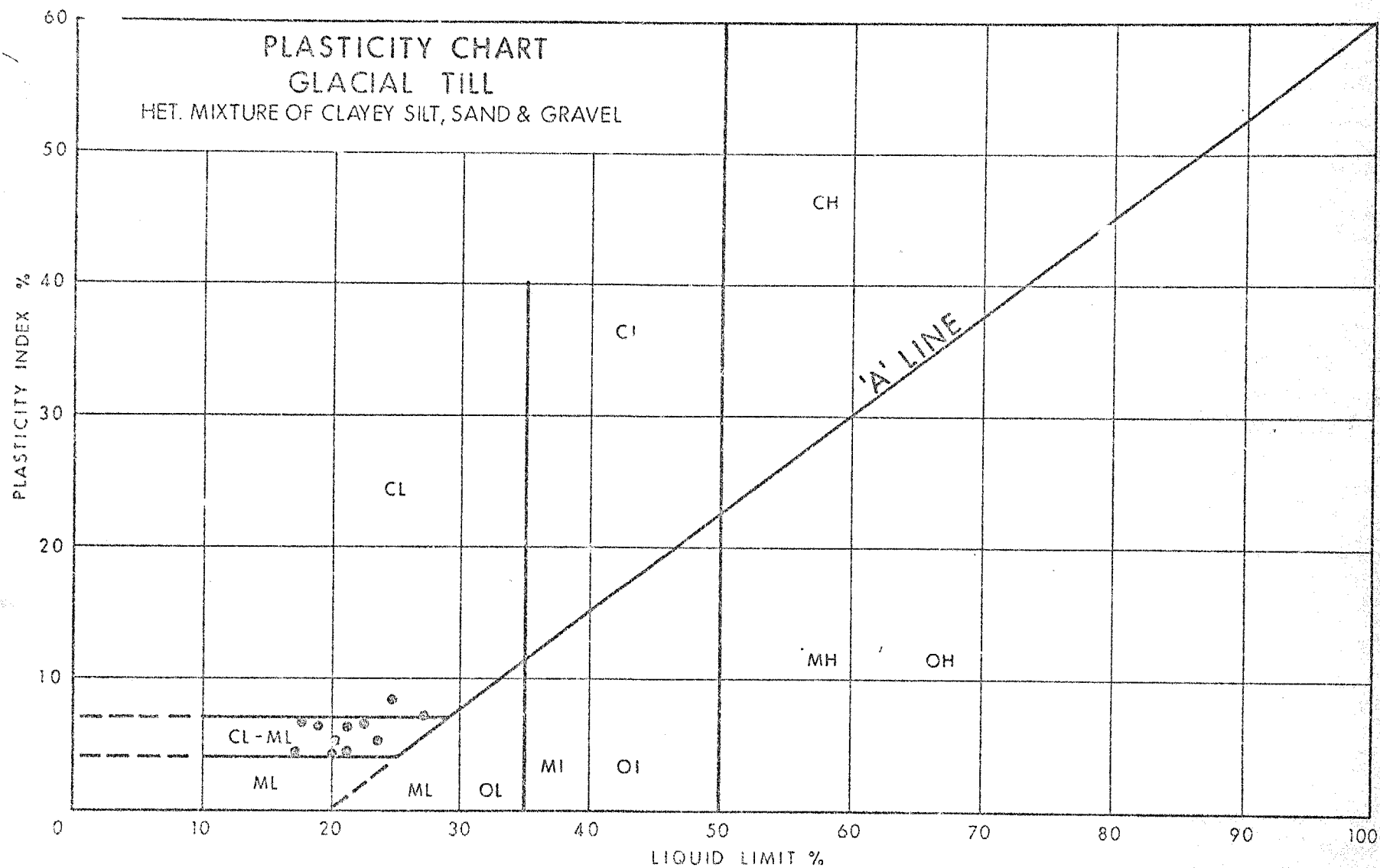


FIG. 1

GRAIN SIZE DISTRIBUTION

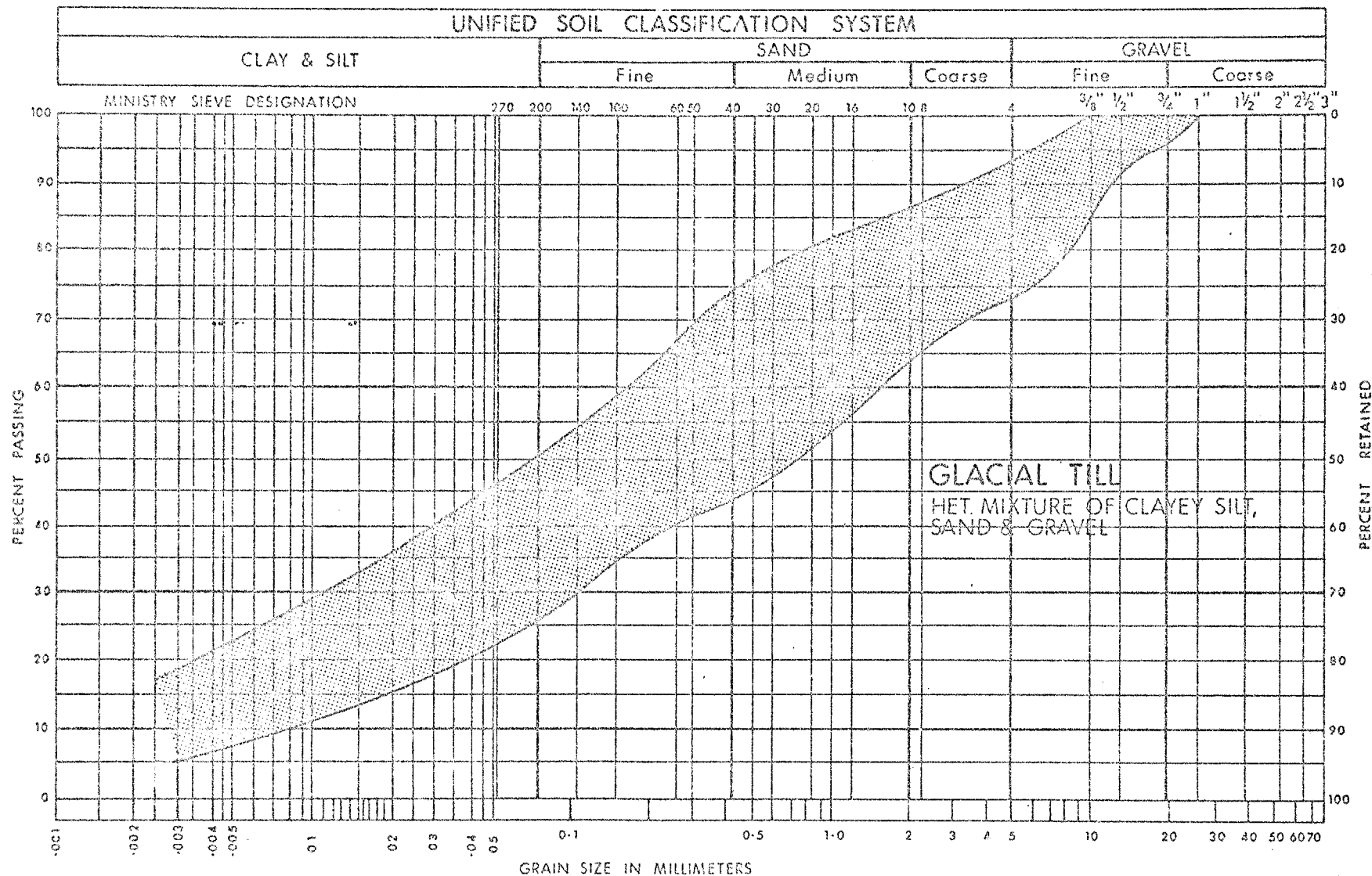


FIG. 2

GRAIN SIZE DISTRIBUTION

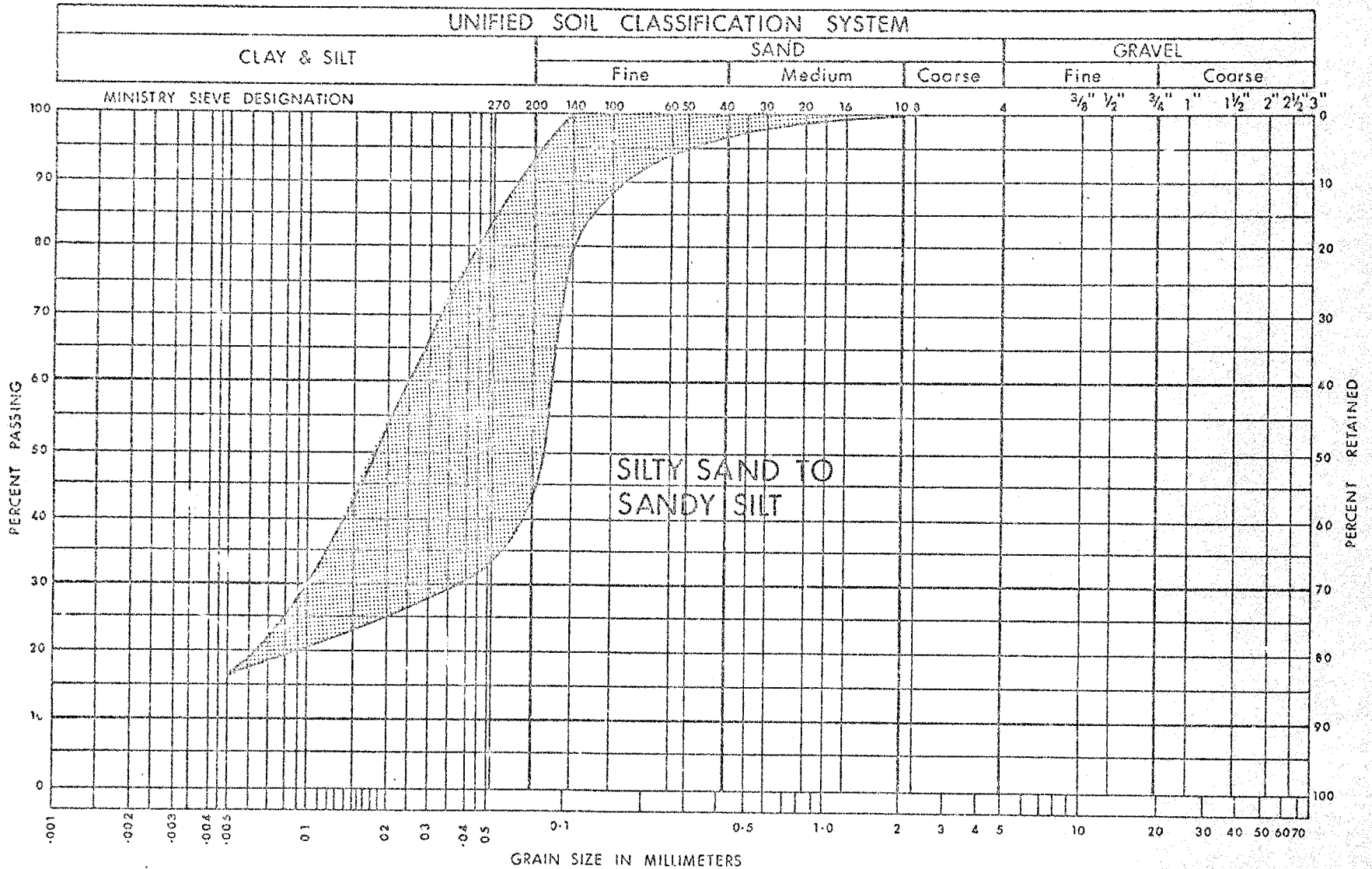


FIG. 3

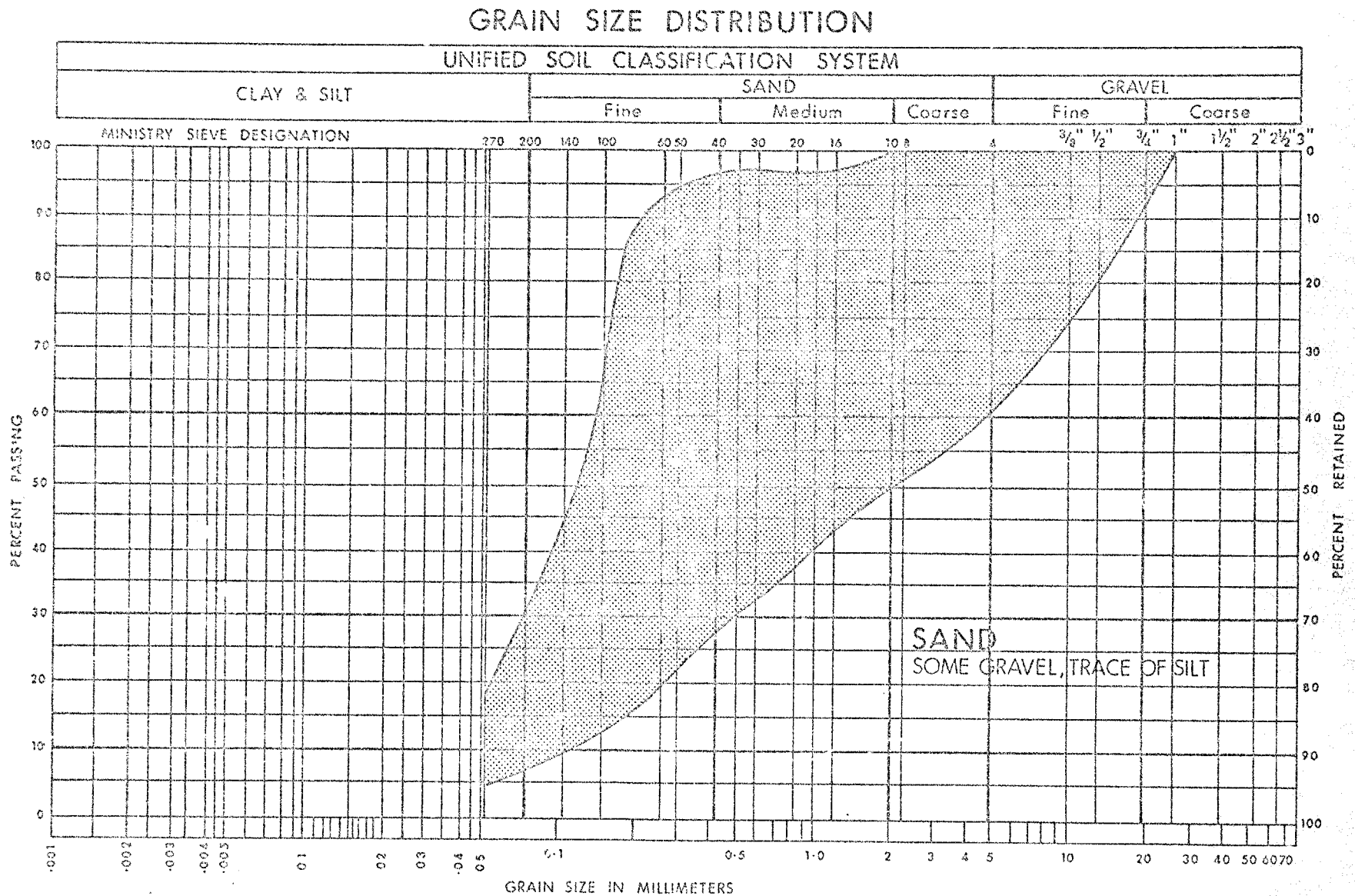


