

## MEMORANDUM

23-65-262

To: Mr. A. M. Toye,  
Bridge Engineer,  
Bridge Division.

FROM: Foundation Section,  
Materials & Research Div.,  
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: June 19, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

## FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at Islington  
Ave. & Hwy. 401, Twp. of Etobicoke,  
County of York, District No. 6  
W.J. 64-F-38 -- W.P. 238-60

Attached, please find detailed foundation investigation report outlining the subsoil conditions existing at the above structure site.

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

AGS/MdeF  
Attach.

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

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER

Foundations Office  
Gen. Files

# FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at Islington  
Ave. & Hwy. 401, Twp. of Etobicoke,  
County of York, District No. 6  
W.J. 64-F-38 -- W.P. 238-60

In conjunction with the present Hwy. #401 reconstruction programme, it is proposed to construct a new interchange at the intersection with Islington Avenue in Metropolitan Toronto.

A total of five new structures will be required. This report deals with the main structure carrying Islington Avenue over Hwy. #401. A request was received from Mr. J. Curtis, Bridge Location Engineer (memo dated April 8, 1964), to carry out the necessary foundation investigation. A field investigation consisting of five sampled boreholes and five dynamic cone penetration tests was subsequently carried out by this Section. Following, are the results of this investigation, together with our recommendations pertaining to the proposed structure foundations:

## Subsoil:

Subsoil at the site was found to consist of a very stiff to hard deposit of glacial origin, composed of a heterogeneous mixture of clayey silt, sand and traces of gravel, extending for a depth of from 30 to 50 feet, followed by a very dense stratum of silty sand.

The 'N' values for the overall deposit ranged from 17 to more than 100 blows per foot, generally increasing with depth.

contd. /2 ...

Subsoil: (cont'd.) ...

Ground water observations indicate the water level to be approximately 25 feet below the surface.

Recommendations:

It is proposed to construct a 600-ft. long, 6-span structure some 125 ft. wide to replace the existing bridge which carries Islington Avenue over Hwy. #401. At this location Hwy. #401 is formed in a cut and present proposals indicate that further cutting will be required to form the future extension to the highway. The proposed pier footings will be located in the future cut section of Hwy. #401, and the proposed perched abutments will be located on Islington Avenue where the subsoil consists of original ground. In view of these facts, it is recommended that the new bridge be supported on spread footings founded at a depth of 6 ft. or more below finished grade levels. A design load of 3 T.S.F. is recommended in this case.

No dewatering problems are anticipated as the subsoil is relatively impermeable.

No stability problems with regard to the proposed 2:1 cut slopes are anticipated.

Miscellaneous:

The field work was carried out from May 8 to May 15, 1964 under the supervision of Mr. V. Korlu, Project Foundation Engineer who also wrote this report. The report was reviewed by Mr. M. Devata, Senior Foundation Engineer. The drilling equipment was supplied by Johnston Drilling Co. of Toronto.

June 1964

APPENDIX I



JOB 64-F-38

LOCATION Hwy. 401 &amp; Islington; 422/65, 155' to Rt. of E

ORIGINATED BY V.K.

