82-26025-2

GEOCON REPORT

SOIL CONDITIONS & FOUNDATIONS
PROPOSED CNR UNDERPASS
DORVAL DRIVE
OAKVILLE, ONTARIO

FOUNDATION OF CANADA
ENGINEERING CORPORATION LIMITED

File Roads
6322
ROADS

T9853

REPORT

TO

FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED

ON

SOIL CONDITIONS AND FOUNDATIONS

PROPOSED CNR UNDERPASS - DORVAL DRIVE

OAKVILLE ONTARIO

Distribution:

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Rexdale, Ontario
November 18th, 1974

Foundation of Canada Engineering
Corporation Limited
1 Yonge Street
Toronto, Ontario

Attention: Mr. R. Treftlin, P. Eng.
Supervising Engineer Highways

Re: Soil Conditions and Foundations
Proposed Underpass-CNR
Oakville, Ontario

Dear Sirs:

This letter reports the results of our investigation carried out in accordance with our proposal of September 24, 1974 and your letter of October 2, 1974.

The purpose of the investigation was to determine by detailed boreholes at the structure locations the soil and groundwater conditions for foundation design. In addition, a series of probes were put down along the approaches leading to the underpass structure to provide an indication of the depth to the shale.

1.0 PROCEDURE AND EQUIPMENT

The field work for this investigation was carried out for the most part between October 9th and 22nd, 1974. To provide supplementary information alongside a number of the dynamic penetration test, additional augerholes were put down on November 7, 1974.

The boreholes were put down using a bombardier mounted power auger. Sampling in the overburden was by 2 inch split spoon sampler, coring of bedrock was in BXL size. In a number of the boreholes at the structure, drill casing was required to bedrock because of slight caving conditions in the overburden. The probes along the approaches to the structure were put down by initially driving dynamic cone penetration tests on the north side of the railway. South of the railway, the probes were put

1.0 PROCEDURE AND EQUIPMENT (continued)

down by augering to practical refusal. Because of a lack of correlation of termination elevations between the penetration test and the drilling, supplementary augerholes were put down on November 7th, 1974 on the north side of the railway. Only occasionally, was it apparent that the dynamic cone penetration test effectively reached the surface of the shale.

The samples and core recovered from this investigation will be stored at our Toronto soils mechanics laboratory until November 1st, 1975, at which time you will be contacted for instructions regarding its disposal.

The locations of the boreholes were intially located approximately by our field forces. They were subsequently tied in accurately by your survey staff who similarly obtained elevations of ground level.

Detailed logs of the boreholes are given on the Office Reports on Soil Exploration in Appendix I. The location of the boreholes are given on Drawing T9853-1 at the rear of this report.

2.0 SITE AND GEOLOGY

The site investigated extends approximately from 500 feet south of the CNR tracks to approximately 1000 feet north. The topography both north and south of the tracks is relatively flat. To the north of the tracks the area is mostly grassed covered with occasional trees, immediately south of the tracks and in the area of our boreholes there is fairly dense bush and trees. Immediately west of the boreholes and south of the track there are open fields. The CNR track is raised above the surrounding land with a ditch parallelling the track embankment on the north side and a cinder road parallelling the track on the south side.

From previous experience in the general area, the bedrock is a shale typically reddish brown and grey, the upper part of which is generally weathered and depending on type of overburden difficult to define the transition between soil and weathered rock. The overburden typically is a reddish brown clay occasionally containing gravel and probably of till origin overlain in places by a thin veneer of granular soil.

3.0 SUMMARIZED SOIL CONDITIONS

The summarized soil conditions encountered in the vicinity of the structure, Boreholes 1 to 4 inclusive are as follows.

To a depth of 9 to 12 feet approximately, the surface cover of topsoil or cinders is underlain by a mixture of silty sand and gravel, till with weathered shale and clay, generally occurring with depth.

Since it was difficult to establish a distinct pattern of stratification between the 4 boreholes and because of the wide variation in types encountered and erratic pattern to the standard penetration resistances, it is conceivable that this stratum is in fact a fill. There is, however, no surface evidence, in terms of changes in topography to indicate why fill should be present at this location, unless as part of railway construction and development of the hydro transmission line that parallels on the north side of the tracks, a general re-grading was done. It is conceivable that within the depth range of 9 to 12 feet approximately the stratum consists in fact of an upper fill and sand followed by clay and till, in accordance with the pattern that might normally be anticipated for the general area.

The boreholes at the structure encountered at a depth below ground level of 9 to 12 feet approximately shale, the upper part of which, based on relatively low core recoveries, is judged to be highly weathered, the condition improving with depth to the termination of the boreholes.

Typically the shale is reddish brown to greenish grey with occasional seams, one inch to five inches, of harder limy shale. In the upper zone there were traces of clay seams in the core recovered; since core was lost in drilling, despite the use of the BXL series equipment, the clay layers or highly weathered shale layers may be more extensive then observed in the recovered core.