FIG. 4

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 "		
CAO	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

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

GENERAL

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

STRESS AND STRAIN

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

EARTH PRESSURE

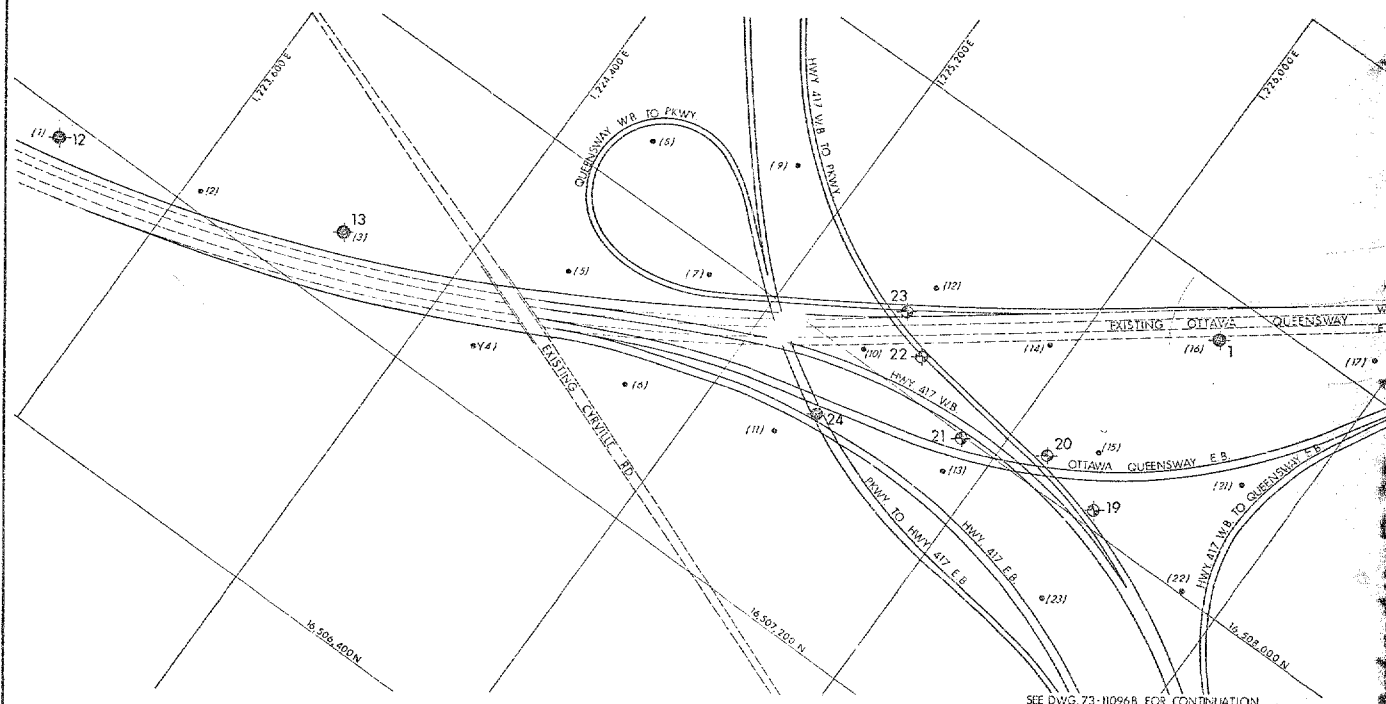
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

