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Rexdale, Ontario,
November 30th, 1965.

Department of Highways, Ontario,
Materials and Testing Division,
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,
Principal Foundation Engineer.

Re: Soil Conditions and Foundations,
Proposed Kipling Avenue Underpass,
and C.N.R. Subway,
Etobicoke, Ontario;.

Dear Sirs:

This letter accompanies our report on the above investigation.

We find that the soil conditions consist of a surficial cover of topsoil or fill underlain by dense to very dense brown to grey silt till and very dense sand till. The actual soil and groundwater conditions are described in detail in the report.

Based on the findings of this investigation, spread footings founded within the silt till would be a suitable foundation for the proposed abutments, piers and retaining walls. Recommended allowable bearing values and lateral earth pressure coefficients for design are given in the report. Other recommendations from a soil mechanics standpoint pertinent to foundation design and construction of the proposed structures are also given in the report.

We believe that this report provides all the information required from this investigation. If you should wish to discuss this report in any way or if we can be of assistance otherwise, please do not hesitate to call us.

Yours very truly,

GEOCON LTD

M. A. J. Matich, P. Eng.,
President.

MAJM/reb

T7818A

REPORT

TO

DEPARTMENT OF HIGHWAYS, ONTARIO

MATERIALS AND TESTING DIVISION

ON

SOIL CONDITIONS AND FOUNDATIONS

PROPOSED KIPLING AVENUE UNDERPASS

AND C.N.R. SUBWAY

ETOBICOKE ONTARIO

Distribution:

11 copies - Department of Highways, Ontario,
Materials and Testing Division,
Downsview, Ontario.

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INTRODUCTION

Geocon Ltd has been retained by the Department of Highways, Ontario by letter and by Purchase Order No. J34798 dated November 9th, 1965 to investigate and report on the soil conditions for the proposed C. N. R. Subway and Kipling Avenue Underpass on Kipling Avenue North between the Highway 401 and Rexdale Boulevard in the Township of Etobicoke, Ontario.

The object of the investigation was to determine and interpret the soil and ground water conditions as they effect the design and construction of the proposed C. N. R. Subway and Kipling Avenue Underpass.

SUMMARIZED SOIL CONDITIONS

The site is covered by a layer of topsoil or fill. The topsoil is up to 2.5 feet thick. The fill which is very loose to compact consists of silt till fill or sandy to clayey fill with gravel and cinders. The fill varies in thickness from 0.7 to 10.3 feet.

Underlying the topsoil and fill is a layer of brown silt till which becomes grey in colour at a depth of between 14 and 17 feet. The relative density of the silt till is generally dense to very dense. However, the upper few feet of both the brown and grey silt till are compact to dense.

Beneath the grey silt till and encountered between elevation 477 and 485 is a stratum of very dense grey sand till. The sand and silt tills are separated in places by a thin stratum, between 1 and 2 feet, of stiff grey silty clay with silt layers.

DISCUSSION

It is understood that it is proposed to construct a subway beneath the C. N. R. tracks at Kipling Avenue North about 1/2 mile north of the Highway 401. The elevation of the C. N. R. tracks is about 520, and it is understood that it is proposed to lower Kipling Avenue at this point to about elevation 500. Because of limited space the approach ramps to the subway, which are about 400 feet long, will be constructed using retaining walls up to about 22 feet high. The use of retaining walls will cut off access to the Law Construction Yard to the south-east of the site. Access to this Yard is to be provided by an access bridge over Kipling Avenue, south of the C. N. R. tracks. It is understood that the two bridge structures spanning Kipling Avenue will have two closed abutments and a central pier. Kipling Avenue will be widened to 4 lanes and have a central boulevard up to 36 feet wide.

The discussion which follows will deal with the foundation recommendations for the C. N. R. Subway and for the Kipling Avenue Underpass and retaining walls separately. In addition, the discussion contains a number of general recommendations from a soil mechanics' standpoint which will apply to both structures.

C. N. R. Subway

The significant soil stratum from the point of view of the foundations of this structure is the dense to very dense grey silt till. The soil conditions are suitable for the use of spread footings for the proposed abutments, pier and retaining walls.

For frost protection purposes, it is recommended that all footings subject to frost action be provided with a minimum of 4 feet of earth cover. To meet this frost protection requirement and with the proposed grades, footings will be founded at about elevation 496, i. e. within the dense to very dense grey silt till. For footings founded within the grey silt till at elevation 496 a net allowable bearing value of 2 tons per square foot may be used in design. The resulting total and differential settlements of footings designed for the above net

C. N. R. Subway (continued)

allowable bearing value will then be within tolerable limits for the type of construction proposed. It is recommended, however, that suitable construction joints be provided, in particular between the abutments and the retaining walls.

Kipling Avenue Underpass

The significant soil strata, from a foundation point of view, for the Kipling Avenue Underpass, that is, the Law Construction Access Bridge and the 400 foot long retaining walls, are the dense to very dense brown and grey silt tills. The soil conditions are suitable for the use of spread footings for the proposed bridge piers and abutments, and retaining walls. For frost protection it is recommended that all footings subject to frost action be provided with a minimum of 4 feet of earth cover.

With frost protection and proposed grade requirements, the footings for the access bridge will be founded at about elevation 496, that is, within the dense to very dense grey silt till. As presently proposed the retaining walls will range from 2 to 22 feet in height. As such, the foundations for the retaining walls will range from about elevation 496 to about elevation 520. The foundations for the retaining walls will then be within the brown and grey silt tills.

Kipling Avenue Underpass (continued)

For the design of spread footings for the above structures it is recommended that a net allowable bearing value of 2.0 tons per square foot be used. At this allowable bearing value, total and differential settlements will be within tolerable limits for the type of construction proposed. It is recommended that suitable construction joints be provided, in particular between the abutments and retaining walls.

General

With a foundation elevation of about 496 at the C.N.R. Subway and the adjacent section of the Underpass, excavation will be required to or slightly below the ground water level. Due to the impermeable nature of the silt till, inflow of water into the excavation will be small and may be readily handled by pumping from filter equipped sumps. Excavations for the retaining walls should be cut back on a slope of 1 horizontal to 1 vertical. If, because of space considerations, this is not possible, suitable shoring such as soldier beams and lagging will be necessary in the deeper cut sections.

General (continued)

Positive permanent subsurface drainage will be required since the proposed grade of the Underpass will be below the observed ground water level. It is pointed out that the ground water level could be higher during the spring than observed during the time of investigation. For subdrainage purposes, perforated or open-jointed drainage pipes could be used if embedded in suitable filter material. These should be led to a sump or sumps, from which accumulated water would have to be removed either by pumping, or gravity if this is practical. The actual detail of the drainage system would depend on details of natural and other forms of existing drainage such as storm sewers.

To avoid disturbance of the base of the excavations by water or construction traffic it is recommended that, when they have been trimmed to final grade, the base of the excavations be covered by a thin mud mat of lean concrete.

It is recommended that backfill behind the abutments and retaining walls consist of at least 4 feet of compacted, well graded, non-frost susceptible granular material and that this backfill be provided with positive permanent drainage to avoid build-up of hydrostatic pressure behind the abutments and retaining walls. If the build-up of hydrostatic pressure is prevented,

General (continued)

the abutments and retaining walls may be designed only for lateral earth pressure, with due allowance for any surcharge that may be involved. For the case that the abutments are constructed integrally with the deck slabs and as such act as rigid frames a coefficient of "at rest" earth pressure of 0.5 is recommended. For the case where the decks are not constructed intergrally with the abutments a coefficient of 0.4 may be used. The retaining walls should also be designed using a lateral earth pressure coefficient of 0.4 with due allowance for surcharge.