The probes put down along the approaches to the underpass involved augering to a practical resistance to further advancement of the power auger; no formal soil sampling was carried out during penetration and the descriptions of soil strata on the accompanying logs are based purely on observation of the auger cuttings, these being highly disturbed. They indicate a trend that south of the

3.0 SUMMARIZED SOIL CONDITIONS (continued)

railway a granular stratum of silty sand and gravel of varying thickness overlies a reddish brown clay which in turn is underlain by what is inferred to be weathered shale; partial penetration into the weathered shale was achieved by augering. On the north side of the railway, the overburden appears to be thicker, with again sand overlying clay, and the thickness of sand decreasing at the north end of the investigation area.

4.0 WATER CONDITIONS

Water levels were observed during drilling and in standpipes installed in boreholes put down at the structure locations. The observations indicate that the water levels in the boreholes have not stabilized, as a result of the low permeability of the clay, where it occurs, and shale, as is particularly evident at Borehole 4. Based on all observations, it is judged that at the time of investigation the groundwater was fairly close to the surface of the shale. We would anticipate that following periods of wet weather and during the spring, saturation of the overburden above the shale would readily occur. In the probes, where water was observed during the augering the accompanying logs contain notes to this effect. It should be realized that in low permeability soils seepage may not be detected during augering.

5.0 DISCUSSION

It is understood that the proposed underpass will have two abutments and a centre pier and that foundations will be 20 to 25 feet below ground level. Short wing walls will likely be constructed from the abutments, the remainder of the approach slopes being at about 2 horizontal to 1 vertical.

Insofar as foundations for the bridge structure are concerned, these will be carried within the shale and at a sufficient depth below ground level to be below the zone of extensive weathering.

Foundations supported within the weathered portion of the shale may be designed for a net allowable bearing value of 5 tons per square foot. Foundations within the more competent shale may be designed using a bearing value of 10 tons per square foot.

5.0 DISCUSSION (continued)

Settlements of footings designed for the above bearing values are expected to be negligible.

Temporary construction slopes should be at at least 1 vertical to 1 horizontal through the overburden and excavation side slopes of about 70 degrees should be allowed for within the shale; in practice, attempts should be made to cut the more competent shale vertically with the above configuration assumed for purposes of design.

Since the shale is susceptible to deterioration from the effects of water, frost and the like, ponded water should be removed from the excavated grade.

In the design of the abutment walls it is recommended that a lateral earth pressure coefficient of 0.4 be used over the full height of the wall. The selection of this coefficient is based on the fact that the retaining walls will extend through the overburden, weathered shale and into the more competent shale and limestone. The earth pressure has, therefore, been selected for a structure founded on an unyielding base with allowance for weathering and clay seams in the shale. This approach may be somewhat conservative but it has been selected to take into the account the presence of clay layers and their influence on long term pressure. It is recommended that well compacted free draining and well graded granular material be provided as backfill behind the abutment walls and wing walls for a thickness of at least 3 feet and that suitable positive drainage be provided to prevent the build up of excess hydrostatic pressure behind the walls; with this thickness frost penetration through the wall affecting the clay would virtually be eliminated. The base of the abutment walls on the shale may be designed against sliding using an ultimate friction coefficient of 0.6 where the shale is protected against softening and weathering over the long term; allowance for passive resistance in front of the abutment should be ignored and where additional resistance is required against sliding, this should be provided by the use of dowels or keys.

5.0 DISCUSSION (continued)

Since the shale is susceptible to deterioration under the effects of frost as mentioned earlier, it is recommended that the foundations be located at least 3 feet below final roadway grade.

The probes put down along the approaches to the underpass were primarily intended to establish approximately the surface of the shale. In selecting final slopes to the approaches, it should be recognized that the shale gradually deteriorates over the long term and eventually develops slopes more typical of soil. Similarly, following periods of rain, seepage will occur through the overburden, and will concentrate likely at the interface between the overburden and shale particularly where the overburden is predominantly sand. The form of surface treatment should be designed to prevent erosion of the sand. As a guide, it is recommended that permanent slopes in the overburden and shale be at least 2 horizontal to 1 vertical for long term stability and they should be protected by a vegetation cover other suitable means to minimize surface weathering; provision for surface drainage at the crest of the slopes should be made.

6.0 GENERAL

We trust that this report provides all of the information required from this investigation at this time. Should you have any questions or require further assistance from us during final design, please do not hesitate to call us.

Yours very truly,

GEOCON LTD

D.B. Oates

DBO:jc
T9853

D. B. Oates, P. Eng.
Regional Engineer

APPENDIX I

OFFICE REPORTS ON SOIL EXPLORATION

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EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

The object of this form is to enable a comprehensive study of the soil to be made by combining on one sheet all of the information obtained from the boring. An explanation of the various columns of the report follows.