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

SLOPES

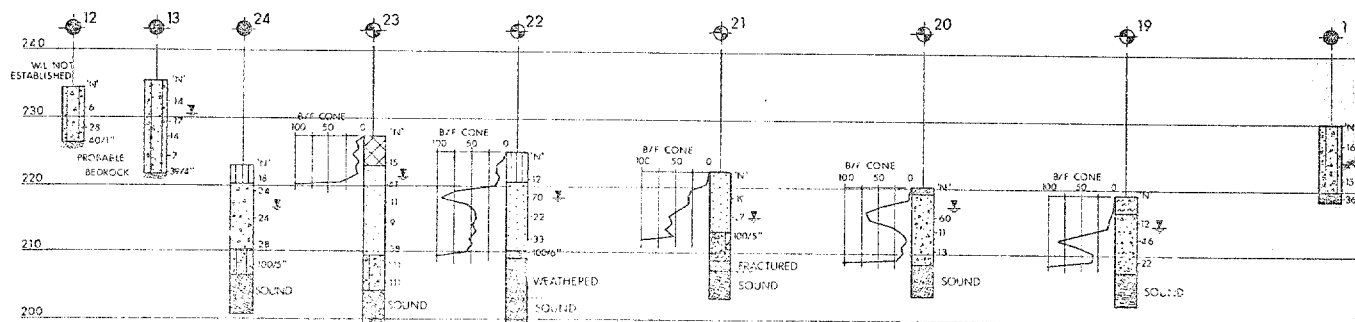
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN

200 100 0 SCALE 200 400 FT.

SEE DWG. 73-110968 FOR CONTINUATION



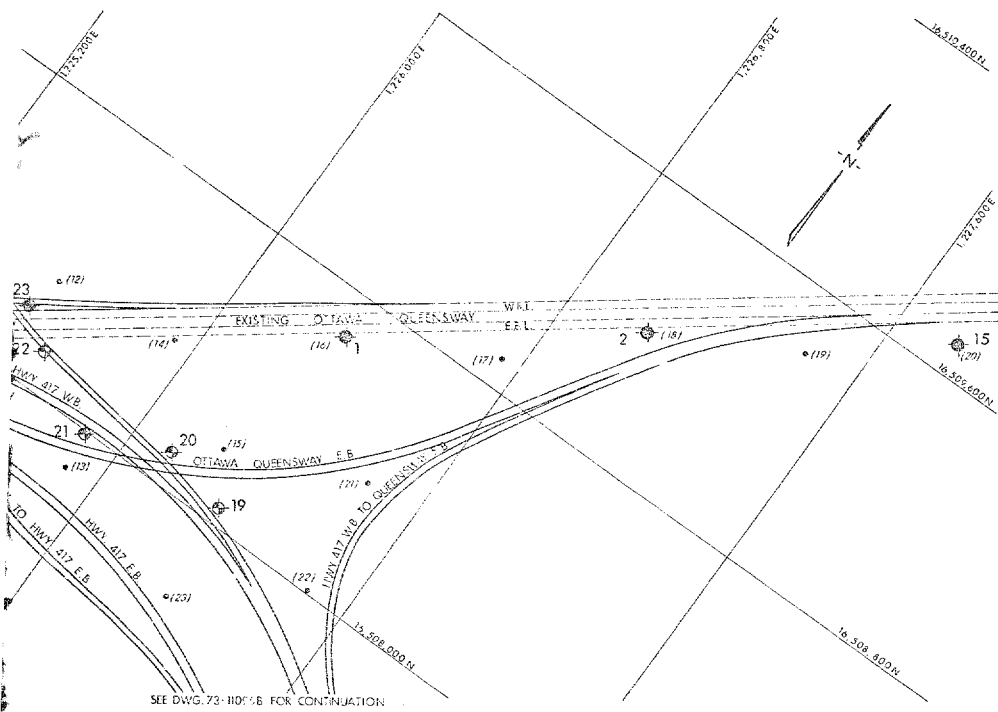
LEGEND

- | | | |
|-----|-------------------------------|---------------------------------|
| 199 | FILL MATERIAL Comp | SAND & GRAVEL Comp. to V. Dense |
| | ORGANIC MATTER Soft to Firm | GLACIAL TILL Stiff to V. Stiff |
| | CLAYEY SILT Stiff to V. Stiff | SHALE BEDROCK |
| | SAND & SILTY SAND | |

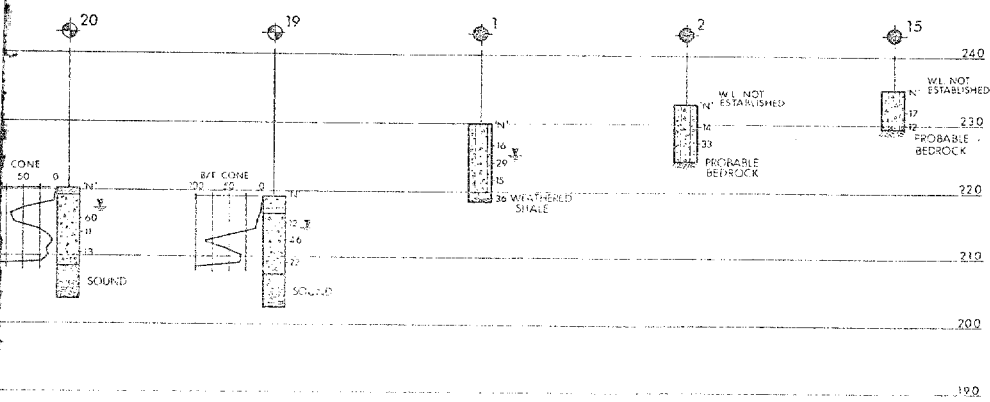
BORE HOLES

10 5 0 SCALE 10 20 FT.