The design of the abutments and retaining walls should be checked against sliding and a factor of safety of at least 1.5 provided.

Calculations, on the stability of the retaining structures against deep-seated failure considering a maximum height of about 22 feet, indicate that the factor of safety is greater than the acceptable value of 1.3.

It is assumed that construction of the Subway will involve an initial detour of the existing C.N.R. Tracks, as is presently being carried out at the intersection of Martin Grove

General (continued)

and the C. N. R. Tracks. Should however, planning call for underpinning measures we would be pleased to provide pertinent information from a soil mechanics standpoint.

CONCLUSIONS AND RECOMMENDATIONS

1) The site is covered by a layer of topsoil or till fill. The maximum thickness of fill encountered was about 10 feet. These are underlain by dense to very dense brown to grey silt till and very dense sand till. In places the silt and sand tills are separated by a thin layer of stiff silty clay.

2) The ground water level at the time of the investigation ranged between elevations 508 and 497.

3) It is recommended that the piers, abutments and retaining walls be carried on spread footings at the net allowable bearing values given in the report.

4) The piers, abutments and retaining walls will experience settlements which should be within tolerable limits as discussed in the report.

5) Recommendations for the lateral forces to be used in design of the retaining walls and the abutments are given in the report.

PERSONNEL

The field work for this report was carried out under the supervision of Mr. Peters. This report was written by Mr. J. N. Beckett, checked by Mr. D. B. Oates, P. Eng. and reviewed by Mr. M. A. J. Matich, P. Eng.

Yours very truly,

GEOCON LTD

J. N. Beckett,
Soils Engineer.

JNB/reb

APPENDIX I

PROCEDURE

SITE AND GEOLOGY

SOIL CONDITIONS

WATER CONDITIONS

OFFICE REPORTS ON SOIL EXPLORATION

PROCEDURE

The field work for this project was commenced on November 10th, and completed on November 18th, 1965. Seventeen boreholes were put down using two mobile power augers. The boreholes, which ranged in depth from 12 to about 50 feet, were sampled at five foot intervals.

The locations of the boreholes together with the inferred soil conditions are shown on Drawings T7818-1 and 2 located in the pocket at the rear of this report. Detailed logs of the boreholes are given on the Office Reports on Soil Exploration in this Appendix.

The laboratory testing was carried out in the Toronto Soil Mechanics Laboratory of Geocon Ltd and the results are presented on the Office Reports and on the Figures in Appendix II. The soil samples remaining after testing will be stored until November 1966 at which time you will be contacted for instructions regarding their disposal.

The elevations of the boreholes are referred to a temporary bench mark which was established by Foundation of Canada Engineering Corporation Limited. This bench mark is the top of the catch basin grill located about 300 feet north of the C. N. R. tracks on the west side of Kipling Avenue. The

elevation of this catch basin was given as 523.25 and it is believed that this is referred to Geodetic datum.

SITE AND GEOLOGY

The C.N.R. Subway and the Kipling Avenue Underpass are located about 1/2 mile north of the Highway 401 on Kipling Avenue North in the Township of Etobicoke, Ontario. The approach retaining walls will extend about 400 feet north and south of the C.N.R. tracks, that is, from Bellfield Road at the south to the Ontario Hydro transmission lines to the north. South of the railroad tracks the ground surface is relatively flat at about elevation 516. The railroad tracks are at about elevation 520. From there, the ground surface rises to the north to about elevation 525.

From available geological information and previous work in the area it is known that a deep deposit of glacial drift consisting of several till sheets covers the area. The till sheets are separated in places by interglacial sands, silts and clays.

SOIL CONDITIONS

The principal soil strata encountered in the boreholes are as follows:

Topsoil

A layer of topsoil was encountered in the Ontario Hydro property to the north of the C. N. R. tracks and in the Etobicoke Hydro property to the south and west of the C. N. R. tracks. The topsoil and soil containing a noticeable organic content as encountered at the borehole locations was found to vary from 0. 5 to 2. 5 feet in thickness and generally from 0. 5 to 1. 0 feet at the borehole locations.

Fill

In those areas close to the railroad tracks, in the property of Law Construction south-east of the C. N. R. tracks and on the shoulder of Kipling Avenue where there was no topsoil a stratum of fill was encountered at ground surface. The thickness of the fill was found to range from 0. 7 to 10. 3 feet. The upper few inches of the fill consist generally of gravel with sand. Below this, particularly close to the railroad tracks, the fill becomes a heterogeneous mixture with grain sizes ranging from sand to clay and containing considerable gravel and cinders. At the locations of boreholes 7, 13 and 17 the fill consists mainly of loose to compact silt till with some organic pockets.

Fill (continued)

Standard penetration resistances or "N" values were obtained in the fill. The "N" values range from 2 to 11 blows per foot indicating that the relative density of the fill varies from very loose to compact.

Compact to Very Dense Brown Silt Till

Underlying the topsoil or fill strata in all boreholes is a stratum of brown silt till. The brown silt till is believed to be the desiccated crust of a deeper deposit of grey silt till. The base of the stratum is not clearly defined since the change from brown to grey is gradual. For the purposes of classification, the change has been estimated as the beginning of the grey silt till and this change is shown on the Office Reports. This stratum was not penetrated fully in boreholes 13 and 17 which were put down to investigate the thickness of the fill. The till contains all grain sizes from clay to sand and some subangular to sub-rounded gravel sized particles up to 2 inches in size, as encountered in the boreholes. It is believed that cobbles and boulders also occur within this stratum. The upper few feet of the brown silt till contains some fissuring.

Compact to Very Dense Brown Silt Till (continued)

Four grain size analyses were carried out on samples of the stratum and the resulting grain size distribution curves are shown on Figure 1 in Appendix II. These show that the brown silt till contains 34 to 54 percent sand and gravel and 46 to 66 percent silt and clay sized particles.

Standard penetration resistances or "N" values were obtained in this stratum. The "N" values ranged from 11 to greater than 100 blows per foot. However, the low values occur in the upper few feet of the stratum, where softening by perched water may have taken place. The relative density of the material is therefore generally dense to very dense.

Four undrained triaxial tests were carried out on relatively undisturbed samples of the brown silt till. The compressive strengths were found to be between 4.1 and 8.5 tons per square foot. The corresponding wet unit weights and water contents ranged from 141 to 151 pounds per cubic foot and 9 to 15 percent, respectively.

Dense to Very Dense Grey Silt Till

Underlying the brown silt till described above is a stratum of grey silt till. This strata was fully penetrated in boreholes 1, 2, 3, 8, 9, 10 and 16 where its thickness was found to range from 15.5 feet in borehole 3 to 25 feet in borehole 10. The grey silt till is composed of all grain sizes from sand to clay and contains some sub-angular to sub-rounded gravel sized particles. The maximum size encountered in the boreholes was 2 inches; however, cobbles and boulders may occur within this stratum. It is believed that occasional thin seams of silty clay occur within the till. One of these layers is described separately below.

Two grain size analyses were carried out on samples of this stratum and the resulting grain size distribution curves are shown on Figure 2 in Appendix II. These curves show that the grey silt till is essentially similar to the brown silt till above. The grey silt till contains between 42 and 48 percent sand and gravel sized particles and between 52 and 58 silt and clay sized particles.