ELEVATION AND DEPTH

This column gives the elevation and depth of boundaries between the various soil strata. The elevation is referred to the datum shown in the general heading.

WATER CONDITIONS

In this column the water level in the casing at the time of boring or the water table in the ground, determined by a series of observations in a piezometer or standpipe, is indicated to scale by a horizontal line with the symbol W.L. or W.T. above the line. A notation of any complicated groundwater conditions will be made in this column.

DESCRIPTION

A description of the soil, using standard terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms:

Consistency	U-Strength Tons/sq. ft.
Very soft	0.03 to 0.25
Soft	0.25 to 0.5
Firm	0.5 to 1.0
Stiff	1.0 to 2.0
Very stiff	2.0 to 4.0
Hard	over 4.0

Relative Density	Standard Penetration Resistance. Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

STRATIGRAPHIC PLOT

The stratigraphic plot follows the standard symbols of the National Research Council, Canada.

ELEVATION SCALE

The information in all columns is plotted to a true elevation scale which is shown in this column.

GRAPHS

The main body of the report forms a graph which is used to plot to correct elevation the important soil properties which are obtained through field and laboratory tests. The scales and symbols for the plotting are shown at the head of the column.

OTHER TESTS

In this column are shown, by symbol, the other field or laboratory tests which have been performed on the soil and for which the results have not been plotted on the above graph.

SAMPLES

The first three columns describe the condition, type and number of each sample obtained from the boring. The location and extent of each sample is plotted to scale.

In the last column is shown the penetration resistance in blows of 4200 inch-pounds required to drive one foot of the sampler into the ground. When a 2 inch Drive Sampler is used the result obtained is termed the "Standard Penetration Resistance".

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APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T.9853 BORING # 1 DATUN GEODETIC CASING —

BORING DATE OCT. 18, 1974 REPORT DATE OCT. 22 1974 COMPILED BY N.L CHECKED BY —

SAMPLER HAMMER WT 140 LBS DROP 20 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN-LBS ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; S.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE-FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF; LAB. U-TEST; % STRAIN; FIELD VANE; REMOULDED; LAB. VANE; REMOULDED

WATER CONTENT W% — NAT. Lw Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	OTHER TESTS / R.C. RECOV	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.	DEPTH-FT.
347.0		GROUND LEVEL							0
0.0		5" TOP SOIL DENSE TO VERY DENSE BROWN AND GREY BROWN SAND, GRAVEL, SOME SILT, WEATHERED SHALE / CLAY AT DEPTH (AUGER HOLE CAVING AT 7") (POSSIBLY FILL.)				2"DO	1	15	
						" DO	2	34	
						" DO	3	>100	
						" DO	4	60	
338.0									10
9.0		LIMEY SHALE TO WEATHERED SHALE AND CLAY		58%		5" DXL RC	5	—	
				14%			6	—	
330.0									15
17.0	WL @ EL 329.6' OCT. 22 1874	REDDISH BROWN TO GREENISH GREY SHALE, SEAMS OF LIMEY SHALE (SOME WEATHERED ZONES)		87%		2'-00 DXL RC	8	>100	
				98%			9	—	20
				60%			10	—	
320.3									25
26.7		END OF HOLE							30
									35
									40
									45
									50
									55

75 BLOWS = LAST 6"

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APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T9853 BORING # 2 DATUM GEODETIC CASING

BORING DATE OCT. 9 1974 REPORT DATE OCT 15 1974 COMPILED BY N.L CHECKED BY

SAMPLER HAMMER WT 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: A.S. - AUGER SAMPLE; B.T. - SLOTTED TUBE; W.S. - WASHED SAMPLE; D.O. - DRIVE-OPEN; D.F. - DRIVE FOOT VALVE; C.S. - CHUNK SAMPLE; F.S. - FOIL SAMPLE; S.O. - SLEEVE-OPEN; S.F. - SLEEVE-FOOT VALVE; T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

ABBREVIATIONS: V - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF; LAB. U-TEST; % STRAIN; FIELD VANE; REMOULDED; LAB. VANE; REMOULDED

WATER CONTENT W% @ NAT. Lw Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVN. / DEPTH	DESCRIPTION	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
346.0 / 0.0	GROUND LEVEL					
	10" TOPSOIL — VERY LOOSE TO VERY DENSE BROWN, REDDISH BROWN AND GREY SILTY TILL, SAND AND SILTY SAND AND GRAVEL WITH WEATHERED CLAY AND SHALE. (AUGERHOLE CAVING 8'–10') (POSSIBLY FILL)			2" DO	1	14
				" DO	2	16
				" DO	3	2
				" DO	4	61
				" DO	5	47
				" DO	6	44
334.0 / 12.0	WEATHERED SHALE, LIMEY SHALE & CLAY	RC RECOV 50%			7	—
332.0 / 14.0		100%		2" DO	8	100
	REDDISH BROWN TO GREENISH GREY SHALE, SEAMS OF LIMEY SHALE (SOME WEATHERED ZONES)	96 %		BXL R.C.	10	—
		86%			11	—
		95 %			12	—
320.3 / 25.7	END OF HOLE					

