

MEMORANDUM

W.P. 320-64-1

TO: Mr. A. M. Teye,
Bridge Engineer,
Bridge Division.

FROM: Foundation Section,
Materials and Testing Div.,
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: June 10, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Islington Ave. Underpass on Q.E.W.
Q.E.W. District #6 (Toronto)

W.J. 65-F-35 -- W.P. 320-64-1

A request for a foundation investigation at the site of the proposed Islington Avenue Underpass on Q.E.W., was received from Mr. J. B. Curtis, Regional Bridge Location Engineer, in a memo dated March 29, 1965.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the site of the proposed structure. Following are the results of this investigation, together with our recommendations pertaining to the proposed structure foundations.

The field investigation consisted of 3 sampled boreholes and 6 dynamic cone penetration tests. The locations and elevations are shown on Dwg. 65-F-35A.

The soil conditions at the site were found to be uniform. From ground level on, a 7-ft. thick fine sand layer is followed by

cont'd. /2 ...

June 10, 1965

a sandy silt to silty sand layer, followed by a deposit of stiff to very stiff clayey silt. The total thickness of these layers is about 16 feet.

The clayey silt stratum is underlain by Dundas shale bedrock. The upper portion - approx. 1 to 2 ft. of the bedrock is weathered.

In view of the above, it is recommended that the proposed structure be founded on spread footings, placed directly on the sound bedrock, where a safe pressure of 10 tons/sq.ft. could be achieved.

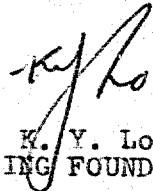
The field work was carried out during the period of April 2 to 7, 1965, under the direction of Mr. P. Payer, Project Foundation Engineer, who also prepared this report under the general supervision of Mr. K. G. Selby, Senior Foundation Engineer.

We believe that the data contained in this report will suffice for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

PP/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
J. C. Thatcher
T. J. Kovich
A. Watt

Foundations Office
Gen. Files


K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 65-F-35LOCATION O.E.W. & IslingtonORIGINATED BY P.P.W.P. 320-64-1BORING DATE April 2 & 5, 1965.COMPILED BY P.P.DATUM GeodeticBOREHOLE TYPE Auger & Washbore - BX Casing.CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					WATER CONTENT %				
							25	50	75	100	125	WP	W	WL		
343.0	Groundlevel															
0.0	Fine sand. Brown Compact				340										
337.5			1	SS	12											
5.5	Sandy silt to silty sand. Grey		2	SS	41											
	Dense to v. dense.		3	SS	59											
331.7																
11.3	Clayey silt.	////														
331.0																
12.0						330										
	Dundas Shale Calcareous		4	RC	-											
	(Bedrock)															
325.5																
17.5	End of borehole.															
						320										

Refusal

Sa 16%
Si 81%
Cl 3%
W.L.
El. 335.5'

FOUNDATION SECTION

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT						LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.						WATER CONTENT % WP W WL 10 20 30			P.C.F.	
343.0	Groundlevel															
0.0	Fine sand. Brown Compact		1	SS	15											<div style="text-align: center;">▼ W.L.</div> <div style="text-align: center;">El. 335.0'</div>
335.9			2	SS	28											
7.1	Sandy silt to silty sand. Grey		3	SS	40											
331.0	Compact to dense.		4	SS	3											
12.0	Clayey silt with traces of sand Grey Soft to v. stiff.		5	SS	23											
326.5	Bedrock															
16.5	End of borehole.															

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 65-F-35

LOCATION Q.E.W. & Islington Ave.

ORIGINATED BY P.P.

W.P. 320-64-1

BORING DATE April 2, 1965.

COMPILED BY P.P.