Dense to Very Dense Grey Silt Till (continued)

Standard penetration resistances or "N" values were obtained in this stratum;the resulting "N" values ranged from 17 to greater than 100 blows per foot. The low values occur in the upper part of the grey silt till. The relative density of the stratum therefore, is generally dense to very dense, however, in places the upper few feet are compact to dense.

Undrained triaxial compression tests were carried out on relatively undisturbed samples of the silt till. The resulting unconfined compressive strengths range from 1.7 to 6.6 tons per square foot. The wet unit weights and natural water contents range from 139 to 156 pounds per cubic foot and 7 to 24 percent.

Stiff Grey Silty Clay with Silt Layers

Underlying the grey silt till as encountered in boreholes 1, 2, 3 and 16 is a thin layer of silty clay. This layer was found to be between 1 and 2 feet in thickness as encountered in the boreholes. The surface of this layer is between elevation 480 and 486. A similar layer was encountered within the grey silt till in borehole 11 at an elevation of about 493. The clay is grey in colour and is horizontally laminated. Silt and clayey silt partings and layers up to 1/4 of an inch in thickness occur within the clay.

Stiff Grey Silty Clay with Silt Layers (continued)

Standard penetration resistances or "N" values obtained in the clay layer were 25 and 52 blows per foot.

An Atterberg limit test was obtained on a sample of the silty clay. The resulting liquid and plastic limits were 39 and 22 respectively. The corresponding natural water content was 30 percent.

An undrained triaxial compression test carried out on a relatively undisturbed sample of the silty clay gave a compressive strength of 1.5 tons per square foot. The corresponding wet unit weight was 127 pounds per cubic foot. The consistency of the stratum is therefore considered to be stiff.

Very Dense Grey Sand Till

Underlying the grey silty clay in boreholes 1, 2, 3 and 16 and underlying the grey silt till in boreholes 8, 9 and 10 is a stratum of grey sand till. The surface of this stratum occurs between elevations 477 and 485. The sand till was not fully penetrated in any of the boreholes. The sand till is composed predominantly of silt and sand sized particles and contains some subangular to subrounded gravel sized particles and boulders.

Very Dense Grey Sand Till (continued)

Two grain size analyses were carried out on samples of the sand till. The resulting grain size distribution curves are presented on Figure 3 in Appendix II. The sand till contains between about 40 and 80 percent sand and gravel and between 60 and 20 percent silt sized particles.

Standard penetration resistances or "N" values obtained in the sand till ranged from 57 to greater than 100 blows per foot. In one instance in borehole 16 the sampler was pushed into this stratum. Examination of the sample indicates that this was cave material. The relative density of the stratum is therefore very dense.

WATER CONDITIONS

Observations taken during augering of the boreholes indicate that the ground water level ranges between approximate elevations 508 and 497. Within the area of the C.N.R. Subway the ground water level was at a depth below ground level of about 20 feet. Depending on location the groundwater level along the proposed retaining walls for the Underpass varies from about 15 to 20 feet below ground level.

Piezometers were installed at a depth of about 30 feet within the grey silt till in boreholes 1 and 16. Subsequent observations indicate a water level close to ground surface. However, examination of all the samples recovered within a depth of 15 feet below ground surface and in particular the dry surfaces of the joints and fissures within the samples, indicates that the bentonite seals above each piezometer were not completely effective and as such the piezometers are recording the perched water level at ground surface.

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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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 1 DATUM GEODETIC CASING —
BORING DATE NOV. 10/65 REPORT DATE NOV. 15, 1965 COMPILED BY A.E.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; 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 P.C.F.; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
519.4 / 0.0	WL @ EL. 496.4 ON NOV 10 1965	GROUND LEVEL		520
		DARK BROWN SANDY TO CLAYEY FILL WITH CINDERS		
515.4 / 4.0		COMPACT TO VERY DENSE BROWN SILT TILL		510
504.4 / 15.0		DENSE TO VERY DENSE GREY SILT TILL		500
		STIFF GREY SILTY CLAY WITH SILT LAYERS		490
480.4 / 39.0 / 40.0		VERY DENSE GREY SAND TILL		480
469.6 / 49.8		END OF HOLE		470

COMPRESSIVE STRESS - T.S.F. ▲ (Q) ▼ (Qc) — 30, 40, 60, 80
WATER CONTENT W% — ⊙ NAT ▽ Lw △ Pw — 10, 20, 30, 40
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
M γ=142		2.00	1	2
		" DO	2	20
		" DO	3	86
γ=151		" DO	4	42
M γ=146		" DO	5	32
γ=147		" DO	6	38
		" DO	7	>100
γ=150		" DO	8	>100
		" DO	9	>100
M		" DO	10	96
		" DO	11	>100

APPENDIX I

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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 2 DATUM GEODETIC CASING —
BORING DATE NOV. 11, 1965 REPORT DATE NOV. 15, 1965 COMPILED BY A.E.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
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 P.C.F.
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	COMPRESSIVE STRESS - T.S.F. ▲ (Q) 30 40 60 80 / WATER CONTENT W% ⊙ NAT. ○ LW △ PW 10 20 30 40 / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
					2					
				520						
514.0 / 0.0		GROUND LEVEL			0.7' GRAVEL FILL					
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510				2'DO	1	22
								DO	2	47
			T					DO	3	100
500.0 / 14.0				500						
		DENSE TO VERY DENSE GREY SILT TILL	T					DO	4	45
								DO	5	37
			T	490	▲ ⊙	γ=141		DO	6	>100
								DO	7	>100
480.0 / 34.0		STIFF GREY CLAY & SILT LAYERS	T	480				DO	8	57
35.0	WL @ EL 4969 NOV 11, 1965									
		VERY DENSE GREY SAND TILL	T					DO	9	53
				470						
466.0 / 48.0		END OF HOLE						DO	10	>100
				460						

APPENDIX I

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 3 And 4 DATUM GEODETIC CASING —
BORING DATE NOV. 11, 1965 REPORT DATE NOV. 15, 1965 COMPILED BY A.E.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
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

3

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		WATER CONTENT W% @ NAT. ○ Lw △ Pw							
		DYNAMIC PENETRATION TEST BLOWS PER FOOT							
516.6 0.0	WL @ EL 500.6 NOV. 11, 1965	GROUND LEVEL		520					
		9.7" GRAVEL FILL							
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510			2"DO	1	23
							" DO	2	39
							" DO	3	81
502.1 14.5			T	500			" DO	4	38
		DENSE TO VERY DENSE GREY SILT TILL	T				" DO	5	32
		STIFF GREY SILTY CLAY WITH SILT LAYERS	T	490			" DO	6	>100
485.6 WL: 32.0			T				" DO	7	49
480.6 36.0		VERY DENSE GREY SAND TILL	T				" DO	8	99
		END OF HOLE		460					

4

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
				520					
514.4 1.0	WL @ EL 496.4 NOV. 11, 1965	GROUND LEVEL							
		GRAVEL FILL							
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510			2"DO	1	18
							" DO	2	33
							DO	3	81
500.4 14.0			T	500			" DO	4	36
		DENSE TO VERY DENSE GREY SILT TILL	T				" DO	5	49
488.4 26.0			T	490			" DO	6	95
		END OF HOLE							
				480					