WL @ EL. 333.1' OCT. 22 1974

10 BLOWS LAST 1" — 50 BLOWS NO ADVANCE

-2-

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APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T9853 BORING # 3 DATUM GEODETIC CASING —
BORING DATE OCT. 20. 1974 REPORT DATE OCT 22 1974 COMPILED BY N.L. CHECKED BY [signature]
SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION
- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES
- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE-OPEN
- D.F. - DRIVE-FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
- R.C. - ROCK CORE

ABBREVIATIONS
- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- QC - TRIAXIAL CONSOLIDATED UNDRAINED
- Q - TRIAXIAL UNDRAINED
- S - TRIAXIAL DRAINED
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF; LAB. U - TEST 10 - 5 % STRAIN; FIELD VANE; REMOULDED; LAB. VANE; REMOULDED
WATER CONTENT W% (● NAT., ⊡ Lw, △ Pw): 20, 40, 60, 80
DYNAMIC PENETRATION TEST BLOWS PER FOOT: 20, 40, 60, 80

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS / R.C. RECOV
343.3		GROUND LEVEL	
342.1 / 0.0		BLACK CINDERS	
334.3 / 1.2		DENSE TO VERY DENSE REDDISH BROWN, GREY BROWN AND DARK BROWN SILTY SAND AND GRAVEL WEATHERED SHALE / CLAY (POSSIBLY FILL)	
327.3 / 9.0	WL @ EL. 333.1' OCT. 22. 1974	WEATHERED SHALE LIMEY SHALE AND CLAY	24%, 16%
317.0 / 16.0		REDDISH BROWN TO GREENISH GREY SHALE SEAMS OF LIMEY SHALE (SOME WEATHERED ZONES)	100%, 85%
26.3		END OF HOLE	

125 BLOWS — LAST 10"

SAMPLES

CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
Disturbed	2" DO	1	12
Disturbed	" DO	2	33
Disturbed	" DO	3	>100
Disturbed	" DO	4	52
Disturbed	" DO	5	65
	" DO	6	>100
	BXL RC	7	—
	BXL RC	8	—
	2" DO	9	>100
	BXL RC	10	—
	BXL RC	11	—

DEPTH - FT.: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55

APPENDIX I

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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T.9853 BORING # 4 DATUM GEODETIC CASING —

BORING DATE OCT. 20 1974 REPORT DATE OCT. 22 1974 COMPILED BY N.L. CHECKED BY N.T.

SAMPLER HAMMER WT. 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: AS - AUGER SAMPLE; ST - SLOTTED TUBE; WS - WASHED SAMPLE; DO - DRIVE-OPEN; DF - DRIVE-FOOT VALVE; CS - CHUNK SAMPLE; FS - FOIL SAMPLE; SO - SLEEVE OPEN; SF - SLEEVE FOOT VALVE; TO - THIN WALLED OPEN; RC - ROCK CORE

ABBREVIATIONS: V - IN SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; QC - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF (0 – 5 – 10 % STRAIN); FIELD VANE; REMOULDED; LAB. VANE; REMOULDED

WATER CONTENT W% (20 40 60 80) NAT; LW; PW

DYNAMIC PENETRATION TEST BLOWS PER FOOT (20 40 60 80)

ELEVN / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
344.9		GROUND LEVEL						
0·0		BLACK CINDERS						
1·2	WL@EL. 340.9' OCT 22 1974	DENSE TO VERY DENSE BROWN REDDISH & GREY BROWN SILTY SAND, GRAVEL, WEATHERED SHALE/CLAY (POSSIBLY FILL TO 9') (SAND 9·5'–11') (NB WET AT 12·2' ON AUGER				2" DO	1	7
						" DO	2	45
						" DO	3	>100
						" DO	4	70
						" DO	5	43
						" DO	6	39
332·5						" DO	7	>100
12·4						" DO	8	>100
		REDDISH BROWN AND SOME GREY WEATHERED SHALE WITH CLAY SEAMS		80%			9	—
327.6								
17·3		REDDISH BROWN TO GREENISH GREY SHALE SEAMS OF LIMEY SHALE (SOME WEATHERED ZONES)		80%		BXL RC	10	—
				91%			11	—
318·4								
26·5		END OF HOLE						

