Gen. Files

23-65-263

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

Attention: Mr. S. McCombie

From: Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Date: May 13, 1965

Our File Ref.

In reply to

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed Retaining Walls #1 & #2 at
Hwy. #401 and Islington Avenue,
District #6, Toronto
W.J. 65-F-42 -- W.P. 85-59-6

A request from Mr. J. Curtis of the Bridge Office, for a foundation investigation at the above site, was received by this Section.

The subsequent investigation consisted of 4 sampled boreholes, carried out in April 1965.

The subsoil at the site consists of a thin layer of topsoil, underlain by an extensive deposit of glacial till. This till consists generally of clayey silt with sand and occasional gravel. The consistency of the till as estimated from the results of the Standard Penetration Test ('N' values 13 blows/ft. to 200 blows/ft.) varies from stiff to hard. Water level observations in the boreholes, carried out during the time of investigation, indicated the ground water level to be approximately 0.5 ft. below the ground level at the location of Retaining Wall #1, while it was found to be approximately 4 ft. below the ground level at the location of Retaining Wall #2.

cont'd. /2 ...

Our recommendations pertaining to the retaining structures are as follows:

1) The footings for the proposed retaing walls may be placed 5 ft. below the finished grade of the roadway with a safe bearing pressure of 3.0 t.s.f.

2) If footings are placed within the proposed fill material, the fill material below the top of the footings should consist of well-compacted G.B.C. Class 'A' material and should extend for a horizontal distance of not less than 3 ft. on either side of the footing tops as shown on Dwg. 65-F-42B. The fill should be completed to the finished grade before re-excavating for the footings. A safe bearing pressure of 2 t.s.f. may be used for design purposes. The sequence of filling operations, together with the extent of granular material required, are shown on Dwg. 65-F-42B.

3) Because of the limited number of boreholes carried out for the long retaining structure, some slight variations in consistency of the subsoil can be anticipated during construction. In view of this, it would be advisable, whenever some doubt exists, to have the footing excavations inspected by the Foundation Section prior to pouring the concrete. Provision should also be made in the Contract for deepening the foundations should this prove to be necessary.

cont'd. /3 ...

The field work, along with the preparation of this report, was undertaken by Mr. R. Magi, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

Equipment was owned and operated by Master Soil Investigations, Ltd., of Toronto.

We believe the contents of this report will prove adequate for your requirements; however, should there be any queries in connection with this project, please do not hesitate to contact our Office.

K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

RM/MdeF
Attach.
cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
G. K. Hunter (2)
J. C. Thatcher
T. J. Kovich
A. Watt

Foundations Office
Gen. Files

APPENDIX I.

FORM OB-ML-126-REVISED
64-3040

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 65-F-42 LOCATION Sta 403+72 120' Rt. ORIGINATED BY R.M.
W.P. 85-59-6 BORING DATE April 23, 1965 COMPILED BY R.M.
DATUM BOREHOLE TYPE Washboring CHECKED BY M.D.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	REMARKS
460.9	Groundlevel						WL Elev. ▼ 460.4
459.9	Topsoil					460	
1	Glacial Till (Clayey silt with sand and occasional gravel)		1	SS	13		
			2	SS	20	455	
			3	SS	68		Gr2% Sa25% Si49% Cl 24%
			4	SS	61	450	
			5	SS	50	445	
	Stiff to hard						Gr6% Sa32% Si40% Cl 22"
439.4			6	SS	81	440	
21.5	End of borehole						

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
w_P w w_L
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 65-F-42 LOCATION Sta 405+09 140' Rt. ORIGINATED BY R.M.

W.P. 85-59-6 BORING DATE April 23, 1965 COMPILED BY R.M.

DATUM BOREHOLE TYPE Washboring CHECKED BY M.D.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % (10 20 30)	BULK DENSITY P.C.F.	REMARKS
466.5	Groundlevel									WL Elev ▼466.5
465.5	Topsoil									
1	Glacial Till (Clayey silt with sand and occasional gravel)		1	SS	16	465				
			2	SS	32	460				Sa19% Si50% Cl 31%
			3	SS	71					
			4	SS	44	455				
			5	SS	41	450				Gr6% Sa24% Si46% Cl 24%
			6	SS	42	445				
	V. stiff to hard.									
440.0			7	SS	126	440				
26.5	End of borehole.									

