

23-69-05

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis  
Bridge Engineer  
Bridge Division

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

Attn: Mr. S. McCombie

DATE: September 19, 1967

OUR FILE REF.

IN REPLY TO

SEP 22 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
for  
Proposed Retaining Walls at the  
Site of Hwy. #401, 27 and Rich-  
view Expressway Interchange  
District 6 (Toronto)  
W.J. 67-F-68 -- W.P. 201-62-1

Enclosed, please find our foundation investigation report for Retaining Walls No's. 1, 2, 3, 4 and 5, to be constructed at Hwy. #401, 27 and Richview Expressway Interchange.

We believe the information contained in the report will be sufficient for your design purposes. If any points require further clarification, please contact this office.

AGS:mt

Attech.

cc: Messrs: B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (2)  
F. Allen  
W. S. Melinyshyn  
T. J. Kovich  
B. A. Singh

Foundation Files  
General Files

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

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FOUNDATION INVESTIGATION REPORT  
For  
Proposed Retaining Walls at the  
Site of Hwy. #401, 27 and Rich-  
view Expressway Interchange  
District 6 (Toronto)  
W.J. 67-F-68 -- W.P. 201-62-1

1. INTRODUCTION:

A foundation investigation was requested by Mr. W. Melinyshyn, Regional Bridge Location Engineer, for the proposed retaining walls at the site of Hwy. #401, 27 and Richview Expressway Interchange. The request, dated July 27, 1967 called for an investigation for some five proposed walls, numbered 1 to 5 inclusive. It was further indicated that as definite information concerning other walls became available, it would be forwarded to us.

Accordingly, a field and laboratory investigation was carried out by this section, the results of which are presented in this report, together with recommendations concerning foundations.

It is our intention, that as soon as the investigations for further walls are completed, recommendations will be submitted as part of the present report.

2. DESCRIPTION OF THE SITE AND FIELD INVESTIGATION:

The site under investigation covers the existing interchanges of Hwy. #401, 27 and the Airport Rd. The vicinity is partly flat, partly undulating terrain, occupied by residential, light industrial and farming communities.

Geologically the area belongs to the "South Slope" physiographic region. The landforms of this portion of the region consist of ground moraines with irregular knolls and hollows.

Some 17 sampled boreholes were carried out during the recent field work at the site of the five retaining walls. Three other boreholes, numbered 2, 9 and 41 were also incorporated in

2. DESCRIPTION OF THE SITE AND FIELD INVESTIGATION: (cont'd)

the soil profiles. These holes were drilled earlier for Contract #7 (Yellow) and are marked on the drawings with the appropriate job number (W.J. 66-F-102) in brackets. The field work was carried out by means of a continuous flight auger, taking split spoon samples at regular intervals. Standard penetration tests were performed by conventional methods and the penetration "N" values recorded. The locations of the borings are shown on Drawing #67-F-68A.

3. SOILS AND GROUNDWATER CONDITIONS:

3.1) General

Heterogeneous glacial fluvial or lacustrine, and glacial deposits form the overburden beneath the investigated area. No bedrock was encountered due to the relatively shallow depths of the boreholes. Subsoil may be divided into brown and grey cohesive clayey silts with some sands and traces of gravel, and to grey silty sands with gravel and some clay. A brief description of the soil is as follows.

3.2) Brown clayey silt with some sand and gravel

This is the uppermost layer, covering the entire area investigated, and has an average thickness of 16 - 20 feet. The consistency of this deposit increases with depth, being generally stiff to very stiff within the upper 5 - 10 feet, becoming hard below that depth. On a few occasions however, a soft consistency was also measured. The material exhibits slight plasticity, with an average plastic limit of 15% and liquid limit of 22%. The slightly over-consolidated nature of the stratum is confirmed by the low values of natural moisture contents, lying generally below the plastic limits.

cont'd. /3...

3. SOILS AND GROUNDWATER CONDITIONS: (cont'd.)

3.3) Grey clayey silt with sand and traces of gravel:

Underlying the surficial layer, a slightly cohesive grey clayey silt stratum was encountered in most of the boreholes, extending to the end of the borings. The deposit appears to be glacial till, having a generally hard consistency with penetration "N" values in excess of 100 blows/ft. The average value of plastic limit of the layer may be taken to be approx. 12%, and the average liquid limit about 18%.

3.4) Silty sand to sandy silt:

This material was found in boreholes #1, 2, 4 and 5 underlying the clayey silt. The deposit is similar to the grey clayey silt, having only a somewhat higher percentage of sand grains. Due to the constituent sand particles the deposit behaves as a granular, rather than a cohesive, layer. Relative densities, measured by the standard penetration tests were found to be very dense, corresponding to "N" values of around 80 - 150 blows/ft. The material exhibits slight plasticity on account of the 4 - 8% clay binder.