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T78-18 BORING # 5 And 6 DATUM GEODETIC CASING —
BORING DATE NOV. 12, 1965 REPORT DATE NOV. 15, 1965 COMPILED BY A.E.L. CHECKED BY J.N.R.
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 P.C.F.
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

5

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
516.5 / 0.0	WL @ EL 499.5 NOV 12, 1965	GROUND LEVEL		520
		0.5' TOPSOIL		
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510
502.5 / 14.0			T	
		DENSE TO VERY DENSE GREY SILT TILL	T	500
493.0 / 23.5		END OF HOLE		490

COMPRESSIVE STRESS - TS.F ▲ (Q) — 20 40 60 80
WATER CONTENT Ws — 10 20 30 40 @ NAT @ PLw @ Pw
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS: M; Qc = 41

SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT
	DO	1	20
	DO	2	44
	DO	3	35
	DO	4	38
	DO	5	82

6

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
516.0 / 0.0	WL @ EL 502.8 NOV 12, 1965	GROUND LEVEL		520
513.5 / 2.5		TOPSOIL	T	
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510
502.8 / 13.2			T	
		DENSE GREY SILT TILL	T	500
493.3 / 22.5		END OF HOLE		490

SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT
	DO	1	15
	DO	2	38
	DO	3	>100
	DO	4	34
	DO	5	30

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GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 7 And 8 DATUM GEODETIC CASING —
BORING DATE NOV. 17-18/65 REPORT DATE NOV. 19, 1965 COMPILED BY A.E.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
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 P.C.F.
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

7

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
518.9 / 0.0	WL @ EL. 500.9 NOV. 17, 1965	GROUND LEVEL		520					
		LOOSE BROWN SILT TILL FILL WITH SOME ORGANIC POCKETS					2" DO	1	( )
							" DO	2	5
508.6 / 10.3		COMPACT TO VERY DENSE BROWN SILT TILL	T	510			" DO	3	28
503.9 / 15.0							" DO	4	62
		DENSE TO VERY DENSE GREY SILT TILL	T	500			" DO	5	40
491.4 / 27.5		END OF HOLE		490			" DO	6	>100

8

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
516.9 / 0.0	WL @ EL. 501.9 NOV. 18, 1965	GROUND LEVEL		520					
515.9 / 1.0		TOPSOIL					2" DO	1	12
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510			" DO	2	43
501.9 / 15.0							" DO	3	76
		COMPACT TO VERY DENSE GREY SILT TILL	T	500			" DO	4	27
			T	490			" DO	5	17
			T		γ=139		" DO	6	54
					γ=15		" DO	7	82
477.4 / 39.5				480			" DO	8	60
		VERY DENSE GREY SAND TILL	T				" DO	9	>100
467.9 / 49.0		END OF HOLE	T	470			" DO	10	100

COMPRESSIVE STRESS - T.S.F. ▲ (Q)
20 40 60 80
WATER CONTENT W% ⊙ NAT ▽ LW △ PW
10 20 30 40
DYNAMIC PENETRATION TEST BLOWS PER FOOT

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 9 DATUM GEODETIC CASING —
BORING DATE NOV. 12, 1965 REPORT DATE NOV. 15, 1965 COMPILED BY A.E.L. CHECKED BY [illegible]
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 P.C.F.; K - PERMEABILITY; C - CONSOLIDATION; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	COMPRESSIVE STRESS - TSF ▲ (Q) 2.0 4.0 6.0 8.0 / WATER CONTENT W% ⊙ NAT. ▽ LW △ PW 10 20 30 40 / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
520.8 / 0.0	WL @ EL. 497.8 NOV. 12, 1965	GROUND LEVEL		530	9					
516.8 / 4.0		SANDY TO CLAYEY FILL WITH GRAVEL		520				2" DO	1	11
		COMPACT TO VERY DENSE BROWN SILT TILL	T					DO	2	20
				510				DO	3	78
505.2 / 15.6			T					DO	4	70
				500				DO	5	33
		DENSE TO VERY DENSE GREY SILT TILL	T					DO	6	56
			T	490				DO	7	>100
								DO	8	>100
480.8 / 40.0			T		⊙ ▲			DO	9	79
		VERY DENSE GREY SAND TILL	T	480				DO	10	>100
470.7 / 50.1								DO	11	>100
		END OF HOLE		470						

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GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 10 DATUM GEODETIC CASING —
BORING DATE NOV. 13-15/65 REPORT DATE NOV. 15, 1965 COMPILED BY A.E.L. CHECKED BY J.H.S.
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

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% (⊙ NAT. ⊟ LW △ PW) / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	WL @ EL. 505.9 NOV 15, 1965				10					
				530						
520.9 / 0.0		GROUND LEVEL								
		TOPSOIL		520						
		COMPACT TO DENSE BROWN SILT TILL	T					2 DO	1	27
						M		DO	2	29
			T	510				DO	3	38
506.9 / 14.0	▼							DO	4	40
		COMPACT TO VERY DENSE GREY SILT TILL	T					DO	5	28
				500		M		DO	6	56
			T					DO	7	>100
				490				DO	8	>100
481.9 / 39.0										
		VERY DENSE GREY SAND TILL	T	480				DO	9	87
475.1 / 45.8		END OF HOLE				M		DO	10	>100
				470						

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 11 And 12 DATUM GEODETIC CASING —
BORING DATE NOV. 15, 1965 REPORT DATE NOV. 17, 1965 COMPILED BY A.E.L. CHECKED BY [illegible]
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 PCF
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

11

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
522.2 / 0.0	WL @ EL 507.2 NOV. 15, 1965	GROUND LEVEL		530
522.0 / 0.2		TOPSOIL		
		DENSE TO VERY DENSE BROWN SILT TILL	T	520
508.2 / 14.0			T	510
		COMPACT TO VERY DENSE GREY SILT TILL	T	500
493.2 / 29.0			T	
31.0		STIFF GREY SILTY CLAY WITH SILT LAYERS	T	490
486.2 / 36.0		END OF HOLE		

COMPRESSIVE STRESS - TSF ▲ (Q) 2.0 4.0 6.0 8.0
WATER CONTENT W% ⊙ NAT ⊙ LW △ PW 10 20 30 40
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS: γ = 142

SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2"DO	1	33
	"DO	2	45
	"DO	3	63
	"DO	4	25
	"DO	5	21
	"DO	6	42
	"DO	7	52
	"DO	8	66

12

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
524.3 / 0.0	WL @ EL 509.3 NOV. 15, 1965	GROUND LEVEL		530
524.1 / 0.2		TOPSOIL		
2.0		DENSE TO VERY DENSE BROWN SILT TILL	T	520
510.3 / 14.0			T	510
		COMPACT TO DENSE GREY SILT TILL	T	500
498.3 / 26.0		END OF HOLE		

M

SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2"DO	1	35
	"DO	2	46
	"DO	3	70
	"DO	4	28
	"DO	5	28
	"DO	6	43

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GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T-7818 BORING # 13 And 14 DATUM GEODETIC CASING —
BORING DATE NOV. 16-17 / 65 REPORT DATE NOV. 18 1965 COMPILED BY A.E.L. CHECKED BY J.N.E.
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

13

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		WATER CONTENT W% ⊙ NAT. ⊡ LW △ PW							
		DYNAMIC PENETRATION TEST BLOWS PER FOOT							
				530					
524.0 / 0.0		GROUND LEVEL							
		GRAVEL AND SILT TILL FILL					2" DO	1	9
521.0 / 3.0			T	520			" DO	2	31
		DENSE TO VERY DENSE BROWN SILT TILL	T				" DO	3	81
512.0 / 12.0		END OF HOLE		510					