FORM OB-ML-126-REVISED
64-3040

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 65-F-42 LOCATION Sta 410+88 215' Rt. ORIGINATED BY R.M.
W.P. 85-59-6 BORING DATE April 26, 1965 COMPILED BY R.M.
DATUM BOREHOLE TYPE Washboring CHECKED BY M.D.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	REMARKS
490.0	Groundlevel						
489.0	Topsoil						
1	Glacial Till (Clayey silt with sand and occasional gravel).		1	SS	35	485	WL Elev ▼ 485.9
			2	SS	42		
			3	SS	54	480	Sa22%Si 71% Cl 7%
			4	SS	65		
			5	SS	14	475	Gr1% Sa23% Si61% Cl 15%
			6	SS	25	470	Gr5% Sa 11% Si 57% Cl 27%
			7	SS	42	465	
	Stiff to hard.		8	SS	155	460	
453.5			9	SS	100/6"	455	
36.5	End of borehole.					450	

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.

LIQUID LIMIT ——— w_L
PLASTIC LIMIT ——— w_P
WATER CONTENT ——— w
WATER CONTENT % 10 20 30

BULK DENSITY P.C.F.

FORM OB-ML-126-REVISED
64-3040

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 65-F-42 LOCATION Sta 411+87 223' Rt. ORIGINATED BY R.M.
W.P. 85-59-6 BORING DATE April 26, 1965. COMPILED BY R.M.
DATUM BOREHOLE TYPE Washboring CHECKED BY M.D.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
490.7	Groundlevel					490
489.7	Topsoil					
1	Glacial Till (Clayey silt with sand and occasional gravel)		1	SS	26	
			2	SS	94	485
			3	SS	63	
			4	SS	27	480
			5	SS	28	
			6	SS	27	475
			7	SS	55	
	V. stiff to hard.					470
459.2			8	SS	155	465
31.5	End of borehole.					460

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT ——
SHEAR STRENGTH P.S.F.

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 10 20 30

BULK DENSITY P.C.F.

REMARKS

WL. Elev 486.7

Gr2% Sa24%
Si 52%
Cl 22%

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 65-F-42 LOCATION 188' Rt., Sta 409+60 ORIGINATED BY T.C.

W.P. 85-59-6 BORING DATE May 27, 1964 COMPILED BY T.C.

DATUM _____ BOREHOLE TYPE Pennsylvania Type Auger CHECKED BY M.D.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
487.2	Groundlevel					
486.2	Topsoil					
1						485
			1	SS	28	
	Glacial Till (Clayey silt with sand and occasional gravel)					
			2	SS	39	480
			3	SS	68	
			4	SS	103	475
			5	SS	35	
			6	SS	33	470
			7	SS	27	465
			8	SS	54	460
			9	SS	67/4"	455
	V. stiff to hard					450
448.2			10	SS	62/5"	
39.0	End of borehole.					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.