W P 238-60

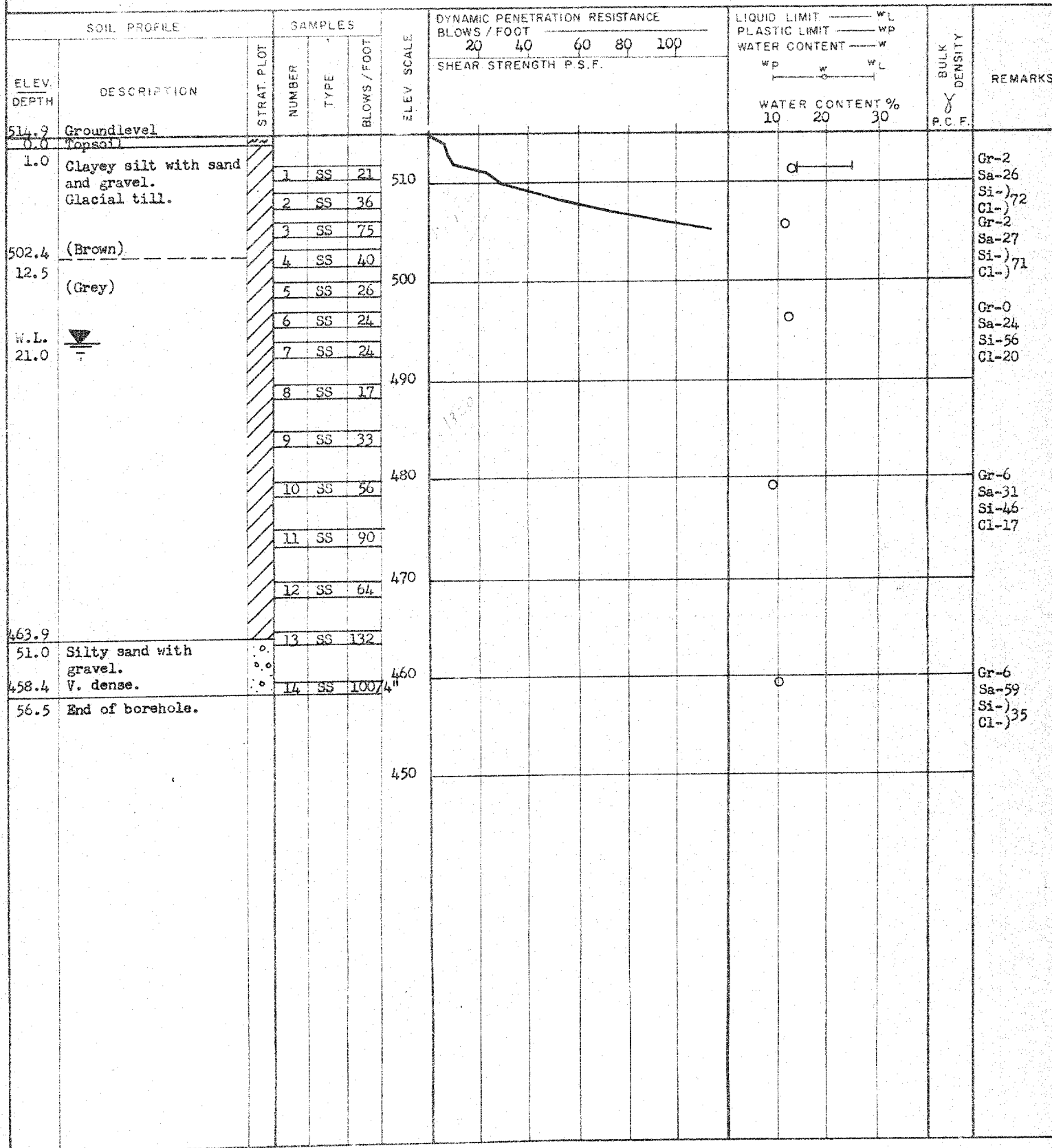
BORING DATE May 11, 1964.