DATUM Geodetic

BOREHOLE TYPE Cone Test Only

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 65-F-35 LOCATION Q.E.W. & Islington Ave. ORIGINATED BY P.P.
W.P. 320-64-1 BORING DATE April 6, 1965. COMPILED BY P.P.
DATUM Geoidetic BOREHOLE TYPE Washbore - BX Casing. CHECKED BY LL

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		25	50	75	100	125	WP	W	WL	
340.5	Groundlevel					340									
0.0	Fine sand Brown Compact														
334.5			1	SS	27										
6.0	Sandy silt to silty sand. Grey.		2	SS	27										
			3	SS	38	330									
328.5	Compact to dense.														
12.0	Clayey silt with traces of sand. Grey		4	SS	10										
325.5	Stiff														
15.0	Dundas Shale Calcareous Bedrock		5	RC	-										
320.5															
20.0	End of borehole.					320									

Refusal

▼ W.L.
El. 334.3

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 3A

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-35

LOCATION Q.E.W. & Islington Ave.

ORIGINATED BY P.P.

W. P. 320-64-1

BORING DATE April 7, 1965.

COMPILED BY P.P.

DATUM Geodetic

BOREHOLE TYPE Cone Test Only.

CHECKED BY

[illegible]

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

TYPE OF SAMPLE

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

SOIL TESTS

Q _u	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS 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
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_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

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

SLOPES

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

C

COCK DOWN 11 MAY 11/66 410P VR

J D FOSTER DIST ENGR

ATT: W O'REILLY

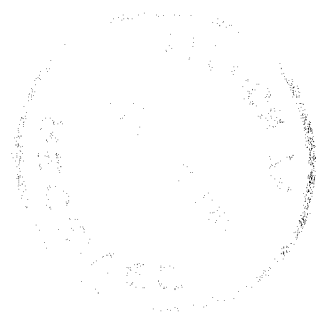
RE: CONTRACT 65-35 JACOBS HILL

WILL MEET YOU AT SITE AT 9AM FRIDAY MAY 13/66

K G SELBY SUPVR FOUNDATION ENGR M & T DIV

JD

465



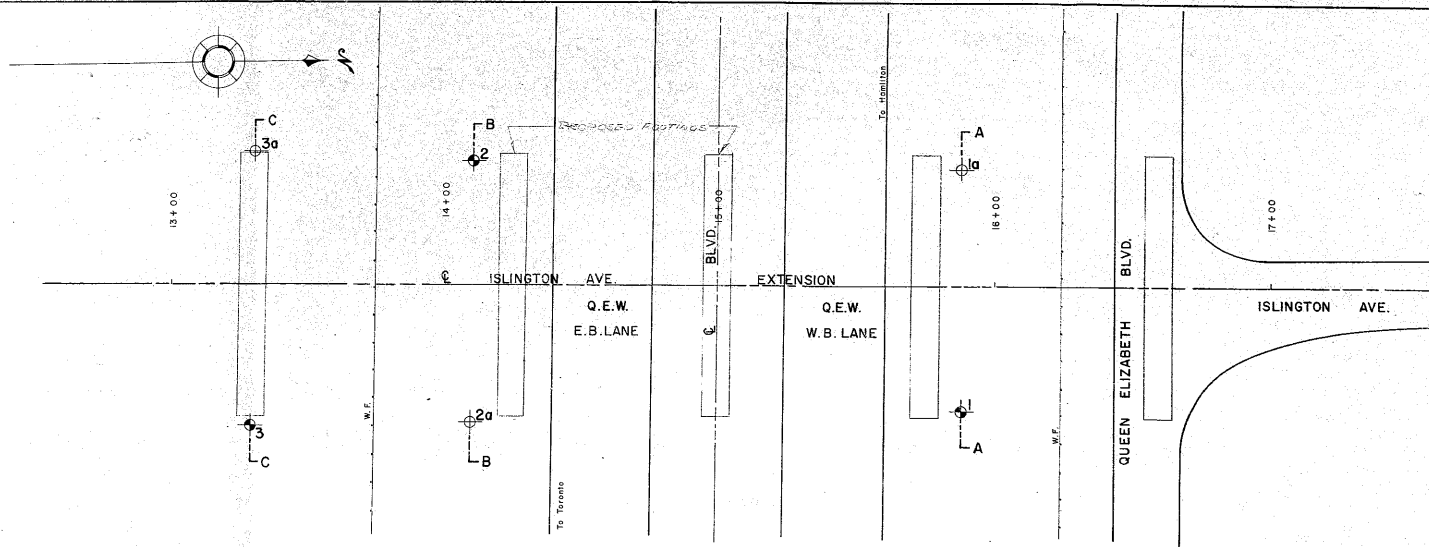
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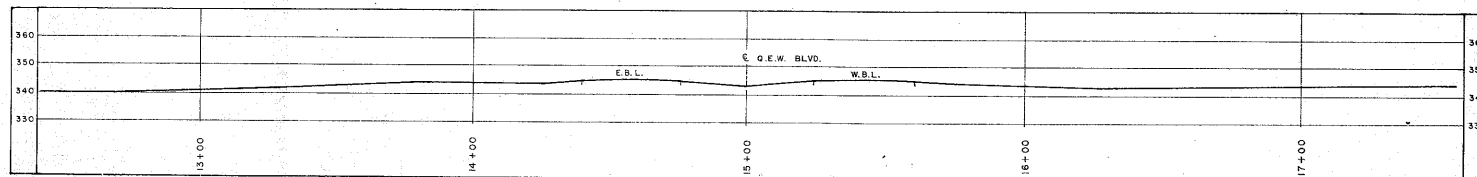
Q.E.W. &