3.5) Groundwater conditions:

The groundwater table established at the borehole locations was found to lie between El. 458 ft. and 490 ft., i.e. at some 4 to 22 ft. below existing groundlevel. Very slow seepage is anticipated in the footing excavations below the waterlevel, due to the rather impervious nature of the clayey silt deposits.

cont'd. /4.....

#### 4. DISCUSSION AND RECOMMENDATIONS:

##### 4.1) General:

(a) This report deals with the foundation investigations for five retaining walls, to be constructed in connection with the proposed Hwy. #401, 27 and Richview Expressway Interchange. The stratigraphical profiles along the walls are shown on Drawing #67-F-68B. On the same drawing the approximate dimensions and elevations of the walls are also marked, according to the 40 ft. scale contour plan supplied by the Bridge Location Engineer.

Remarks and recommendations concerning the foundations of all walls are given below.

(b) Where spread footings are recommended a minimum cover of four ft. should be provided between the bottoms of footings and the finished grade at the low side of the wall, for frost protection.

(c) No major dewatering problems are anticipated for the footing excavations within the clayey silt strata. In lowering the excavations into the granular silty sand to sandy silt however, a dewatering scheme may be necessary to prevent the excavation bottom "boiling". In the case of using interlocking sheet piles, they should be driven to a depth below the base of the excavations, equal to the height of water above it.

(d) The horizontal component of all lateral pressures tends to cause the wall to slide along the base. This sliding force is resisted by a horizontal force which consists of friction, adhesion or a combination of both. In computing the resistance to lateral pressures for walls placed within the in situ granular layers (sandy silt, silty sand, sand) a coefficient of friction  $\tan \phi = 0.45$  (rough concrete slab sliding on coarse grained soil with silt) may be used.

For walls constructed within the well compacted G.B.C. class "A" fill, the friction coefficient may be increased to  $\tan \phi = 0.55$ .

cont'd. /5.....

4. DISCUSSION AND RECOMMENDATIONS: (cont'd.)

4.1) (d) cont'd.

For walls placed in the cohesive layers (clayey silt) the adhesion between the base and the soil is assumed to be equal to the cohesive strength of the deposit and  $\phi$  is assumed to be zero. An adhesion value of 3,000 p.s.f. may be assumed for calculation purposes.

For retaining walls supported on piles, the entire vertical and horizontal load should be assumed to be carried on piles. No frictional resistance and no adhesion should be considered to act along the base slab.

(e) In some locations piled foundations are recommended. The working load on the piles should be checked during pile driving by means of the Hiley Formula (D.H.O. Standards DD 1218 and 1219).

(f) In the case of supporting the walls on piles, the uplift piles (under the heel) should be anchored in the base for the tension anticipated.

Detailed recommendations for the foundations of the individual walls follow.

4.2) Retaining Wall #1:

Four Boreholes, numbered 7, 8, 9 and 10 were drilled along the proposed, approx. 480 ft. long, wall. The design finished ground at the low side of the wall coincides with the existing groundlevel. Soft and stiff soils were observed within the upper 5 - 9 ft. depth of the boreholes. Footings should be placed below these soils, on the very stiff to hard strata, which have adequate strength to support the structure on spread footings. Due to the rather deep (9 ft.) excavations, necessary for spread footings, piled foundation might be more economical. The recommended elevations for the bottom of spread footings, also the estimated tip elevations of the alternate piles are tabulated below, at each borehole location.

cont'd. /6.....

4. DISCUSSION AND RECOMMENDATIONS: (cont'd.)

4.2) Retaining Wall #1: (cont'd.)

<u>BOREHOLE LOCATION</u>	<u>BOTTOM OF SPREAD FOOTINGS AT OR BELOW EL. (FT.)</u>	<u>ESTIMATED TIP ELE- VATIONS OF "H" PILES (FT.)</u>
7	475.0	455.0 - 465.0
8	475.0	450.0 - 455.0
9	479.0	450.0 - 455.0
10	480.0	450.0 - 455.0

Up to 4 t.s.f. design pressure may be used on spread footings at the listed elevations. It is estimated that 12 BP @ 53 steel "H" piles, driven to the above elevations, will support loads of 70 T/pile.