4

50 BLOWS: — LAST 3"

DEPTH - FT. (0 5 10 15 20 25 30 35 40 45 50 55)

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APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T9853 BORING # P1, P2 & P2A DATUM GEODETIC CASING —

BORING DATE OCT. 22, 1974 REPORT DATE OCT. 28 1974 COMPILED BY N.L CHECKED BY —

SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION

DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES

AS - AUGER SAMPLE
ST - SLOTTED TUBE
WS - WASHED SAMPLE
DO - DRIVE OPEN
DF - DRIVE FOOT VALVE
CS - CHUNK SAMPLE
FS - FOIL SAMPLE
SO - SLEEVE OPEN
SF - SLEEVE FOOT VALVE
TO - THIN WALLED OPEN
RC - ROCK CORE

ABBREVIATIONS

V - IN SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF
LAB. U - TEST 12 — 6 % STRAIN
FIELD VANE
REMOULDED
LAB. VANE
REMOULDED
WATER CONTENT W% @ NAT @ LW ▲ PW
DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.	DEPTH - FT.
P1									
336.9		GROUND LEVEL							
0.0		TOP SOIL							
0.5		SILTY SAND AND GRAVEL							
330.4									
6.5		REDDISH BROWN CLAY							
328.9									
8.0		CLAY AND WEATHERED SHALE							
327.4									
9.5		END OF AUGER HOLE (REFUSAL TO AUGERING)							
P2									
336.9		GROUND LEVEL							
0.0		SAND AND GRAVEL							
334.9									
2.0		REDDISH BROWN CLAY (WET AT 6.5')							
329.9									
7.0		CLAY WEATHERED SHALE							
327.9									
9.0		END OF AUGERHOLE (REFUSAL TO AUGERING)							
P2A									
340.4		GROUND LEVEL							
0.0									
329.9									
10.5		END OF AUGERHOLE (REFUSAL TO AUGERING)							

NB
DESCRIPTION BASED ON AUGER CUTTINGS ONLY.

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APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T9853 BORING# P3 & P4 DATUM GEODETIC CASING —

BORING DATE OCT. 21, 1974 REPORT DATE OCT. 28, 1974 COMPILED BY N.L. CHECKED BY

SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- ⊠ DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- AS - AUGER SAMPLE
- ST - SLOTTED TUBE
- WS - WASHED SAMPLE
- DO - DRIVE-OPEN
- DF - DRIVE-FOOT VALVE
- CS - CHUNK SAMPLE
- FS - FOIL SAMPLE
- SO - SLEEVE-OPEN
- SF - SLEEVE FOOT VALVE
- TO - THIN WALLED OPEN
- RC - ROCK CORE

ABBREVIATIONS

- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- CC - TRIAXIAL CONSOLIDATED UNDRAINED
- Q - TRIAXIAL UNDRAINED
- S - TRIAXIAL DRAINED
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF

LAB. U - TEST 0 5 10 % STRAIN

FIELD VANE ✱ REMOULDED ✱ LAB. VANE ✱ REMOULDED

WATER CONTENT W% 20 40 60 80 ⊕ PAT. ⊡ LW ▲ PW

DYNAMIC PENETRATION TEST BLOWS PER FOOT 20 40 60 80

SOIL PROFILE				ELEVATION SCALE	OTHER TESTS	SAMPLES				
ELEVN / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT			CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.	DEPTH - FT.
340.7		GROUND LEVEL								
0.0		BROWN TO RED BROWN SILTY SAND AND GRAVEL, (INCREASE IN GRAVEL AT 2', 4' & 8')								
329.7										
11.0		RED BROWN SHALE								
12.0		END OF AUGERHOLE (REFUSAL TO AUGERING)								

P3

340.7		GROUND LEVEL								
0.0		BROWN TO RED BROWN SILTY SAND AND GRAVEL. REDDISH BROWN CLAY AND WEATHERED SHALE AT DEPTH GRAVEL AT 4'-5' GREY SHALE AT 12' (WET AT 8' ON AUGERS)								
325.7										
15.0		END OF AUGERHOLE (REFUSAL TO AUGERING)								

P4

N.B. DESCRIPTION BASED ON AUGER CUTTINGS ONLY.