LIQUID LIMIT ——— w_L
PLASTIC LIMIT ——— w_P
WATER CONTENT ——— w

w_P w w_L

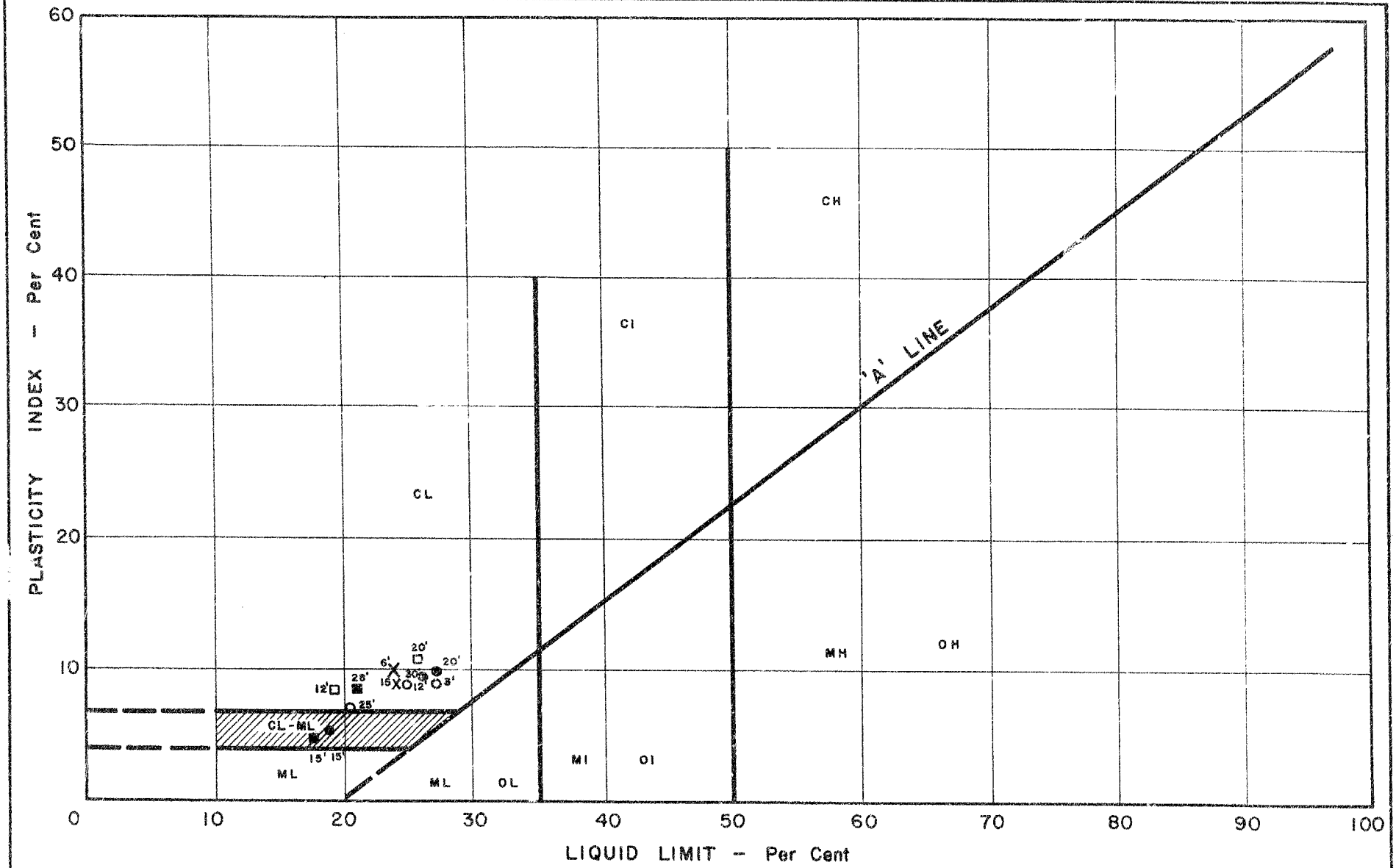
WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS

WL Elev ▽ 483.2

FORM OB-ML-252 (REV. MARCH 62)



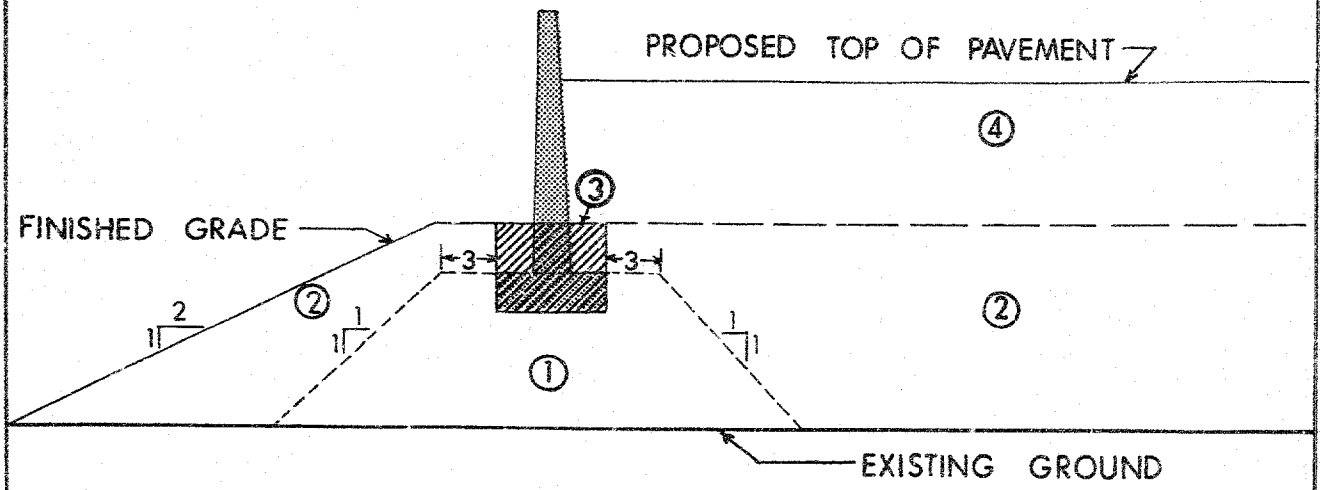
NOTES BOREHOLE 1- X
" 2- O
" 3- ●
" 4- □
" 5- ■