4.3) Retaining Wall #2:

Boreholes #13, 14, 15 and 16 were placed along this wall, as indicated by the soil profile on Drawing #67-F-68B. Below a 4 - 5 ft. thick stiff to very stiff surficial layer, hard clayey silts were encountered along the proposed wall. From the plan, supplied by the Bridge Location Section, the wall appears to be on a fill, the design ground at the low side of the wall being some 3 to 18 ft. higher than the existing groundlevel. Spread footings, constructed within the hard original soils, will support up to 4 t.s.f. safe loads. The recommended elevations of the footings at the borehole locations are listed below:

<u>BOREHOLE LOCATIONS</u>	<u>BOTTOM OF SPREAD FOOTINGS AT OR BELOW EL. (FT.)</u>
13	488.0
14	488.0
15	488.0
16	482.0

cont'd. /7.....



4. DISCUSSION AND RECOMMENDATIONS: (cont'd.)

4.3) Retaining Wall #2: (cont'd.)

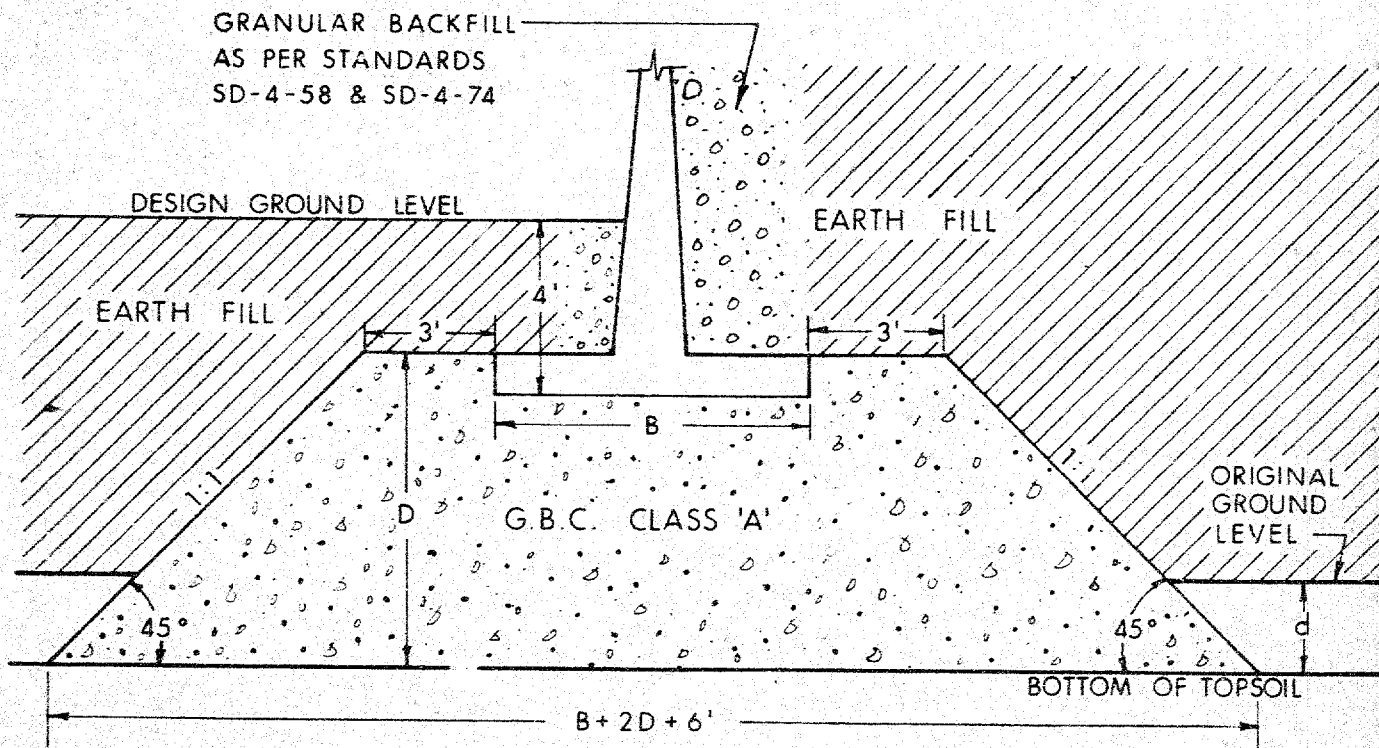
The wall may also be supported partly or entirely on well compacted G.B.C. class "A" granular fill. The method of construction of the granular fill is shown on Fig. #1, together with the recommended sequence of operations. This sequence should be strictly adhered to, in order to achieve the desired bearing capacity. A safe design load of 2 t.s.f. may be assumed for footings within the fill, constructed according to the specified method. Vertical expansion joints should be incorporated between the sections supported on fill and sections within the original soil.