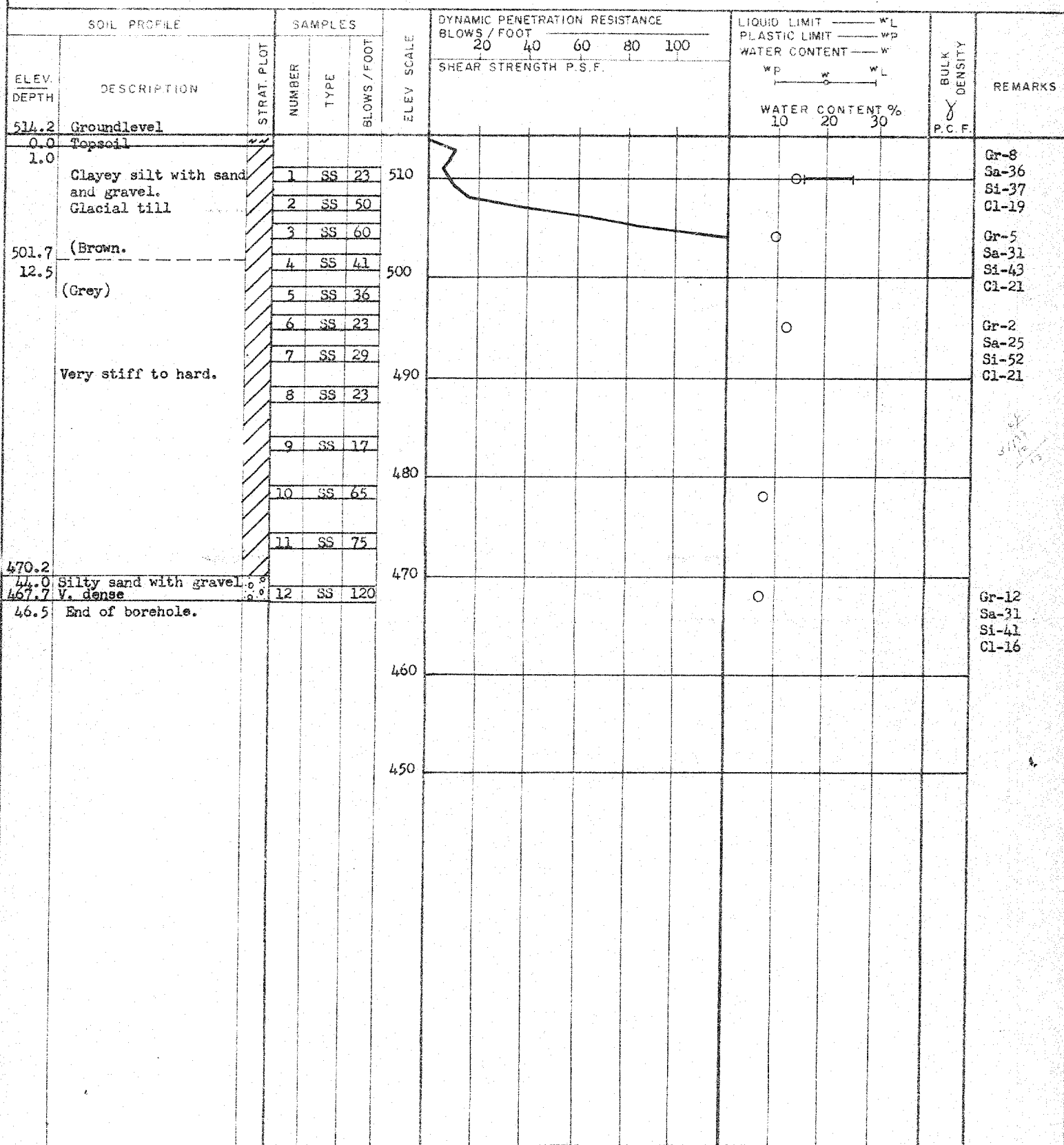
COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY M.D.



JOB 64-F-38LOCATION Hwy. 401 & Islington, 424<sup>th</sup> St., 80' N. of EORIGINATED BY V.K.W.P. 238-60BORING DATE May 13, 1964.COMPILED BY V.K.DATUM GeodeticBOREHOLE TYPE Penn-drillCHECKED BY M.D.

JOB <u>64-F-38</u>	LOCATION <u>Hwy. 401-Islington; 422/90, 111' Lt. of E</u>	ORIGINATED BY <u>V.K.</u>
W. P. <u>238-60</u>	BORING DATE <u>May 15, 1964.</u>	COMPILED BY <u>V.K.</u>
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>Penndrill</u>	CHECKED BY <u>M.D.</u>

SOIL PROFILE			SAMPLES			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	SHEAR STRENGTH P S F.				WATER CONTENT % 10 20 30			
512.0	Groundlevel												
0.0	Topsoil												
1.0													
	Clayey silt with sand and gravel. Glacial till Hard (Brown)		1	SS	51								
			2	SS	53								
			3	SS	46								
			4	SS	71								
496.0			5	SS	50								
16.0	Grey		6	SS	41								
			7	SS	54								
			8	SS	24								
			9	SS	31								
479.0			10	SS	95								
33.0	Silt to silty sand with gravel.		11	SS	103								
			12	SS	45								
W.L.	Dense to v. dense		13	SS	100								
45.5													
460.5													
51.5	End of borehole.												



JOB 64-F-38 LOCATION Hwy. 401 & Islington; 424<sup>th</sup> St., 178' Lt. of E ORIGINATED BY V.K.  
W.P. 238-60 BORING DATE May 14, 1964. COMPILED BY V.K.  
DATUM Geodetic BOREHOLE TYPE Penn-drill CHECKED BY M.D.

[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
WS	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 <sub>u</sub>	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL	S	SENSITIVITY

# ABBREVIATIONS USED IN THIS REPORT

## SOIL PROPERTIES

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

## GENERAL

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

## STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

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

## FOUNDATIONS

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

## SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

HURTY  
DEPARTMENT OF HIGHWAYS ONTARIO  
MEMORANDUM

APRIL 29, 1964.