14

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	OTHER TESTS	SAMPLES: CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
				530					
525.7 / 0.0		GROUND LEVEL							
		0.5' TOPSOIL	T				2" DO	1	13
	WL @ EL. 508.7 ON NOV. 18, 1965	COMPACT TO VERY DENSE BROWN SILT TILL	T	520			" DO	2	25
			T				" DO	3	59
508.7 / 17.0			T	510			" DO	4	88
							" DO	5	42
		DENSE TO VERY DENSE GREY SILT TILL	T	500			" DO	6	34
							" DO	7	81
489.9 / 35.8			T	490			" DO	8	>100
		END OF HOLE							

APPENDIX I

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 15 DATUM GEODETIC CASING —
BORING DATE NOV. 15-16/65 REPORT DATE NOV. 17, 1965 COMPILED BY AEL CHECKED BY JMS
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
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Qc - TRIAXIAL CONSOLIDATED UNDRAINED
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S - TRIAXIAL DRAINED
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE								SAMPLES			
ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% ⊙ NAT. ⊡ Lw △ Pw DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
523.7 / 0.0	WL. @ EL. 505.7 NOV. 16, 1965	GROUND LEVEL TOPSOIL		530	15					
2.5		COMPACT TO VERY DENSE BROWN SILT TILL	T	520				2" DO	1	17
			T					" DO	2	20
				510				" DO	3	48
507.7 / 16.0								" DO	4	66
			T					" DO	5	30
		COMPACT TO VERY DENSE GREY SILT TILL		500				" DO	6	26
			T					" DO	7	>100
489.0 / 34.7		END OF HOLE		490				" DO	8	>100

APPENDIX I

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7818 BORING # 16 And 17 DATUM GEODETIC CASING —
BORING DATE NOV. 12-18/65 REPORT DATE Nov. 19, 1965 COMPILED BY A.E.L. CHECKED BY W.N.S.
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 P.C.F.
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

16

ELEVN. / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
520.2 / 0.0		GROUND LEVEL		520
516.2 / 4.0		SANDY TO CLAYEY FILL WITH GRAVEL		
		COMPACT TO VERY DENSE BROWN SILT TILL	T	510
505.2 / 15.0			T	
	WL @ EL. 500.2 NOV. 13, 1965	DENSE TO VERY DENSE GREY SILT TILL	T	500
			T	490
481.2 / 39.0		STIFF GREY SILTY CLAY WITH SILT LAYERS		
41.0		VERY DENSE GREY SAND TILL	T	480
469.9 / 50.3		END OF HOLE	T	470

COMPRESSIVE STRESS - T.S.F. ▲ (Q)
2.0 4.0 6.0 8.0
WATER CONTENT W% ⊙ NAT. ▽ Lw △ Pw
10 20 30 40
DYNAMIC PENETRATION TEST BLOWS PER FOOT

OTHER TESTS: γ = 151; γ = 127

SAMPLES CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2" DO	1	7
	" DO	2	11
	" DO	3	82
	" DO	4	52
	" DO	5	38
	" DO	6	73
	" DO	7	>100
	" DO	8	>100
	" DO	9	25
	" DO	10	PUSH
	" DO	11	>100

17

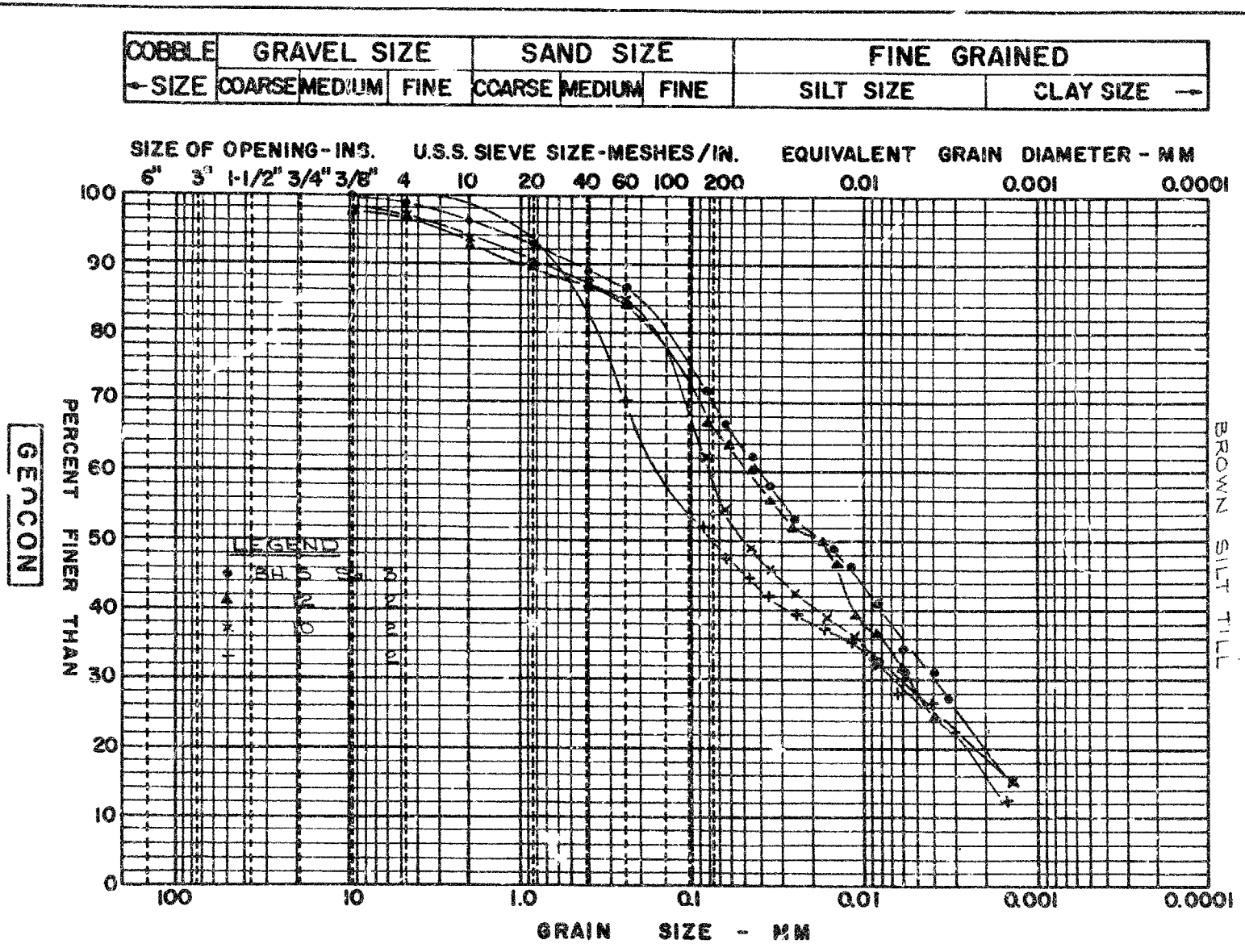
ELEVN. / DEPTH	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
520.1 / 0.0	GROUND LEVEL		520
515.1 / 5.0	GRAVEL AND SILT TILL FILL		
	COMPACT TO VERY DENSE BROWN SILT TILL	T	510
509.1 / 11.0	END OF HOLE		