4.4) Retaining Wall #3:

A total of six boreholes, numbered 1 - 6 inclusive was carried out along the proposed 880 ft. long wall. Somewhat non uniform consistencies were revealed by the boreholes within the upper clayey silt layer. In some of the borings the consistencies were measured to be hard from groundlevel downward. In some of the holes however, stiff materials were found within the upper 10 ft., corresponding to penetration resistances of 9 blows/ft. and above. The underlying silty sand and sandy silt stratum were observed to be very dense.

The base of the wall will be quite near the existing groundlevel, however, there will be a low fill some 3 ft. in height at the north side, and a cut of 1 - 2 ft. at the south. In considering spread footings, they should be lowered as deep as 10 - 12 ft. below groundlevel along a certain length of the wall, due to the weak upper layer. It is believed that in such cases a piled foundation will be more economical. On the table shown below, both the depth of spread footings, and the estimated tip elevations of steel "H" piles are listed, related to borehole locations. It is suggested that the most economical method be adopted.

FIGURE 1



### LEGEND

- B = BREADTH OF FOOTINGS
- D = DEPTH OF G.B.C. CLASS 'A' BACKFILL
- d = DEPTH OF TOPSOIL

### SEQUENCE OF OPERATION

- 1 - STRIP TOPSOIL
- 2 - CONSTRUCT G.B.C. CLASS 'A' TO FULL HEIGHT AS SHOWN
- 3 - CONSTRUCT REMAINDER OF FILL TO CONVENIENT HEIGHT
- 4 - RE-EXCAVATE FOR RETAINING WALL FOOTING

TYPICAL SECTION OF A RETAINING WALL SUPPORTED ON SPREAD FOOTINGS WITHIN THE FILL MATERIAL

4. DISCUSSION AND RECOMMENDATIONS: (cont'd.)

4.4) Retaining Wall #3: (cont'd.)

<u>BOREHOLE LOCATION</u>	<u>BOTTOM OF SPREAD FOOTINGS AT OR BELOW EL. (FT.)</u>	<u>ESTIMATED TIP ELEVATION OF "H" PILES (FT.)</u>
1	476.0	445.0 - 450.0
2	472.0	445.0 - 450.0
3	468.0	450.0 - 455.0
4	468.0	450.0 - 455.0
5	472.0	455.0 - 460.0
6	481.0	460.0 - 465.0

If it is decided that part of the wall be supported on spread footings and part of it on piles, expansion joints should be constructed between the sections of the wall supported on different foundations.

The safe design load on spread footings, placed on the above elevations, may be taken to be up to 4 t.s.f. 12 BP @ 53 steel "H" piles, driven to practical refusal will support loads of 70 T/pile.

4.5) Retaining Wall #4:

One borehole numbered 11 was drilled at the location of proposed Wall #4 during the recent field investigation. Another borehole (BH. #2 of 66-F-102) put down earlier was also incorporated in the soil profile. The uppermost 7 - 8 ft. layer of the clayey silt subsoil was found to be stiff, corresponding to penetration "N" values of 9 - 12 blows/ft. Below this depth the consistency of the soil is hard with penetration resistances in excess of 100 blows/ft. The finished ground of the low side of the wall is designed to be approximately the same as the existing ground level.

cont'd. /9...

4. DISCUSSION AND RECOMMENDATIONS: (cont'd.)

4.5) Retaining Wall #4: (cont'd)

The wall may be supported on spread footings below the stiff upper stratum. In this case, the footing of the north half of the approx. 125 ft. long wall should be placed at or below El. 483 ft., i.e. some 7 ft. below groundlevel. The footing for the south half of the wall should be gradually stepped to El. 481 ft. Design pressures up to 4 t.s.f. may be assumed. Footings may also be placed at 4 ft. below finished ground and supported on piles. 12 BP @ 53 "H" piles will carry safe loads of 70 T/pile when driven to practical refusal. It is assumed that practical refusal will be reached around El. 450 - 455 ft. The more economical foundation should be adopted.

4.6) Retaining Wall #5:

Since two previously drilled boreholes (#9 and 41 of W.J. 66-F-102) could be utilized for the soil stratigraphy along the proposed wall, only two new holes, numbered 17 and 18 were carried out during the recent soil survey.

Generally hard clayey silt soils with some sand and gravel were encountered in the boreholes from groundlevel, extending to the end of the boreholes. Beneath the southern half of the proposed wall some very stiff consistencies were also observed under the approx. 10 ft. thick dessicated upper layer. The penetration resistances within the very stiff layer range from 20 to 28 blows/ft.

The base of the proposed 700 ft. long wall will closely follow the existing groundlevel at the north side. The southern, approx. 500 ft. length of the wall, will be in a cut, the depth of which increases towards the south. The construction of spread footings at some 4 ft. below finished grade appears to be feasible along the full length of the wall. Footings will support safe loads up to 3 t.s.f. beneath the southerly 400 ft. and up to 4 t.s.f. below the rest of the wall.

cont'd. /10.....