GEOCON

APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T.9853 BORING # P5 & P6 DATUM GEODETIC CASING —

BORING DATE NOV. 7 1974 REPORT DATE NOV. 11, 1974 COMPILED BY N.L. CHECKED BY JO

SAMPLER HAMMER WT 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE OPEN
- D.F. - DRIVE FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
- R.C. - ROCK CORE

ABBREVIATIONS

- V - IN-SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- Qc - TRIAXIAL CONSOLIDATED UNDRAINED
- Q - TRIAXIAL UNDRAINED
- S - TRIAXIAL DRAINED
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF (0 – 10) ⊕ FIELD VANE ⊗ REMOULDED ✕ LAB. VANE ▼ REMOULDED

LAB. U - TEST ⊞ 5 % STRAIN

WATER CONTENT Ws ——— ⊙ NAT. ⊡ Lw ▲ Pw (20, 40, 60, 80)

DYNAMIC PENETRATION TEST BLOWS PER FOOT (20, 40, 60, 80)

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT
350.4		GROUND LEVEL	
0.0		TOP SOIL	
0.8		BROWN TO REDDISH BROWN SILTY SAND TO SANDY SILT WITH STRATIFIED WEATHERED SHALE OR GRAVEL LAYERS @ 2', 3', 7', 10' & 12'	
333.4			
17.0		WEATHERED SHALE	
326.9			
23.5		END OF AUGERHOLE REFUSAL TO AUGERING	
351.6		GROUND LEVEL	
0.0		TOP SOIL	
0.8		BROWN TO REDDISH BROWN SILTY SAND WITH STRATIFIED GRAVEL LAYERS @ 4', 5', 7.5' & 9'	
338.6			
13.0		REDDISH BROWN CLAYEY SILT (TILL) WET AT 14'	
336.6			
15.0		WEATHERED SHALE	
332.6			
19.0		END OF AUGERHOLE REFUSAL TO AUGERING	

P5: 50 BLOWS LAST 6"

P6: 60 BLOWS LAST 6"

N.B. DESCRIPTION BASED ON AUGER CUTTINGS ONLY.

OTHER TESTS

SAMPLES: CONDITION | TYPE | NUMBER | PENETRATION RESISTANCE BLOWS/FT. | DEPTH - FT.

GEOCON

APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T9853 BORING # P.7 & P.8 DATUM GEODETIC CASING —

BORING DATE NOV. 7 1974 REPORT DATE NOV. 11, 1974 COMPILED BY N. L. CHECKED BY

SAMPLER HAMMER WT. 140 LBS DROP 30 INCHES. (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION

DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES

AS - AUGER SAMPLE
ST - SLOTTED TUBE
WS - WASHED SAMPLE
DO - DRIVE-OPEN
DF - DRIVE-FOOT VALVE
CS - CHUNK SAMPLE
FS - FOIL SAMPLE
SO - SLEEVE-OPEN
SF - SLEEVE FOOT VALVE
TO - THIN WALLED OPEN
RC - ROCK CORE

ABBREVIATIONS

V - IN SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
GC - TRIAXIAL CONSOLIDATED UNDRAINED
Q - TRIAXIAL UNDRAINED
S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF (0, 5, 10) — FIELD VANE — LAB. VANE — REMOULDED — REMOULDED

LAB. U-TEST — % STRAIN

WATER CONTENT W% — @ NAT — Lw — Pw (20, 40, 60, 80)

DYNAMIC PENETRATION TEST BLOWS PER FOOT (20, 40, 60, 80)

ELEVN / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.	DEPTH - FT.
351.8		GROUND LEVEL								0
0.0		7" TOP SOIL								
		BROWN TO REDDISH BROWN SILTY SAND WITH SOME GRAVEL								5
343.8		REDDISH BROWN CLAYEY SILT (TILL)								
8.0		PEN. TEST WET @ 8.5'								
341.8		WET @ 10' ON AUGER								10
10.0		WEATHERED SHALE								
339.6										
12.2		END OF AUGERHOLE REFUSAL TO AUGERING								15
										20
352.2		GROUND LEVEL								
0.0		REDDISH BROWN SILTY CLAY (TILL) MIXED WITH SHALE FRAGMENTS OR LAYERS OF WEATHERED SHALE. (PEN. TEST RODS WET @ 7.6' WET @ 12' ON AUGER)								25
339.7										30
12.5		WEATHERED SHALE								
339.7										35
13.5		END OF AUGERHOLE REFUSAL TO AUGERING								40
										45
										50
										55

P7

7.3 BLOWS LAST 6"

P8

8 BLOWS FOR 8"
92 BLOWS LAST 4"

N.B. DESCRIPTION BASED ON AUGER CUTTINGS ONLY

GEOCON

APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T.9853 BORING # P.9 & P.10 DATUM GEODETIC CASING —
BORING DATE NOV. 7. 1974 REPORT DATE NOV. 11. 1974 COMPILED BY N. L. CHECKED BY —
SAMPLER HAMMER WT 140 LBS DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION: DISTURBED; FAIR; GOOD; LOST

SAMPLE TYPES: AS - AUGER SAMPLE; ST - SLOTTED TUBE; WS - WASHED SAMPLE; DO - DRIVE-OPEN; DF - DRIVE-FOOT VALVE; CS - CHUNK SAMPLE; FS - FOIL SAMPLE; SO - SLEEVE-OPEN; SF - SLEEVE FOOT VALVE; TO - THIN WALLED OPEN; RC - ROCK CORE