SAMPLES CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
	2" DO	1	24
	" DO	2	64

APPENDIX II

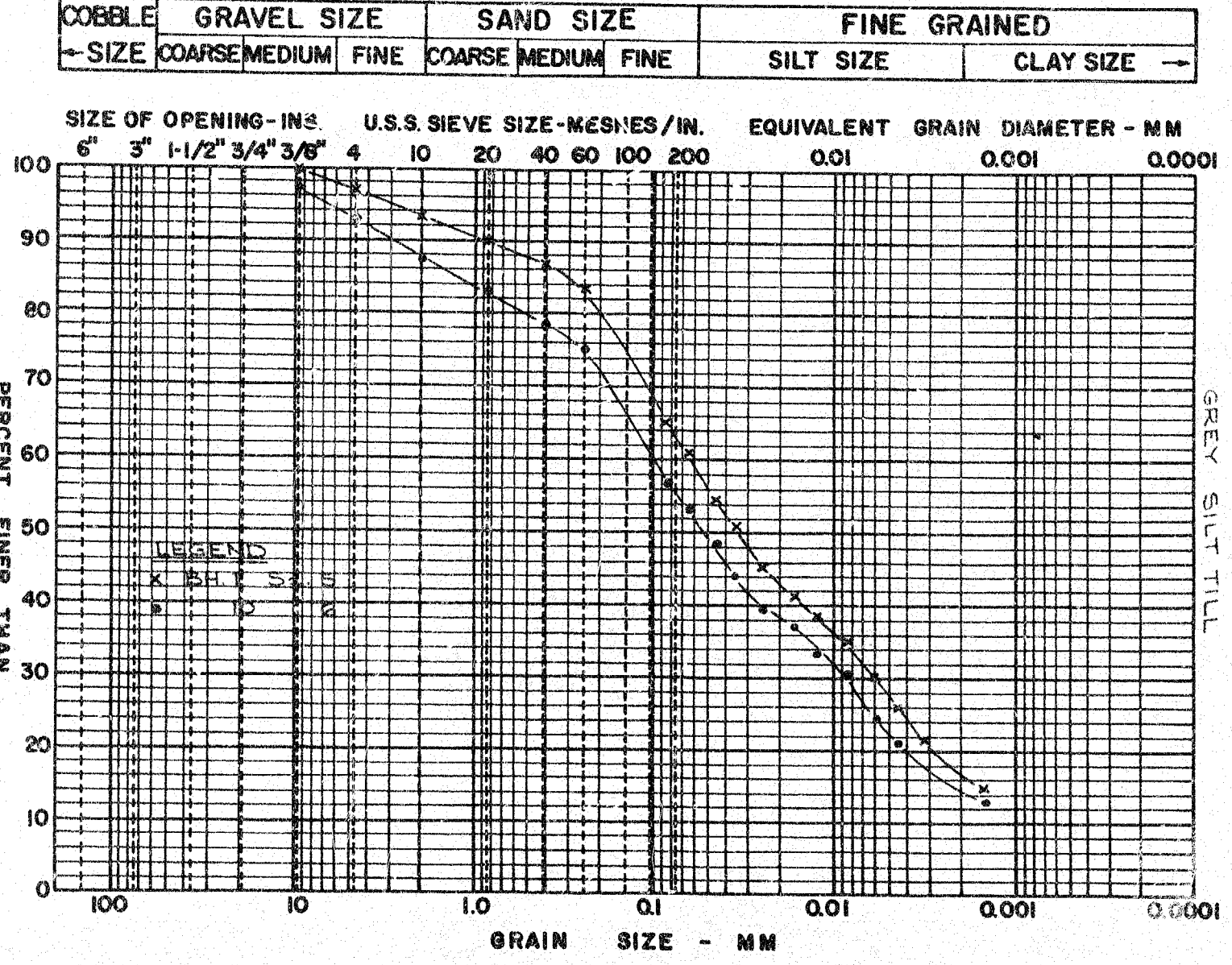
FIGURES - LABORATORY TESTING

GRAIN SIZE DISTRIBUTION



APPENDIX II
FIGURE 1
PROJECT T7818

GRAIN SIZE DISTRIBUTION



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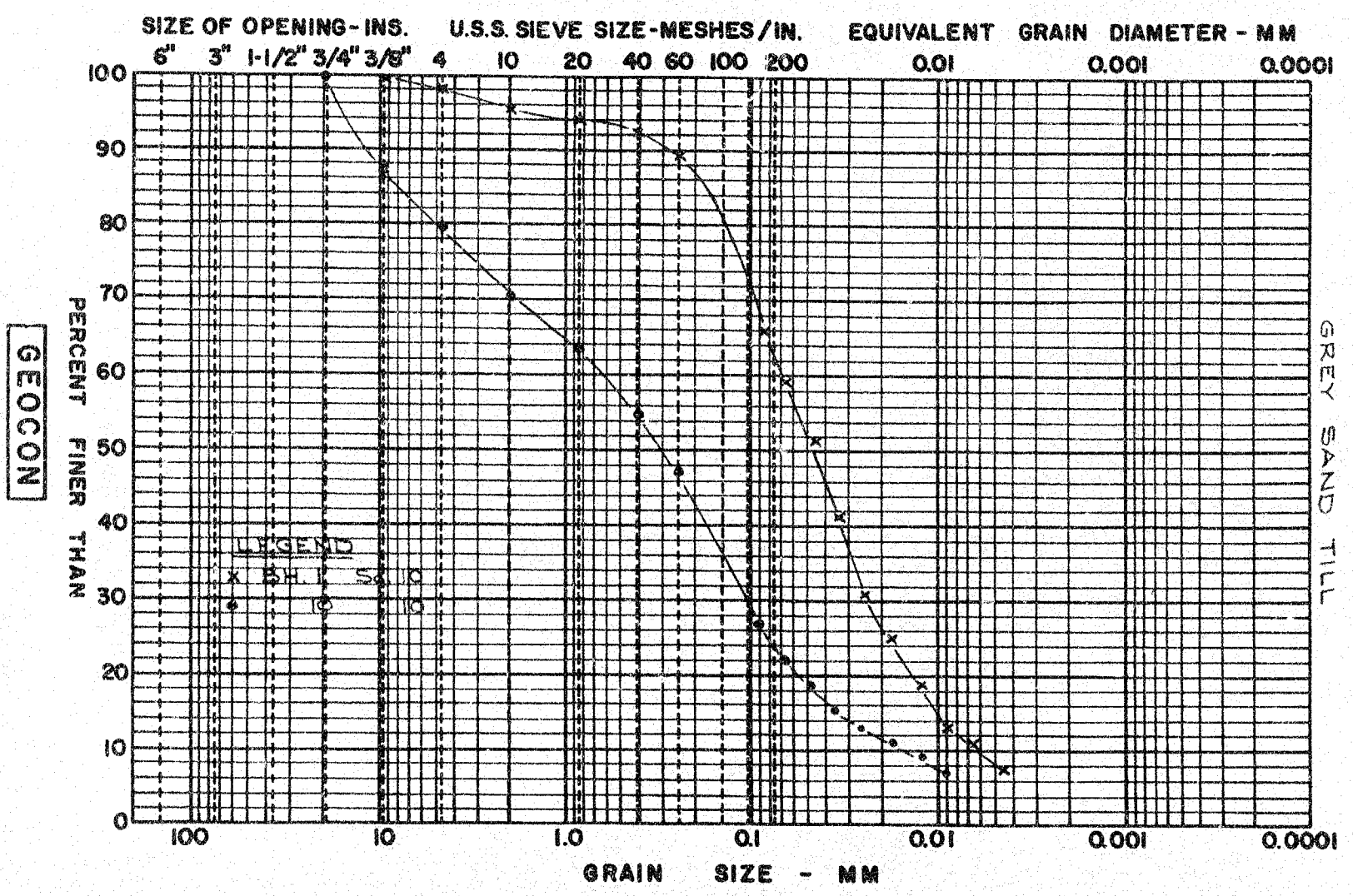
M.I.T. GRAIN SIZE SCALE

APPENDIX II
FIGURE 2
PROJECT T7818

GRAIN SIZE DISTRIBUTION

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



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M.I.T. GRAIN SIZE SCALE

APPENDIX II
FIGURE 3
PROJECT T7818

Hwy. 401 & Keele St.,
Downsview, Ontario.