ISLINGTON

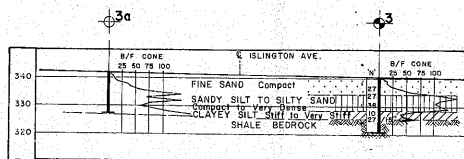
AVENUE



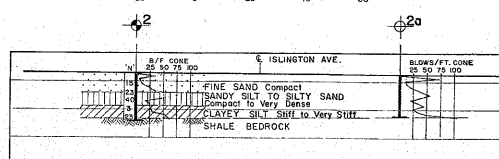
PLAN
SCALE IN FEET
0 20 40 60



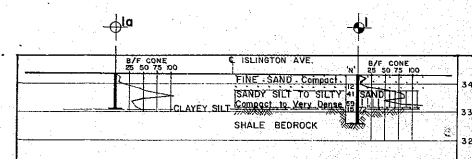
PROFILE
SCALE IN FEET
0 20 40 60



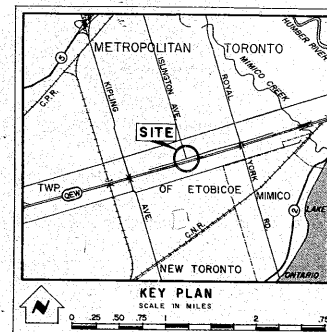
C - C



B - B
SCALE IN FEET
0 20 40 60



A - A



LEGEND

- Bore Hole
- ⊕ Cone Penetration Hole
- ⊕ Bore & Cone Penetration Hole
- ⬆ Water Levels established at time of field investigation.

NOTE: STATIONS USED ARE ASSUMED

NO.	ELEVATION	STATION	OFFSET
1	343.0	15+88	46.0 RT.
1a	343.5	15+88	42.5 LT.
2	343.0	14+10	45.0 LT.
2a	342.5	14+10	49.5 RT.
3	340.5	13+30	51.0 RT.
3a	342.0	13+30	48.5 LT.

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

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

ISLINGTON AVE. EXTENSION

KING'S HIGHWAY NO. Q.E.W. DIST. NO. 6
CO. YORK METROPOLITAN TORONTO
TWP. ETOBICOKE LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D P.P. CHECKED: W.P. NO. 320 - 64 - 1 M.T. DRAWING NO.
DRAWN G.H. CHECKED: JOB NO. 65 - F - 35 65-F-35A
DATE: 17/7/65 SITE NO. BRIDGE DRAWING NO.
APPROVED: CONT. NO.

Prepared by: Foundation Section