5. MISCELLANEOUS:

The field work carried out during the period July 31 - August 10, 1967 was supervised by Mr. B. R. Gray, Project Foundation Engineer. Equipment used was owned and operated by Dominion Soil Investigation Ltd. General supervision and the preparation of this report was undertaken by Mr. A. K. Barsvary, Senior Foundation Engineer.

Mr. K. G. Selby, Supervising Foundation Engineer, reviewed the report.

September 1967

APPENDIX I

## 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

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

$\gamma$	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 INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	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
$\bar{\sigma}$	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



DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-2-68

LOCATION Co-ord 866,132 N; 980,874 E.

W.P. 201-62-1

BORING DATE August 1, 1967

DATUM Geodetic

BOREHOLE TYPE Penn Drill

FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY BRG

CHECKED BY

# RECORD OF BOREHOLE NO. 1

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2 (66-F-102)

FOUNDATION SECTION

JOB 67-F-68 LOCATION Co-ord. 867,754 N.; 979,701 E. ORIGINATED BY Dom. Soil  
W.P. 201-62-1 BORING DATE December 13, 1966 COMPILED BY DAM  
DATUM Geodetic BOREHOLE TYPE Augering CHECKED BY SL

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		SHEAR STRENGTH P.S.F.				WP	W	WL		
490.6	Ground Level														
0.0	Clayey silt with sand.  Firm to hard.		1	SS	12	490									
			2	SS	72	480									
			3	SS	53										
			4	SS	44	470									
			5	SS	58										
457.6			6	SS	82/9"	460									
33.0	Silty sand.  Very dense.		7	SS	150/4"										
			8	SS	110/6"	450									
445.5			9	SS	100/1"										
45.1	End of Borehole														

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-68

LOCATION Co-ord. 866,298 N.; 980,832 E.

ORIGINATED BY BRG

W.P. 201-62-1

BORING DATE August 1, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY SR

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		SHEAR STRENGTH P.S.F.				wp	w	wL		
481.1	Ground Level														
0.0	Clayey silt with some sand and traces of gravel. Stiff to hard.		1	SS	13	480									
			2	SS	23										
			3	SS	45	470									
			4	SS	45										
			5	SS	175/11"										
461.1	brown grey														
20.0	Sandy silt to silty sand with gravel & clay. Compact to very dense		6	SS	27	460									
			7	SS	99										
449.6			8	SS	81	450									
31.5	End of Borehole														

470.1  
6 36 47 11

12 37 43 8

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-68

W.P. 201-62-1

DATUM Geodetic

DATUM \_\_\_\_\_

RECORD OF BOREHOLE NO. 3

LOCATION Co-ord. 866,442 N.; 980,790 E.

BORING DATE August 1, 1967

BOREHOLE TYPE Penn Drill

FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY        BRC

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 67-F-68 LOCATION Co-ord. 866,584 N.; 980,747 E. ORIGINATED BY BRG  
W.P. 201-62-1 BORING DATE August 2, 1967 COMPILED BY BRG  
DATUM Geodetic BOREHOLE TYPE Penn Drill CHECKED BY SR

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— WL PLASTIC LIMIT ——— wp WATER CONTENT ——— w			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT				wp ——— w ——— WL				
480.4	Ground Level														
0.0	Clayey silt with some sand and traces of gravel.		1	SS	9	480									
			2	SS	10										
			3	SS	13	470									
	Stiff to Hard.		4	SS	73										
			5	SS	115										
460.4						460									
20.0	Silt to sandy silt traces of clay & gravel. Very Dense.		6	SS	67										
454.5			7	SS	125/5"										
25.9	End of Borehole														

4 34 51 11

457.9

6 41 49 4



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 67-F-68

LOCATION Co-ord. 866,717 N.: 980,714 E.

ORIGINATED BY BRG

W. P. \_\_\_\_\_ 201-62-1

BORING DATE August 2, 1967

COMPILED BY BRG

DATUM \_\_\_\_\_ Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY                     

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 67-F-68 LOCATION Co-ord. 866,983 N.; 980,665 E. ORIGINATED BY BRG  
W.P. 201-62-1 BORING DATE August 2, 1967 COMPILED BY BRG  
DATUM Geodetic BOREHOLE TYPE Penn Drill CHECKED BY SR

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		SHEAR STRENGTH P.S.F.				wp	w	wL		
485.4	Ground Level														
0.0	Clayey silt with sand traces of gravel  brown grey  Hard		1	SS	30	480									
			2	SS	63										
			3	SS	151	11"									
			4	SS	40										
			5	SS	100	5"	470								
			6	SS	145										
459.1			7	SS	179	9"	460								
26.3	End of Borehole														

472.2





DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

RECORD OF BOREHOLE NO. 8

### FOUNDATION SECTION

JOB 67-F-68

LOCATION C. d. 867,374 N.; 980,052 E.