4-F-21

To: Mr. A. Sternao,  
Principal Foundation Engineer,  
Room 107, Lab. Building.

FROM: Bridge Division,  
Downsview, Ontario.

Attn: Mr. M. Devatz,  
Senior Foundation Engineer.

DATE: April 28, 1964.

Our File Ref.

IN REPLY TO

Subject: Islington Ave. Interchange-Hwy. 401.  
Bridge Site #38-187 W.P. #238-601 ~~64-F-34~~ 64-F-38  
C.N.R. O'head West of Islington Hwy. 401.  
Bridge Site #38-186 W.P. 239-622 64-F-31  
Basket Weave East of Islington, Hwy. 401.  
64-F-35 W.P. # 243-63, Structure on N-W Ramp Islington to 401, De Leuw Drawing # C-163-184, 64-F-36  
Structure on W-E Ramp Belfield Rd. to 401, 64-F-37  
District # 6 Highway # 401.

This is to request site investigations necessary for the design of the above structures. The approximate footing locations are shown in red on the drawing delivered to your office.

Profiles of the Islington Interchange Area will be forwarded to you as soon as possible.

There should be no problem involved in trespassing on private property, however if there is any doubt, please contact Ross Walker of De Leuw Cather Company Limited.

JWC/KS

J.W. Carter,  
for J.B. Curtis,  
Regional Bridge Location Engineer.

Reviewed by [unclear] and [unclear] [unclear] Engineer by phone.

M. Bivala

1964/27/64

Q.E.W. IMPROVEMENT  
WICKMAN ROAD TO GRAND AVENUE

MINUTES OF MEETING WITH THE  
 DEPARTMENT OF HIGHWAYS OF ONTARIO  
 METROPOLITAN TORONTO PLANNING  
 BOARD AND DE LEUW CATHER & COMPANY  
 OF CANADA LIMITED

Held at the offices of

De Leuw, Cather & Company of Canada Limited  
 1127 Leslie Street, Don Mills, Ontario, on  
 Monday June 28th, 1965 at 10:00 a m

PRESENT:

Department of Highways of Ontario

W. Friedmann  
 H. Rainbow  
 J. Ferguson

Metropolitan Toronto Planning Board

J. Vardon  
 L. Haraszti

De Leuw, Cather & Company of Canada Limited

R. Walker  
 R. Barr  
 D. Woods  
 P. Jaunzems

The purpose of this meeting was to review the Islington and Kipling Intersections at Evans Avenue and the Queensway as they affect the proposed interchanges on the Q.E.W.

1. Functional Plan

Mr. R. Barr outlined details of 1"=100 functional plan. The possibility of placing movements for traffic from the north and south on Royal York Road to the east on Q.E.W. was reviewed. It was the feeling of the meeting that these movements would be preferable to ease congestion on Islington and Kipling and to allow better distribution of traffic and flexibility to the system. Mr. Vardon will discuss this at the next Metro Planning Committee Meeting.

2. Islington and Evans Intersection

Mr. J. Vardon presented a plan showing Metro's two proposals for extending Islington Avenue south to connect to Highway 2. In one proposal Islington Avenue joins Eighth Street and in the other it joins Sixth Street. A decision has not been made yet which proposal will be adopted. Mr. Vardon stated that he would prefer to have the Islington-Evans Intersection as far east as possible, thereby providing better alignment for

Islington Avenue South. The alignment shown on De Leuw, Cather's functional plan is approximately centred on extension of existing 86' R.O.W. of Islington north of Queensway. There is a possibility of moving the alignment to the east but additional property would be required on the east side of Islington Avenue and on the north side of Queen Elizabeth Boulevard but less property would be required on the west side of Islington Avenue. (Brandford Coach property would not be required). De Leuw, Cather will compare property costs for the existing alignment with property costs for moving the alignment to the east. The scheme having the smaller property costs will be adopted.

3. Intersection Details

Intersection details of Kipling Avenue and Islington Avenue with the Queensway and Evans Avenue will be reviewed at a later date. Prior to the review, De Leuw, Cather will send a copy of the Functional Plan to Department of Highways of Ontario, Metropolitan Toronto Roads Department and Metropolitan Toronto Planning Board.

4. Royal York Road Structure

The new Royal York structure over Q.E.W. shall be located on the existing centreline. During staging the Islington Avenue overpass will be built first and the Royal York Road traffic diverted over it, while the Royal York Road structure is built.