ABBREVIATIONS: V. - IN-SITU VANE TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Qc - TRIAXIAL CONSOLIDATED UNDRAINED; Q - TRIAXIAL UNDRAINED; S - TRIAXIAL DRAINED; γ - WET UNIT WEIGHT; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF; LAB. U - TEST; % STRAIN; FIELD VANE; REMOULDED; LAB. VANE; REMOULDED

WATER CONTENT W% — NAT. Lw Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVN / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT
351.6		GROUND LEVEL	
0.0		3" TOP SOIL	
		BROWN TO REDDISH BROWN SILTY SAND AND GRAVEL	
348.6			
3.0		REDDISH BROWN SANDY & CLAYEY SILT (TILL) WITH STRATIFIED SAND AND GRAVEL LAYERS AT 4', 5' & 10'	
341.6			
10.0		WEATHERED SHALE	
338.1			
13.5		END OF AUGERHOLE REFUSAL TO AUGERING	

P9

50 BLOWS LAST 1½" → 10'

ELEVN / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT
354.6		GROUND LEVEL	
0.0		3" TOP SOIL	
		REDDISH BROWN SANDY & CLAYEY SILT (TILL) MIXED WITH SHALE FRAGMENTS OCC. STRATIFIED SAND & GRAVEL LAYERS	
346.6		PEN. TEST ROD WET @ 7.5'-8'	
8.0		WEATHERED SHALE	
344.1			
10.5		END OF AUGERHOLE REFUSAL TO AUGERING	

P10

10' →

101 BLOWS LAST 11"

N.B. DESCRIPTION BASED ON AUGER CUTTINGS ONLY

OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT	DEPTH - FT.

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APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T.9853 BORING # P.11 DATUM — CASING —

BORING DATE OCT. 9 1974 REPORT DATE NOV. 12 1974 COMPILED BY N. L CHECKED BY —

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
- W.S. - WASHED SAMPLE
- D.O. - DRIVE-OPEN
- D.F. - DRIVE-FOOT VALVE
- C.S. - CHUNK SAMPLE
- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
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ABBREVIATIONS

- V - IN SITU VANE TEST
- M - MECHANICAL ANALYSIS
- U - UNCONFINED COMPRESSION
- Qc - TRIAXIAL CONSOLIDATED UNDRAINED
- Q - TRIAXIAL UNDRAINED
- S - TRIAXIAL DRAINED
- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