ORIGINATED BY BRG

W. P. \_\_\_\_\_ 201-62-1

BORING DATE August 10, 1967

COMPILED BY BRG

DATUM \_\_\_\_\_ Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY                     

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 9 (66-F-102)

FOUNDATION SECTION

JOB 67-F-68

LOCATION Co-ord. 867,997,N; 980,530 E.

ORIGINATED BY Dom. Soil

W.P. 201-62-1

BORING DATE Nov. 29, Dec. 2, 1966

COMPILED BY DAM

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY *SR*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— w <sub>L</sub>		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— w <sub>p</sub>	WATER CONTENT ——— w		
493.8	Ground Level										
0.0	Clayey silt with sand		1A	CS		490					
			1	SS	99						
			2	SS	58						
	Hard.		3	SS	49/6"	480					5 40 41 14
			4	SS	63	470					
			5	SS	48						468.8
			6	SS	66						5 40 38 17
			7	SS	112/2 1/2"	460					
			8	RC							
			9	10%							
	boulders & cobbles.		10	SS	100/3"						7 33 42 18
			11	SS	50 A.F.	450					
			12	WS							
443.8			14	RC							
50.0	End of Borehole			10%							

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

JOB 67-F-68

LOCATION Co-ord. 867.478 N.; 979,940 E.

ORIGINATED BY BRG

W.P. 201-62-1

BORING DATE August 10, 19, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY                     

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		SHEAR STRENGTH P.S.F.				WATER CONTENT % 10 20 30					
485.3	Ground Level															
0.0	Clayey silt with sand, traces of gravel		1	SS	11	480									470.6	
			2	SS	49											
			3	SS	104											
	Brown		4	SS	190	470										
	Grey		5	SS	66											
	Stiff to hard.		6	SS	75											
464.3																
21.0	Sandy silt with traces of gravel.					460										
458.8	Very Dense.		7	SS	173											
26.5	End of Borehole															

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-68

W.P. 201-62-1

DATUM Geodetic

RECORD OF BOREHOLE NO. 10

LOCATION Co-ord. 867,583 N.; 979,855 E.

BORING DATE August 3, 1967

BOREHOLE TYPE Penn Drill

## FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY BRG

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

JOB 67-F-68

LOCATION Co-ord. 867,680 N.; 979,710 E.

ORIGINATED BY BRG

W.P. 201-62-1


BORING DATE August 3, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY *LR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— PL WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					Wp ——— W ——— WL 10 ——— 20 ——— 30				
488.9	Ground Level															
0.0	Clayey silt with sand, traces of gravel.		1	SS	9	480										
			2	SS	27											
			3	SS	63											
			4	SS	142											
	Brown Grey		5	SS	170	470										
	Stiff to hard.		6	SS	54											
462.4			7	SS	103											
26.5	End of Borehole															

478.4

4 35 46 15

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 67-F-68

LOCATION Co-ord. 867,848 N.; 979,850 E.

ORIGINATED BY BRG

W. P. 201-62-1

BORING DATE August 9, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY                     

RECORD OF BOREHOLE NO. 13

FOUNDATION SECTION

[illegible]



FOUNDATION SECTION

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-68

LOCATION Co-ord. 867,729 N.; 979,960 E.

ORIGINATED BY BRG

W.P. 201-62-1

BORING DATE August 8, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Penn Drill

CHECKED BY AK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 67-F-68

W. P. 201-62-3

DATUM Geodetic

LOCATION Co-ord. 867,575 N.; 980,090 E.

BORING DATE August 8, 1967

BOREHOLE TYPE Penn Drill

FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY BRG

CHECKED BY SK

[illegible]



DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-68

W. P. 201-62-1

DATUM Geodetic

RECORD OF BOREHOLE NO.16

LOCATION Co-ord. 867,442 N.; 980,182 E.