NOTE FOR CONTRACT DOCUMENT
The complete foundation investigation
this structure may be examined at the
Office and Foundations Office, Dist.
and at the Ottawa Dist.

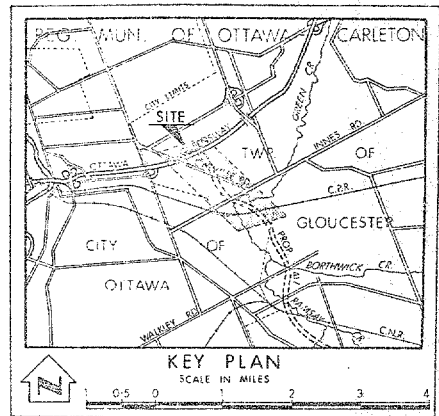


PLAN
0 SCALE 200 300 FT.



BORE HOLES
0 SCALE 100 200 FT.

NOTE FOR CONTRACT DOCUMENT
The complete foundation investigation report for this structure may be examined at the District Office and Foundation Office, Downsview, and at the _____ District Office.



KEY PLAN
SCALE IN MILES

LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Level established at time of field investigation JULY '72 & DEC '73
- High Mast Lighting Pole & Pole NP

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	230.0	16,508,670	1,226,333
2	232.9	16,509,195	1,227,034
15	235.3	16,509,694	1,227,785
19	219.1	16,508,046	1,226,328
20	220.2	16,508,094	1,226,126
21	222.6	16,507,995	1,225,889
22	225.1	16,508,115	1,225,651
23	227.8	16,508,195	1,225,535
24	223.3	16,507,799	1,225,502
12	234.4	16,507,140	1,223,219
13	235.7	16,507,408	1,224,056

NOTE

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

REVISION	DATE	BY	DESCRIPTION

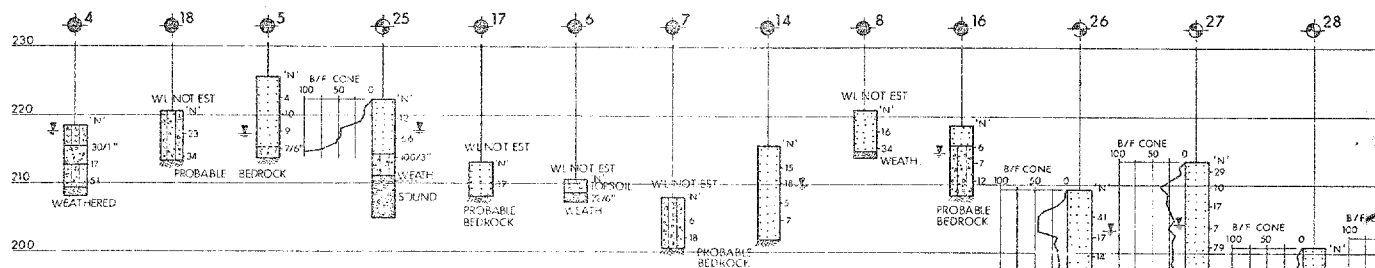
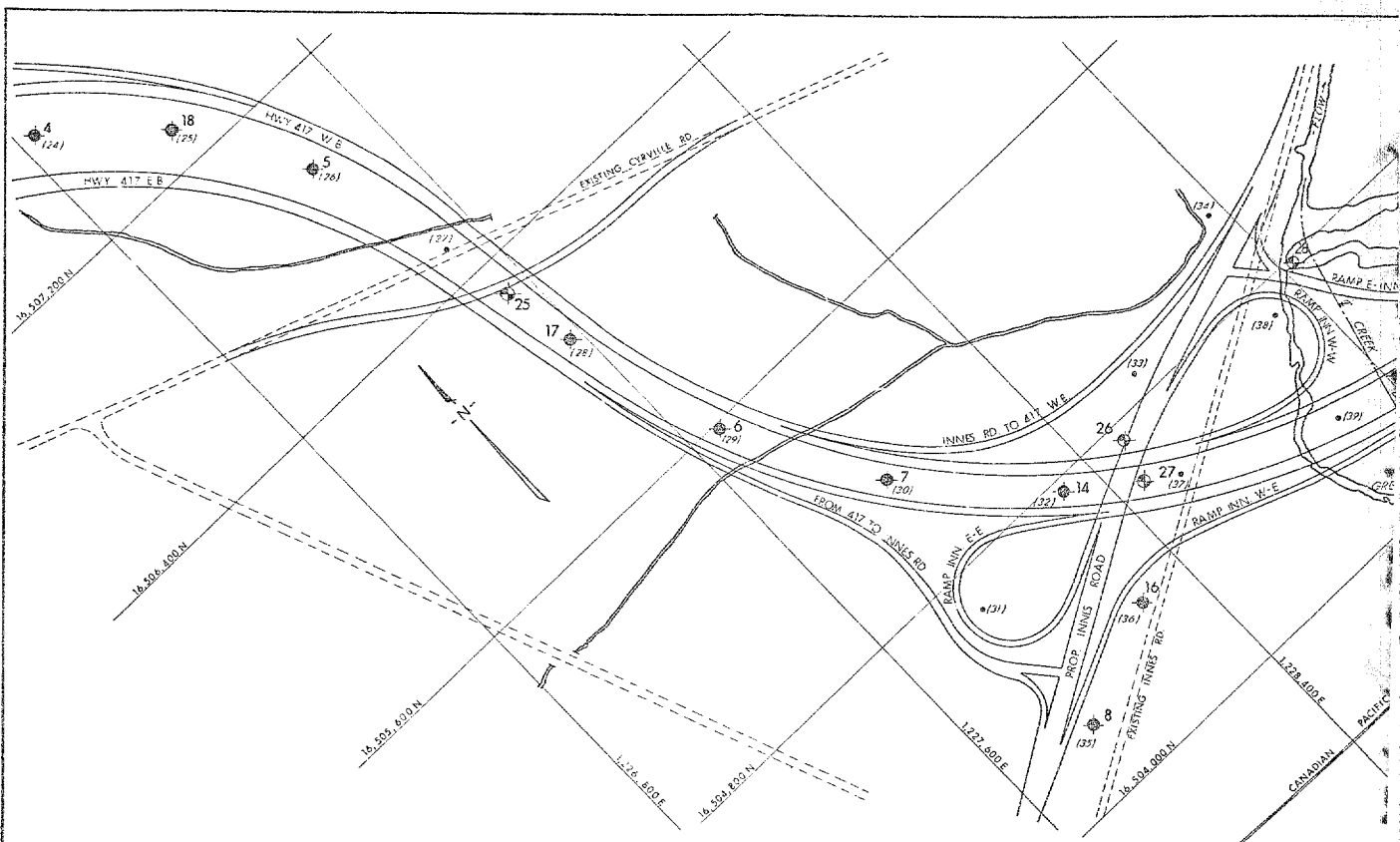
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE

HIGH MAST ILLUMINATION

HIGHWAY NO. 417 & OTTAWA QUEENSWAY DIST. NO. 9
REG. MUN. OF OTTAWA-CARLETON
TWP. GLOUCESTER LOT _____ CON _____

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTAL	DATE	BY	DRAWING NO.
DRAWN	DATE	BY	73-11096A
DATE	DATE	BY	BRIDGE DRAWING NO.
APPROVED	DATE	BY	CONT NO.



LEGEND



ORGANIC SILT
Soft



SILTY SAND &/or SANDY SILT
TRACE OF GRAVEL & CLAY
Loose to Dense



SAND & GRAVEL
Comp. to V. Dense



CLAYEY SILT
WITH TRACES OF SILTY SAND
V. Soft



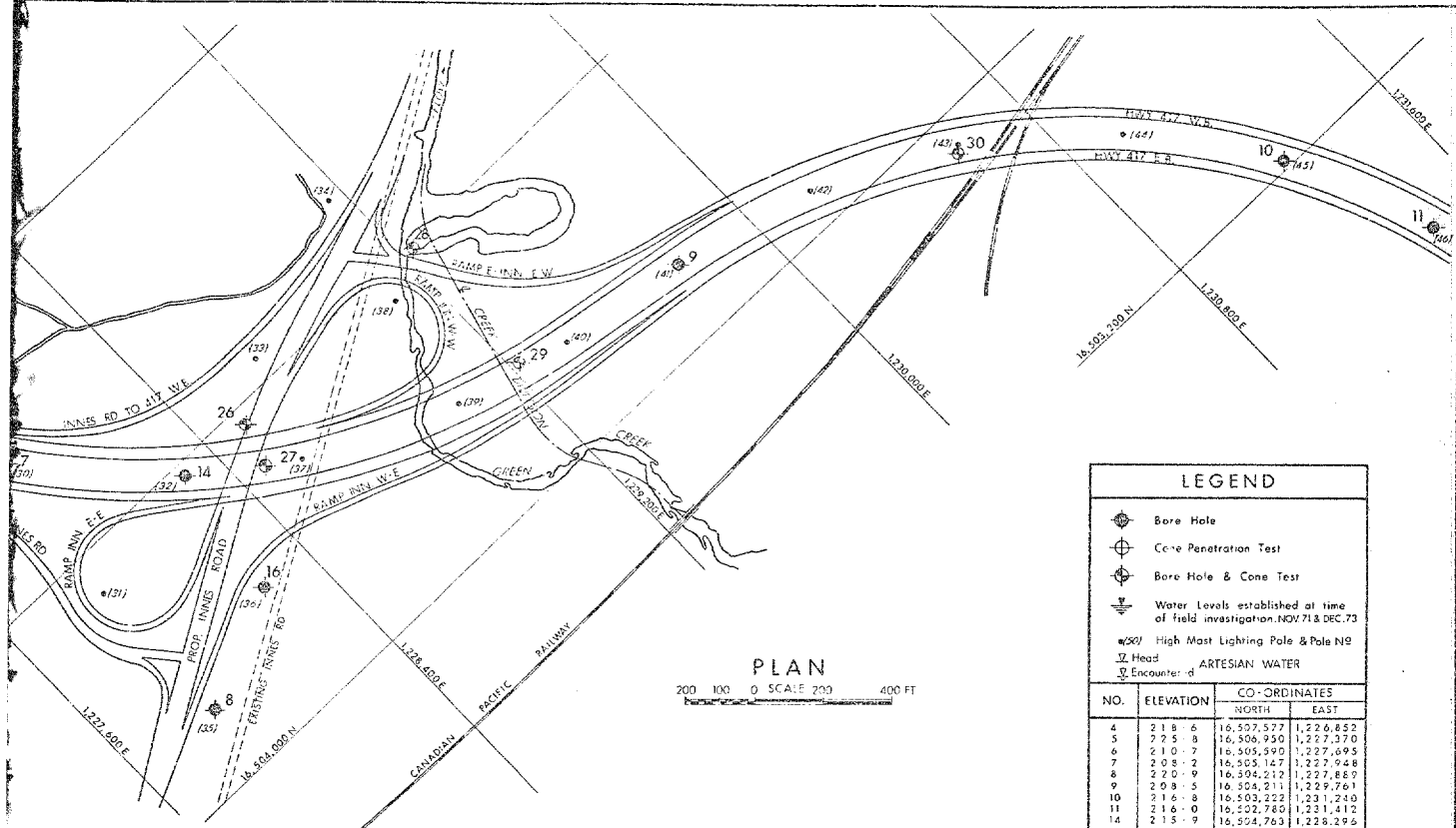
GLACIAL TILL
HET. MIXTURE OF CLAYEY SILT
SAND & GRAVEL
Stiff to V. Stiff