November 9, 1965

Materials and Testing Division

Geocon, Limited,
14 Mann Road,
Rexdale, Ontario.

Attention: Mr. E. Gates

Re: Kipling Ave., C.N.R. Subway, and
Kipling Ave., Underpass adjacent to the
Proposed C.N.R. Subway, 1/2 Mile North
of Hwy. 401, District No. 6 (Toronto),
Site No. 37-763 -- W.P. 308-65-1.

Dear Sir:

This is to authorize you to carry out a foundation investigation at the two above-mentioned sites.

The information is urgently required and it would be appreciated if you could utilize two drills at the site.

The drawing showing the proposed crossings, was given to your representative on November 3, 1965.

You will notice on the drawing that two long retaining walls are proposed. Would you also investigate the subsoil conditions along the projected wall alignment.

In the preparation of the report, you are requested to distinguish between the Subway with the retaining walls and the Underpass. Each of these should be treated in the report separately.

Eleven (11) copies of the final report should be submitted to the Foundation Section by not later than December 7, 1965. Previous requirements as to preliminary borehole information and laboratory testing program, should be followed.

Enclosed with this letter, please find also, two standard size linens (drawings to be prepared in accordance with the D.H.O. standards) - one for each of the above-mentioned structures. You are also requested to provide us with Cronaflex copies of the drawings.

cont'd. /2 ...

You are also requested to submit your charges for the field, lab. investigations, and the report preparation for the Subway and retaining walls, separately from the charges for the Underpass. This is necessary because the Subway and retaining wall charges will be re-invoiced to another client.

Charges for the work performed will be in accordance with your Schedule of Rates, dated March 4, 1960, and invoices to be addressed to the attention of the undersigned.

We are attaching Purchase Order J 34798, covering the purchase of any new material required for this work, in order that you may use this as a basis for exemption from the Federal Tax for such purchases. The Exemption Certificate is printed thereon.

Yours very truly,

A. Ruhle,
MATERIALS AND TESTING ENGINEER

AR:/KDeF
Encls. (2)

cc: Messrs. B. McCombie
G. E. Hunter
J. C. Thatcher
T. J. Kovich
H. Konings
A. Crowley
Mrs. I. Steinberg
M. Sayanenski (2)
Foundations Office
Gen. Files (2)

GEOCON LTD

HEAD OFFICE

420 MICHEL JASMIN, DORVAL, QUEBEC
TELEPHONE 631-9827

DISTRICT OFFICES

14 HAAS ROAD
REXDALE, TORONTO, ONT.
TEL. 244-6476

295 EAST 11TH AVENUE
VANCOUVER 10, B.C.
TEL. 879-2620

Rexdale, Ontario,
December 10th, 1965.

Department of Highways, Ontario,
Materials and Testing Division,
Downsview, Ontario.

Attention: Mr. A. G. Stermac, P. Eng.,
Principal Foundation Engineer.

Re: Soil Conditions and Foundations,
Proposed Kipling Avenue Underpass
and C.N.R. Subway,
Etobicoke, Ontario.

Dear Sirs:

This letter will confirm the telephone conversation of December 6th, 1965, regarding the allowable bearing value for design of spread footings for the above project.

A net allowable bearing value of 2.0 tons per square foot was recommended in our report for use in design of spread footings for the piers, abutments and retaining walls of the above structures. In arriving at this value we have taken into account the measured compressive strengths of the silt till over a depth of about 10 feet (i.e. about probable footing width) below the proposed foundation elevation of 496. Within this depth, the minimum measured compressive strengths of the till were about 2.0 tons per square foot, although it is recognised that the values concerned are probably on the low side due to inevitable disturbance of drive open type samples. Since the till contains sufficient silt and clay sizes to behave in practice essentially as a cohesive soil, from considerations of undrained shear strength alone, it follows from the above that an allowable bearing value greater than 2.0 tons per square foot would apply, and we consider that a value of 3.0 tons per square foot would be permissible, subject to the discussion below.

The silt till is obviously over-consolidated with respect to existing overburden pressure, and from local experience is known to be susceptible to softening when subjected to stress release and effects of ground water seepage and/or access to ponded water. Construction of the Subway will involve removal of about 20 feet of overburden and there will also be a tendency for surface water and seepage through the backfill to flow towards the low point of the excavation. Bearing this in mind, it was judged that an allowable bearing value of 2.0 tons per square foot could be used for spread footing design with normal provisions for collection of surface water and drainage of backfill, and the specified measures for protecting the surface of the clay during construction. If on the other hand, the drainage measures are designed to prevent ponding of water at or above the base of footings, it is considered that an allowable bearing value of 3.0 tons per square foot could be used in spread footing design.

It might be mentioned that the concern over softening of the clay by ponded water was with respect to possible settlements or tilting of footings that may result, rather than base shear failure.

We trust that you will find the above in accordance with your recollection of our discussions, and that you will feel free to call should you wish us to elaborate on any other aspect of the report.

Yours very truly,

GEOCON LTD

M. A. J. Matich, P. Eng.,
President.

MAJM/reb
T7818-A

cc: Foundations Office (Rm. 110)

Mr. R. H. Davis,
Bridge Engineer,
Bridge Division

Attention: Mr. [illegible]

Foundation Section,
Materials and Testing Div.,
Room 177, Lab. Bldg.

December 7, 1965

DEC - 7 1965

FOUNDATION INVESTIGATION REPORT BY:
Geocon, Limited, Toronto
Proposed Kipling Avenue Underpass and
C.N.R. Subway - District 6 (Toronto).
W.P. 308-65-1 -- Site No. 37-763

Attached, please find the above-mentioned foundation investigation report submitted by the Consultant, Geocon, Limited. We have reviewed the report and found the factual information adequate and well presented.

With respect to the allowable bearing pressures, we have discussed this point with the Consultant, and have agreed that provided adequate and effective drainage is provided that will prevent any ponding of water at or immediately above the footing elevations, an allowable bearing pressure of 3.0 tons per square foot can be used. It is also again emphasized that care should be taken to protect the bottoms of excavations from deteriorating due to water or weather action.

It is our suggestion that a coefficient of active earth pressure of 0.3 instead of 0.4 be used where a slight movement of the retaining structure is possible.

Should you require any additional information, please do not hesitate to contact our Office.