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

PLASTICITY CHART

Job No. 65-F-42 W.P. No. 85-59-6

Location RETAINING WALLS 1 & 2



SCALE: 1"=10"

SEQUENCE OF CONSTRUCTION

① Construct granular fill (G.B.C.)

② Construct earth fill to the finished grade level.

③ Re-excavate and construct footing for the retaining structure. (MIN. 5' below finished grade)

④ Complete fill to the proposed grade.

DEPARTMENT OF HIGHWAYS MATERIALS and TESTING DIVISION ONTARIO	HWY. 401 & ISLINGTON AVE. TYPICAL SECTION OF RETAINING WALL ON COMPACTED FILL WP. 85-59-6 JOB. 65-F-42	
DATE 1 JUNE 1965	APPROVED	DRAWING NO. 65-F-42B

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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.	DENSENESS	'N' BLOWS / FT.
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

Qu	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	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 INTERCEPT — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
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 (YOUNGS 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

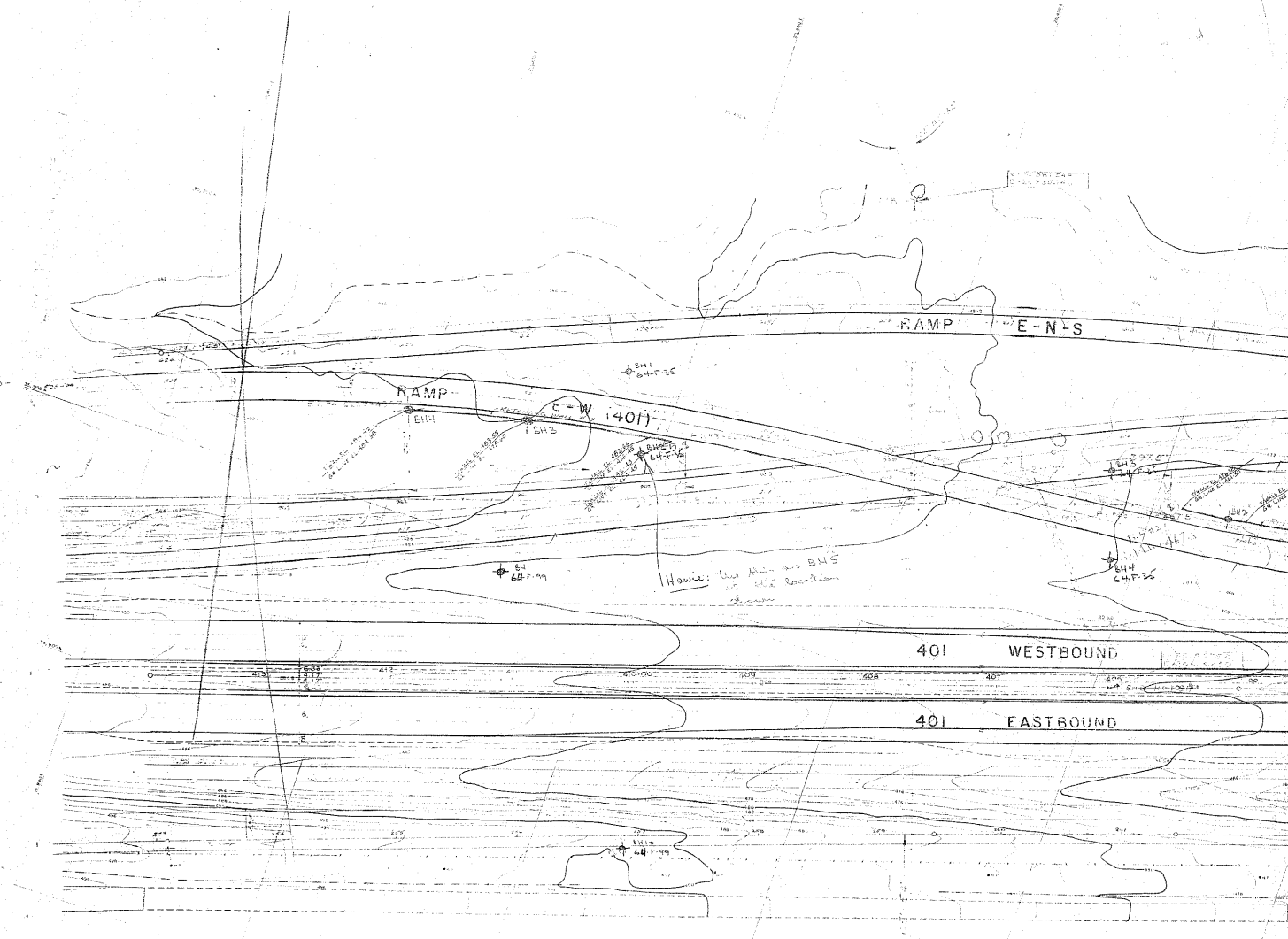
FOUNDATIONS

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

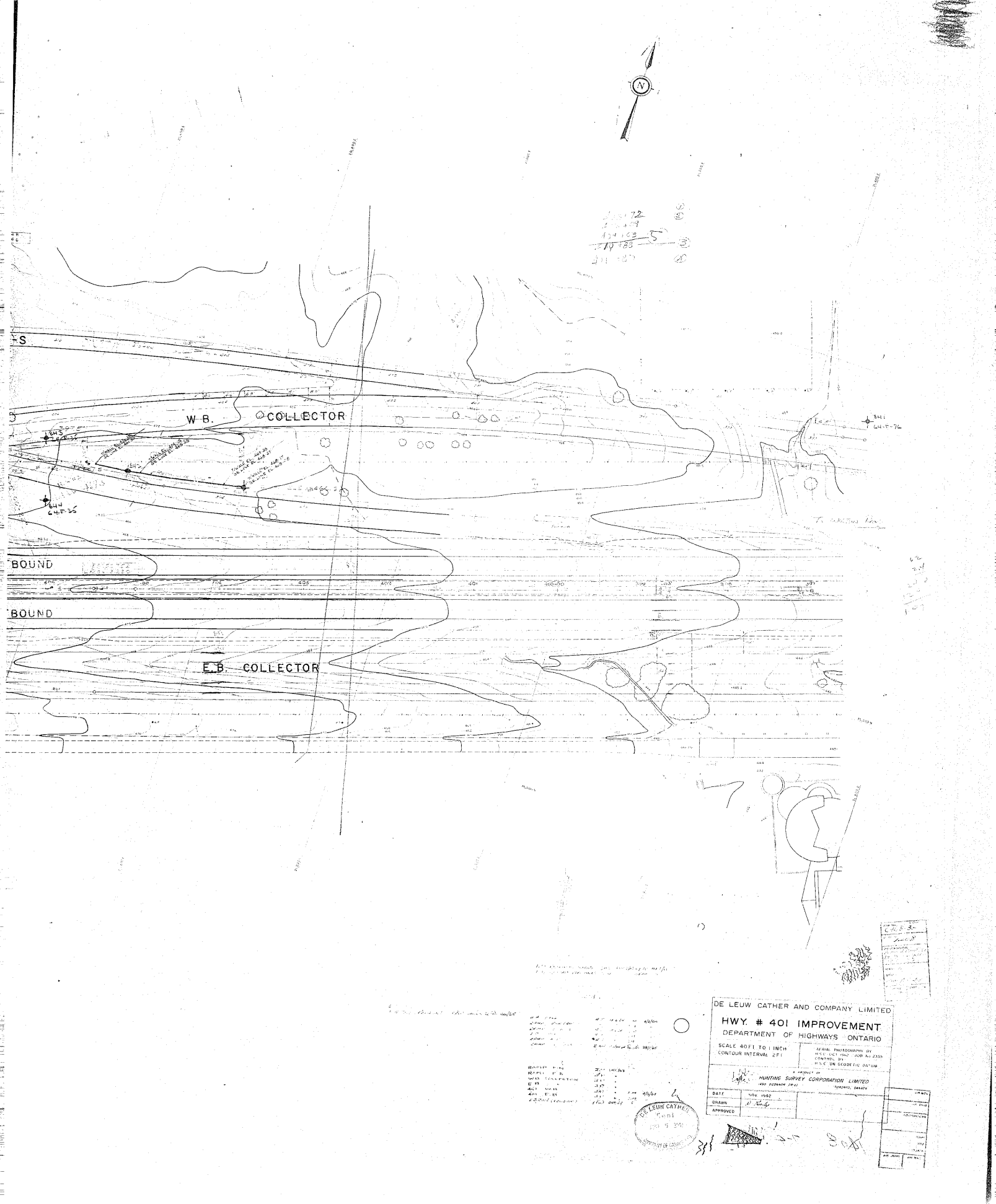
SLOPES

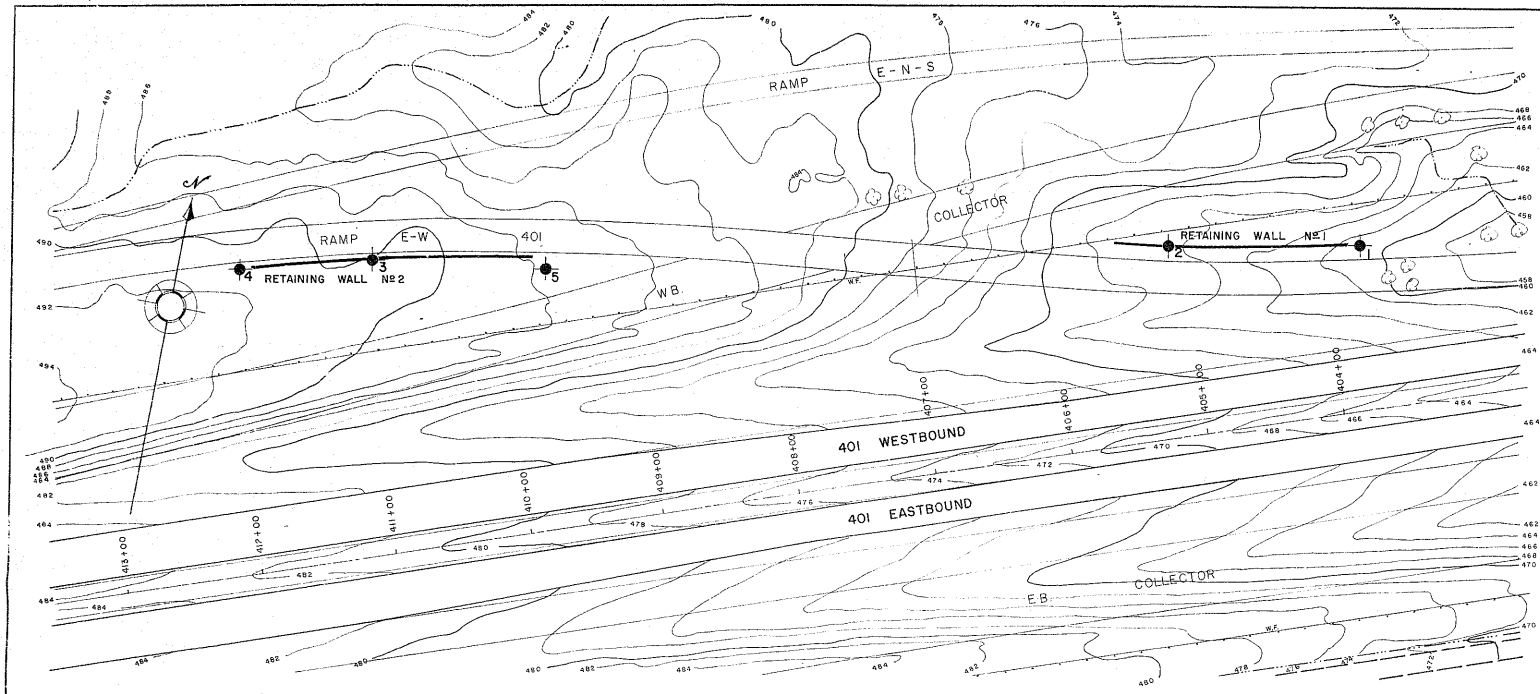
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