SHALE BEDROCK

BORE HOLES

10 5 0 SCALE 10 20 FT



PLAN

200 100 0 SCALE 200 400 FT

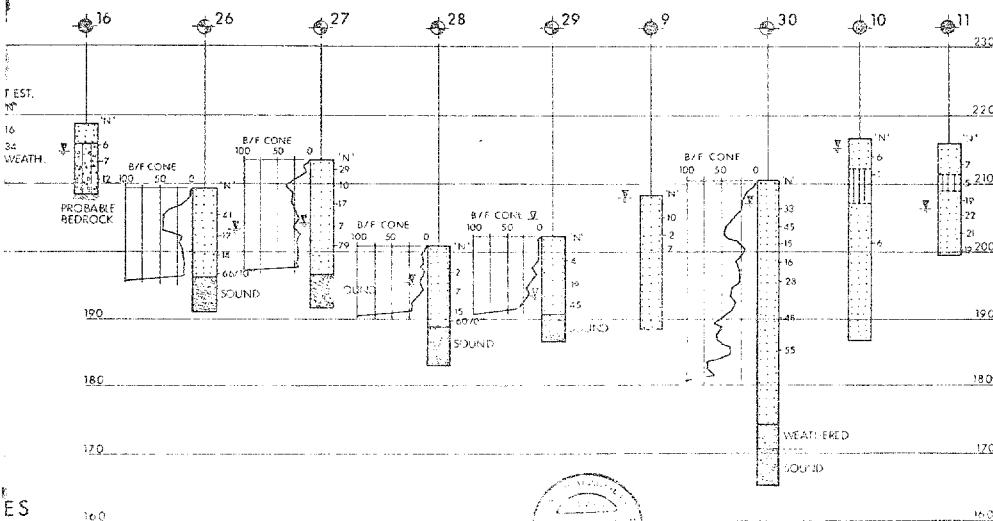
LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation NOV 71 & DEC 73
- High Mast Lighting Pole & Pole No 9
- Head
- Encounter: d
- ARTESIAN WATER

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
4	218.6	16,507,577	1,226,852
5	225.8	16,506,950	1,227,370
6	210.7	16,505,590	1,227,695
7	208.2	16,505,147	1,227,948
8	220.9	16,504,212	1,227,889
9	209.5	16,504,211	1,229,761
10	216.8	16,503,222	1,231,240
11	216.0	16,502,780	1,231,412
14	215.9	16,504,763	1,228,296
16	218.9	16,504,370	1,228,239
17	213.2	16,506,072	1,227,564
18	220.7	16,507,314	1,227,150
25	222.4	16,506,391	1,227,514
26	209.6	16,504,750	1,228,523
27	213.7	16,504,525	1,228,484
28	201.0	16,504,781	1,229,223
29	202.4	16,504,331	1,229,225
30	210.3	16,503,878	1,230,571

— NOTE —

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



DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE

HIGH MAST ILLUMINATION

HIGHWAY NO. 417 & OTTAWA QUEENSWAY DIST. NO. 9
REG. MUN. OF OTTAWA - CARLETON
TWP. GLOUCESTER LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBNO. J.B.	CHECKED	W.P.A.D. 13-14-71	DRAWING NO.
DRAWN S.D.	CHECKED	W.D. NO. 13-14-71	73-11096B
DATE	11-01-71	SITE NO.	ENGINEERING NO.
APPROVED		CONE NO.	

NOTE FOR CONTRACT DOCUMENT:
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the District Office.

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Downsview, Ontario.

FROM: Bridge Section,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: February 15, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 13-68-08 - Hwy. 417 N.B. over Ramp to
Ottawa Queensway W.B. Overpass,
Highway 417, District 9 - Ottawa

Further to your telephone conversation with Mr. Kingsland on February 11, 1972, we would be pleased if you could arrange for a foundation investigation for the above structure.

No E-Plan is available for this structure at present and location of bore hole sites will have to be established from 100' = 1" contour plans, two copies of which are enclosed herewith.



For: A. Van Dalen
T. C. Kingsland
Regional Bridge Planning Engineer

AV/TCK/hl
Encls.

c.c. - J. K. Anderson
R. Forrest
C. S. Grebski

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: T. C. Kingsland,
reg. Structural Planning Engineer,
EASTERN REGION, Kingston.

FROM: Structural Office,
West Bldg., DOWNSVIEW.

ATTENTION:

DATE: January 29th, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Eastbound Overpass of
O.Q.W., Bridge #3,
W.P.#13-68-08, Site #3-303,
Hwy. #417, District #9, Ottawa.

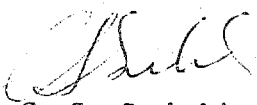
72-11-083

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-3-303-P1 for the above-mentioned structure.


The estimated cost of the proposed structure is \$778,000 which includes tender, materials, engineering, and sundry construction.

Any comments or revisions you may have should be submitted within four weeks.

CSG:dp
Attach.


C. S. Grebski,
Structural Design Engineer.

cc. B. R. Davis,
W. D. Birch,
A. E. McKim,
A. Sternmac (2) ✓
J. Anderson,
R. Forrest,
M. Stoyanoff, plan only,
W. McFarlane, plan only.

 20 comments
M. Stoyanoff
Feb 8/73

Mr. C. S. Grebski,
Structural Design Engineer,
Design Services Branch,
West Bldg., Downsview.

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

February 9, 1973.

Westbound Overpass to Eastern Parkway &
to O.G.W. W.E., (Bridge #1), Site 73-304A,
Hwy. #417, District #9 (Ottawa)
W.O. 72-11083 -- W.P. 13-68-02

We have reviewed the Preliminary Bridge Plan Drawing D-3-304A-P1 for the above-mentioned structure and submit our comments as follows.

In our foundation report we have recommended that all surficial organic deposit be subexcavated and backfilled with suitable earth material prior to the construction of the approach embankments. These details were not shown on your drawing. It is believed that the drawings prepared by the System Design may incorporate the necessary subexcavation of the organic deposit.

CSP/ao

cc: A. J. Percy
T. C. Kingsland

C. S. Poon

C. S. Poon,
Project Foundations Engineer,
For: M. Devata,
Supervising Foundations Eng.

MEMORANDUM

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

FROM: Structural Office,
West Building.

ATTENTION:

DATE: April 10th, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: Westbound O'Pass of O.Q.W.,
to Eastern Parkway, Bridge #2,
W.P.#13-68-03, Site #3-304B,
Hwy. #417, District #9, Ottawa.

72-11-083

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

Kindly give us your comments at your earliest convenience.

CSG:dp
Attach.


C.S. Grebski,
Structural Design Engineer.

cc. Foundation Office.