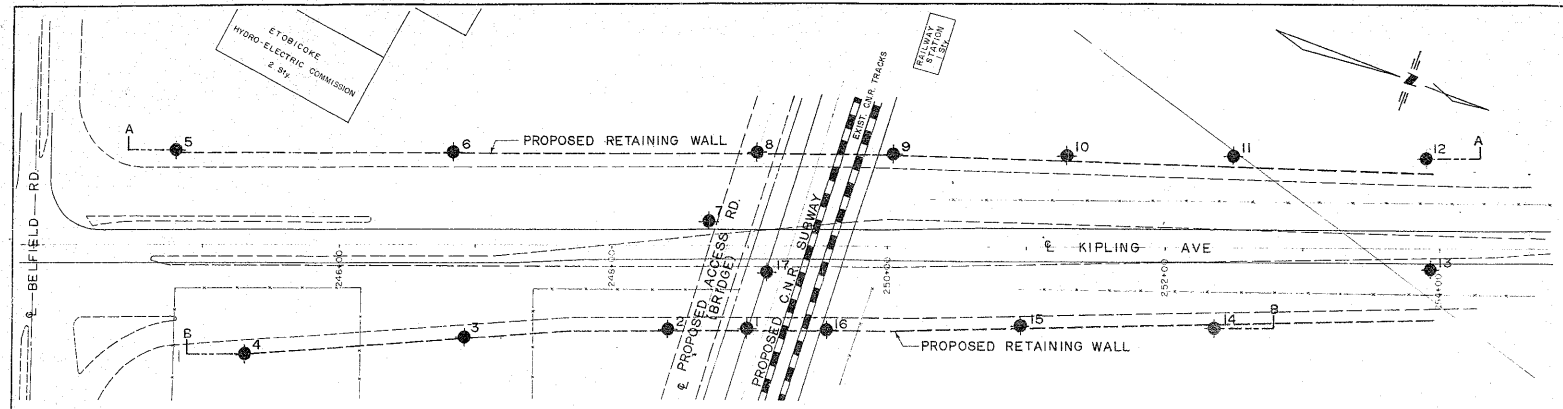
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

[illegible]
Attach.
cc: Messrs. R. H. Davis (2)
K. A. Tregaskes
[illegible]
[illegible] (2)
J. G. Thatcher
T. J. Kovich
D. Watt

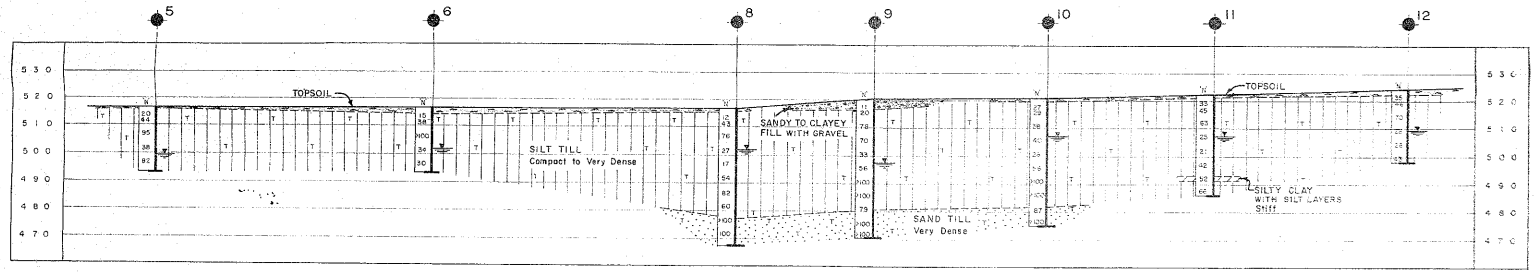
Foundations Office
Gen. Files

#65-F-230
W.P.#308-65-1
KIPLING AVE.
UNDERPASS
& C.N.R.
SUBWAY

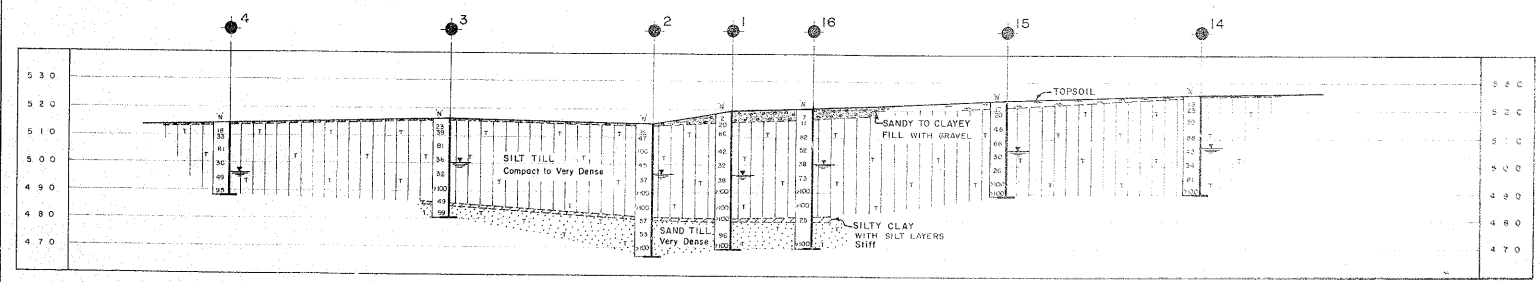
615700 E
4840950 N 17 30 MILE



PLAN
SCALE
40 20 0 40 80 FT.

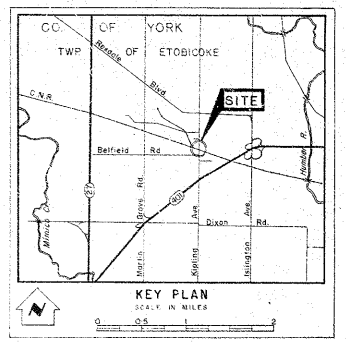


SECTION A-A



SECTION B-B
SCALE
40 20 0 40 80 FT. HORIZONTAL
20 10 0 20 40 FT. VERTICAL

REF. No. 3110-T-12



KEY PLAN
SCALE IN MILES
0 .5 1 2

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. (Nov. 1965)

NO.	ELEVATION	STATION	OFFSET
1	519·4	249+00	60' RT.
2	514·9	248+42	61' RT.
3	516·6	246+93	67' RT.
4	514·4	245+33	79' RT.
5	516·3	244+80	68' LT.
6	516·8	246+63	66' LT.
7	519·9	248+71	16' LT.
8	516·9	249+05	67' LT.
9	520·8	250+03	66' LT.
10	520·9	251+29	66' LT.
11	522·1	252+49	65' LT.
12	524·3	253+90	68' LT.
13	524·0	253+94	15' RT.
14	525·7	252+36	58' RT.
15	525·7	250+97	57' RT.
16	520·2	249+57	61' RT.
17	520·1	249+14	20' RT.

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

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

GEOCON LTD

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

KIPLING AVE. UNDERPASS

ADJACENT TO PROPOSED C.N.R. SUBWAY

KING'S HIGHWAY NO. _____ DIST. NO. 6
CO. YORK (TORONTO)
TWP. ETOBICOKE LOT 25 CON. 'A'

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D W.P.	CHECKED D.G.O.	W.P. NO. 308-65-1	DRAWING NO. T7818-1
DRAWN A.E.L.	CHECKED J.N.B.	JOB NO.	
DATE NOV. 16, 1965		SITE NO.	BRIDGE DRAWING NO.
APPROVED D.G. Geocon		CONT. NO.	