#65-F-42
W.P.#85-59-6
Hwy. #401 &
Islington
Ave. Retaining
Walls #1 & #2
(Proposed)

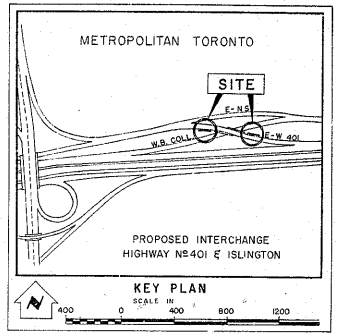


Bridge 424
Tunnels N 415-416


W.B. COLLECTOR
E.B. COLLECTOR
BOUND
BOUND
DE LEUW CATHER AND COMPANY LIMITED
HWY. # 401 IMPROVEMENT
DEPARTMENT OF HIGHWAYS ONTARIO
SCALE 40FT TO 1 INCH
CONTOUR INTERVAL 2FT
AERIAL PHOTOGRAPHS BY
CONTROL BY
MTC DATUM
HUNTING SURVEY CORPORATION LIMITED
TORONTO, CANADA
DATE
NOV. 1962
DRAWN
APPROVED



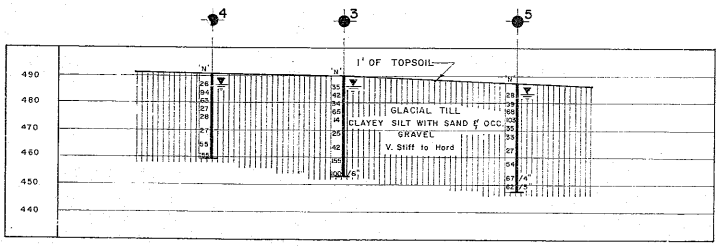
PLAN
SCALE IN FEET
40 0 40 60 80



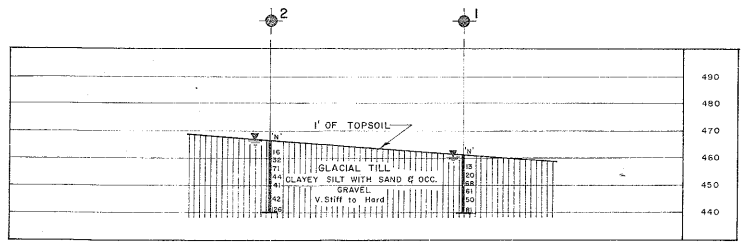
LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. APR./65

NO.	ELEVATION	STATION	OFFSET
1	460·9	403+72	120' RT.
2	466·5	405+09	140' "
3	490·0	410+88	215' "
4	490·7	411+87	223' "
5	487·2	409+63	188' "



SECTION ALONG RET. WALL Nº2



SECTION ALONG RET. WALL Nº1

SCALE FOR SECTIONS
20 0 20 40 60 FT.

- 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

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

RETAINING WALLS Nº1 & 2
ISLINGTON AVE.

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

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D R.M.	CHECKED	W.P. NO. 85-59-6	M.B.T. DRAWING NO. 65-F-42A
DRAWN D.G.H.	CHECKED	JOB NO. 65-F-42	
DATE 31 MAY 1965		SITE NO.	BRIDGE DRAWING NO.
APPROVED (By Principal Foundation Engineer)		CONT. NO.	