BORING DATE August 9, 1967

BOREHOLE TYPE Penn Drill

FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY BRG

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

## RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

JOB 67-F-68 LOCATION Co-ord. 867,625 N.; 980,523 E. ORIGINATED BY BRG  
W.P. 201-62-1 BORING DATE July 31, 1967 COMPILED BY BRG  
DATUM Geodetic BOREHOLE TYPE Penn Drill CHECKED BY SR

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		SHEAR STRENGTH P.S.F.				wp ——— w ——— WL WATER CONTENT % 10 20 30				
487.5	Ground Level														
0.0	Clayey silt with sand traces of gravel.		1	SS	41	480									465.0
	Brown		2	SS	52										
	Grey		3	SS	22										
			4	SS	28										
	Very stiff to hard.		5	SS	34	470									
			6	SS	33										
			7	SS	39	460									
			8	SS	100/5"										
457.0															
30.5	End of Borehole														

▽ 465.0

DEPARTMENT OF HIGHWAYS - ONTARIO

# MATERIALS & TESTING DIVISION

JOB 67-F-68

W. P. 201-62-1

DATUM Geodetic

RECORD OF BOREHOLE NO. 18

LOCATION Co-ord. 867,835 N. 980,553 E.

BORING DATE July 31, 1967



BOREHOLE TYPE Penn Drill

## FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY BRG

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT ——— w <sub>L</sub> PLASTIC LIMIT ——— w <sub>p</sub> WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLCT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			w <sub>p</sub>	w	w <sub>L</sub>		
490.9	Ground Level													
0.0	Clayey silt with sand traces of gravel		1	SS	55	490								482.4 
			2	SS	67									
			3	SS	96									
	Brown		4	SS	157	480								
	Grey		5	SS	55									
			6	SS	50	470								
	Hard to very stiff		7	SS	23									
464.4														
26.5	End of Borehole													

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-68

W.P. 203-62-1

DATUM Geodetic

RECORD OF BOREHOLE NO. 41 (66-F-102)

LOCATION Co-ord. 867,431 N.; 980,496 E.

BORING DATE July 4, 1967

BOREHOLE TYPE Cont. Flight Auger

FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY BRG

**CHECKED BY**

[illegible]

## MEMORANDUM

TO: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Division,  
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: December 20, 1967

OUR FILE REF.

IN REPLY TO

SUBJECT:

## FOUNDATION INVESTIGATION REPORT

For

Proposed Retaining Wall #4 at the Site  
of Hwy. #401, #27 & Richview Expressway  
Interchange -- District #6 (Toronto)

W.J. 67-E-68

W.P. 201-62-1

The Foundation Section was requested by Mr. W. Melnyshyn, Regional Bridge Location Engineer, to carry out a field investigation for proposed Retaining Wall #4. The memorandum, containing the request, was dated November 23, 1967. Wall #4 is proposed to be south of the Carling Brewery, and it is delineated in Contract #6 (Green).

It is to be noted that the original Wall #4, discussed in Foundation Report W.J. 67-E-68, will not be a separate wall. Upon receipt of the memo, a field and laboratory investigation was carried out by this Section at the site of the proposed structure.

Presented on the attached sheets are the results of the investigation as well as recommendations concerning foundations. Please insert these sheets and drawings into your original copy(s) of Foundation Report W.J. 67-E-68.

KCS/ndaf

Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farron  
G. K. Hunter (2)  
F. Allen  
W. S. Melnyshyn  
T. J. Kovich  
B. A. Singh

*1/2 in. 2-1/2 in.*

K. G. Selby,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Stenao,  
PRINCIPAL FOUNDATION ENGR.

Foundations Files  
Gen. Files

1) Soil Conditions:

Some four boreholes were carried out along the proposed wall, as shown on attached Drawing #67-F-683. Coarse-grained deposits were found to be the predominant layers along the larger portion of the line. The granular deposits consist of sandy gravels, silty sands with gravel, and gravelly sands. Beneath the creek the material appears to have very little or no fines; in borehole #23, however, it was observed to contain a fair percent of silt binder. In borehole #20 at the west end of the proposed wall, brown and grey clayey silt with traces of sand and gravel (glacial till) was encountered. The cohesive material has very stiff and hard consistencies, indicated by Standard Penetration 'N' values of 22 blows/ft. to above 100 blows/ft. The underlying shale bedrock was proved by diamond drilling in boreholes #21 and #22, whereas holes #20 and #23 were terminated upon reaching the surface of the shale. The upper portion of the bedrock is badly weathered.

Groundwater level was observed around el. 514 ft. in borehole #20, and some 10 ft. lower in hole #23. Near the creek the groundwater seems to correspond to the creek level.

2) Discussion and Recommendations:

2.1) Wall #4 is proposed to be some 434 ft. long, traversing the existing open channel south of the Carling Brewery. The middle approx. 300-ft. length of the wall will be built over the approximate 15-ft. deep trench. The finished ground at the low side of the wall is assumed to be at el. 515 ft.

2.2) Soil conditions were found to be favourable for shallow foundations along the entire structure. Spread footings may be placed as high as three ft. below existing ground surface, provided that a four-ft. distance between the bottom of footings and the finished ground level at the low side of the wall is maintained. 4 t.s.f. design pressure may be employed on the footings, constructed according to the above method.