UNDRAINED SHEAR STRENGTH - PSF

LAB. U - TEST 15 10 5 % STRAIN

FIELD VANE ⊕ REMOULDED

LAB. VANE ⊗ REMOULDED

WATER CONTENT W% ——— ○ NAT. ◐ LW ▲ PW

20 40 60 80

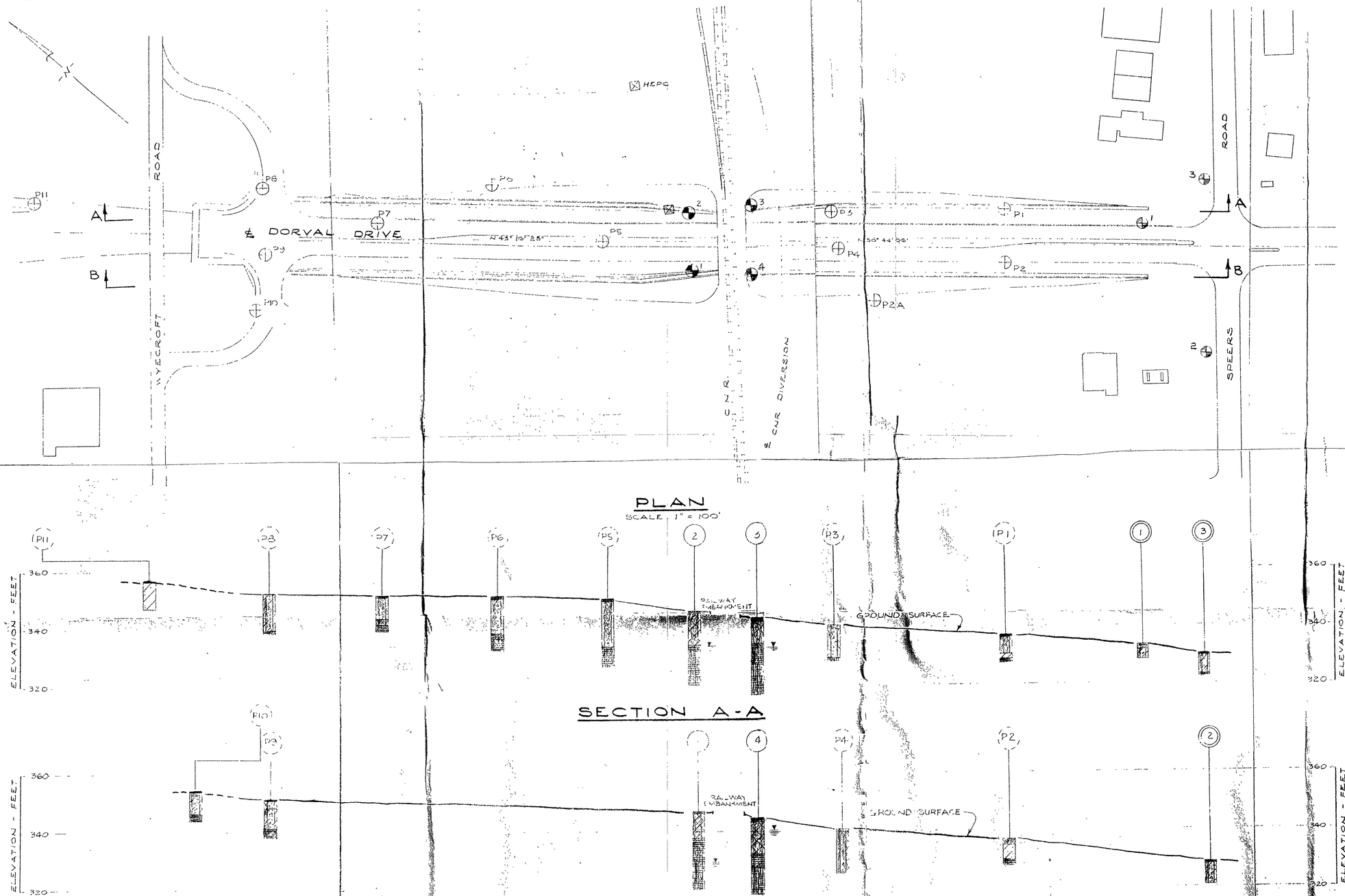
DYNAMIC PENETRATION TEST BLOWS PER FOOT . . v . . . x . . . x . . .

20 40 60 80

ELEVN. DEATH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.	DEPTH - FT.
356.9		GROUND LEVEL								0
0.0		2" TOP SOIL								
		RED BROWN SANDY & SILTY CLAY								5
348.9										
8.0		INCREASED AUGERING RESISTANCE								10
347.4										
9.5		END OF AUGERHOLE REFUSAL TO AUGERING								15
										20
										25
										30
										35
										40
										45
										50
										55

F11

100 BLOWS : LAST INCH



PLAN

SCALE 1" = 100'

SECTION A-A

SECTION B-B

SCALE: HORIZ. 1" = 100'
VERT. 1" = 20'

LEGEND

- BOREHOLE IN PLAN
- AUGERHOLE AND/OR PENETRATION TEST IN PLAN
- AUGERHOLE IN PLAN (PREVIOUS INVESTIGATION)
- BOREHOLE IN SECTION
- AUGERHOLE AND/OR PENETRATION TEST IN SECTION
- AUGERHOLE IN SECTION (PREVIOUS INVESTIGATION)
- WATER LEVEL - OCT. 1974

STRATIGRAPHY

- TOPSOIL CINDERS
- VERY LOOSE TO VERY DENSE BROWN TO GREY SAND, SILTY SAND AND GRAVEL (POSSIBLY FILL)
- BROWN TO REDDISH BROWN SILTY SAND, SANDY SILT AND GRAVEL
- REDDISH BROWN CLAY
- REDDISH BROWN SANDY/CLAYEY SILT (TILL)
- REDDISH BROWN AND GREY WEATHERED SHALE, LIMEY SHALE AND CLAY
- REDDISH BROWN TO GREYISH GREY SHALE

SPECIAL NOTES

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT BOREHOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN BOREHOLES MAY VARY FROM THAT SHOWN.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

REVISIONS			REFERENCE		REFERENCE	
MARK	DATE	DESCRIPTION	DWG NO	DESCRIPTION	DWG NO	DESCRIPTION
			T9635	GEOCON LTD REPORT TO FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED - SOIL INVESTIGATION, DORVAL DRIVE - DATED: DEC. 21, 1972	6322-IT-1	FOUNDATION OF CANADA, ENGINEERING CORPORATION LIMITED - PLAN, DORVAL DRIVE, SPEERS ROAD TO WYECROFT ROAD - TOWN OF OAKVILLE

FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED
TORONTO ONTARIO

PROPOSED UNDERPASS
DORVAL DRIVE
OAKVILLE ONTARIO

BORING PLAN & SOIL STRATIGRAPHY

GEOCON LTD

DATE OCT. 28, 1974 SCALE AS SHOWN

MADE	CHKD	APPD.	No. T9853 - 1
AEL		DW	