*Orig. 72-11083B finalized
and sent to Structural Office
10 July 73*

*no comments.
M. Devada*

MM

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRÉS No. 3165-93

DIST. 9 REGION EASTERN

W.P. No. 13-63-01

CONT. No. _____

W. O. No. 73-F-96

STR. SITE No. _____

HWY. No. 417

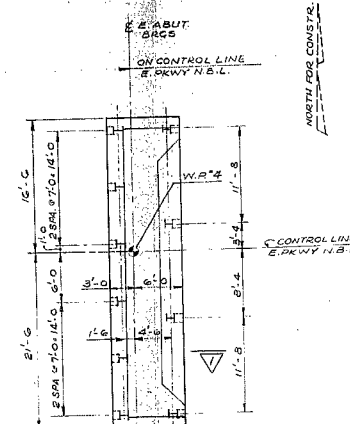
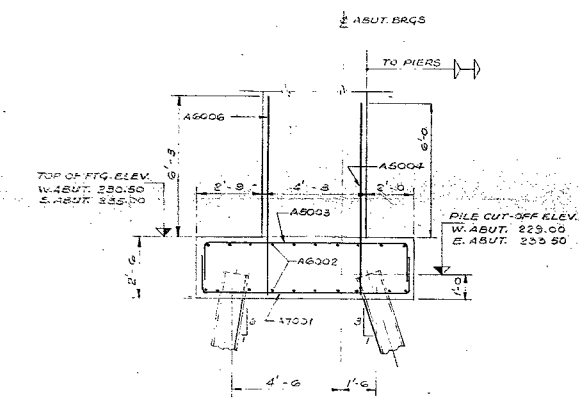
LOCATION W. 1/4 Sec. 17, T. 1N, R. 10E, S. 12, Prop. Hwy 417

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 41

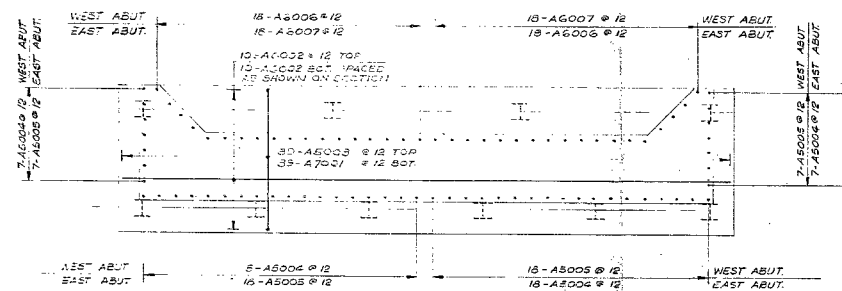
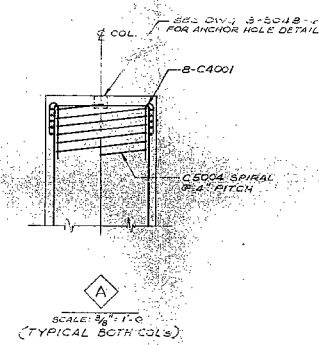
REMARKS: DOCUMENTS TO BE UNREELLED BEFORE

MICROFILMED

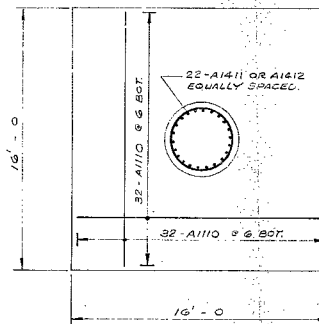
61-30 SEP 1976

[illegible]

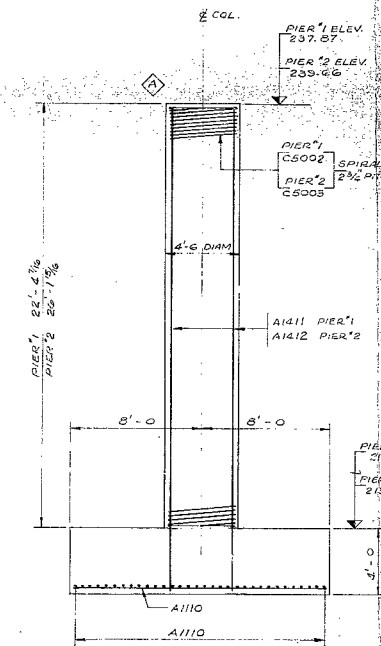
STEEL 'H' PILE DATA			
LOCATION	NO	LENGTH	TYPE
W. ABUT.	10	24'-0	✓ HP12x53
E. ABUT.	10	30'-0	✓ (TYR)



PLAN OF ABUTMENT FTGS.
SCALE: $\frac{1}{4}" = 1'-0"$



PLAN OF PIER FTGS
SCALE: $\frac{1}{4}'' = 1'-0$



NOTES:

1. PILES TO BE DRIVEN TO BEDROCK.
2. SPACING OF PILES TO BE MEASURED AT UNDERSIDE OF FOOTINGS.

3165-93



REVISIONS			
	DATE	BY	DESCRIPTION

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO
DeLeuw, Cather
ENGINEERS & PLANNERS - OTTAWA
WESTBOUND OVERPASS OF Q.I.W.
TO EASTERN PARKWAY
BRIDGE No 2

KING'S HIGHWAY No. 417 DIST. No. 9
CO. REG. MUNICIPALITY OF OTTAWA-CARLETON
TWP. GLOUCESTER LOT 25 CON. II
FOOTINGS & PIER COLUMNS

FOOTINGS & PIER COLUMNS					
APPROVED _____	<table border="1"> <tr> <td>SITE No.</td> <td>W.P. No.</td> </tr> <tr> <td>3-3C4B</td> <td>13-65-03</td> </tr> </table>	SITE No.	W.P. No.	3-3C4B	13-65-03
SITE No.	W.P. No.				
3-3C4B	13-65-03				

STRUCTURAL ENGINEER				CONTRACT	
DESIGN	A.G.	CHECK	L.O.H.	Nos.	
DRAWING	K.A.B.	CHECK		DRAWING	
DATE	APR. 73	LOADING	H520-44	No. 3-304B-3	

FOR REDUCED PLAN

USE SCALE BELOW

— 3 INCHES ON ORIGINAL PLAN

100