*Russell Barr*

R.J.A. Barr  
Assistant Highway Engineer

cc: W. Friedmann (16)	G.G. Stewart
B. Davis (3)	W.E. Carroll
J. Thatcher (1)	C.M. Bishop
R. Strain (1)	S. Cumming
K. Jorns	R.J.A. Barr
J. Vardon	M.R. Rethy
L. Haraszti	
H. Rainbow	

#64-F-38

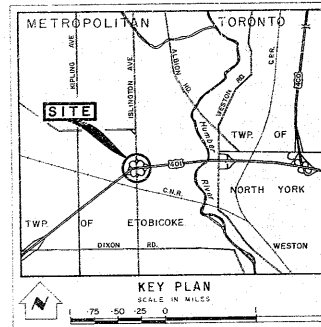
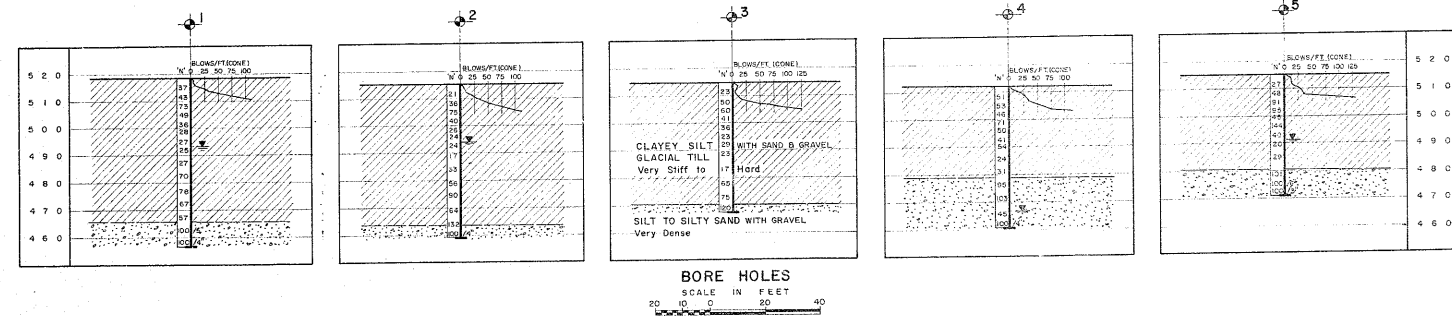
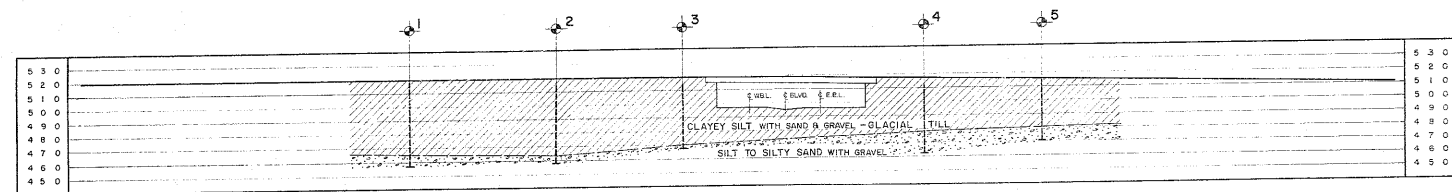
W.P. #238-60

HWY. #401 &


ISLINGTON AVE.


PROP. NEW


STRUCTURE




**LEGEND**

 Bore Hole

 Cone Penetration Hole

 Bore & Cone Penetration Hole

 Water Levels established at time of Field Investigation (May 1964)

NO.	ELEVATION	STATION	OFFSET
1	518.2	424+07	280' RT
2	514.9	422+65	155' RT
3	514.2	424+25	80' RT
4	512.0	422+90	111' LT
5	514.8	424+62	176' 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.

[illegible]

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

ISLINGTON AVENUE

KING'S HIGHWAY NO. 401 DIST. NO. 6  
CO. YORK METROPOLITAN TORONTO  
TWP. ETOBICOKE LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD V.K. CHECKED <i>ll</i>	W.P. NO. 238 - 60	64 - F - 38
DRAWN D.M. CHECKED <i>ll</i>	JOB NO. 64 - F - 38	
DATE 12 JUNE 1964	SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>A. G. Thomas</i> PRINCIPAL ENGINEER	CONT. NO.	

[illegible]