2. Discussion and Recommendations: (cont'd.) ...

2.2) (cont'd.) ...

A dewatering scheme for the footing excavations below the groundwater table will likely be necessary, inasmuch as the sandy gravel subsoil may become unstable under unbalanced hydrostatic head. It is assumed, however, that the channel will be diverted prior to the construction of the retaining wall, and this in turn, might change existing groundwater conditions.

Since the bottom of the trench is more than ten feet lower than the design ground, footings along the middle section of the wall will be some 13 - 14 ft. below the finished ground, necessitating an additional height of wall. It is felt that such a construction will not be the most economical proposition; therefore, two other foundation methods are submitted for consideration, as follows:

2.3) The channel should be filled by suitable earth fill material prior to the construction of the wall. The section of the wall over the new earth fill should be supported on piles and the rest of the wall on spread footings, as discussed under para. (2.2). The bottom of pile caps should be placed some four ft. below finished ground. Employing 12 BP @ 53 steel H-piles driven to bedrock (approx. el. 495 - 497 ft.), 70 T/pile safe pressures may be assumed. The design loads on spread footings may again be taken to be 4 t.s.f. Vertical expansion joints should be incorporated between the sections supported on spread footings and on piles.

2.4) The section of the wall over the trench may also be built on well compacted G.B.C. Class 'A' granular fill, while the remainder of the wall, as was suggested under para. (2.2). The method and sequence of construction of the fill was explained in detail in the original report #67-F-68, Page #7, para. (4.3) and Fig. #1. The difference between the two cases is, that here

RETAINING WALL #4 - (cont'd.) ...

2. Discussion and Recommendations: (cont'd.) ...

3.

2.4) (cont'd.) ...

the bottom of the G.B.C. - 'A' fill will not be horizontal, but on a slope. After stripping the topsoil, therefore, it is recommended that the new fill be keyed into the old slopes as per D.H.O. Standard DD-414.

For remarks about coefficients of sliding resistance and piled foundations, your attention is called to the general discussion and recommendations of the report (Pages #4 & #5).

The backfill of the wall should be carried out according to D.H.O. Standards #SD-4-58 and #SD-4-74.

3. MISCELLANEOUS:

The field work, carried out during the first week of December 1967, was performed by means of a Continuous Flight Auger owned by Canadian Longyear Ltd., under the supervision of Mr. A. M. Seppala, Project Foundation Engineer, of the Foundation Section. This report was prepared by Mr. A. K. Barsvary, Senior Foundation Engineer, and reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

December 20, 1967





DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS & TESTING DIVISION

JOB 67-F-68

LOCATION Co-ords. 868,369 N; 977,338 E.

W. P. 201-62-1

BORING DATE Dec. 5, 1967

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

FOUNDATION SECTION

ORIGINATED BY AMS

COMPILED BY AKB

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

# RECORD OF BOREHOLE NO. 22

FOUNDATION SECTION

JOB 67-F-68

LOCATION Co-ords. 868,395 N; 977,475 E.

ORIGINATED BY AMS

W. P. 201-62-1

BORING DATE Dec. 4, 1967

COMPILED BY \_\_\_\_\_ AKB

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 23

FOUNDATION SECTION

JOB 67-F-68 LOCATION Co-Ords. 868,418 N; 977,598 E. ORIGINATED BY AMS  
W.P. 201=6201 BORING DATE Dec. 1, 1967 COMPILED BY AKB  
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT _____ w <sub>L</sub> PLASTIC LIMIT _____ w <sub>p</sub> WATER CONTENT _____ w				BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				w <sub>p</sub> _____ w _____ w <sub>L</sub> WATER CONTENT %					
515.6	Ground Level															
0.0	Silty sand with gravel to gravelly sand.	0.0	1	SS	123	510										
		0.0	2	SS	100/3"											
	Very dense.	0.0	3	SS	125/6"											
		0.0	4	SS	91											
		0.0	5	SS	165	500										
495.4		0.0	6	SS	100/2"											
20.2	End of Borehole					490										

▼ 504.6

401 & Keele Street  
Downsview, Ontario

July 27, 1967

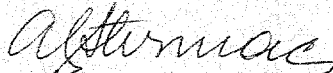
Dominion Soil Investigation Ltd.  
77 Crockford Blvd.  
Scarborough, Ontario

Dear Sirs:

This is to confirm our request of July 27, 1967 for the supply of a Penn Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Hwy. 27 & 401 Toronto, Ontario on July 31, 1967.

This project bears Job Number 67-F-68.

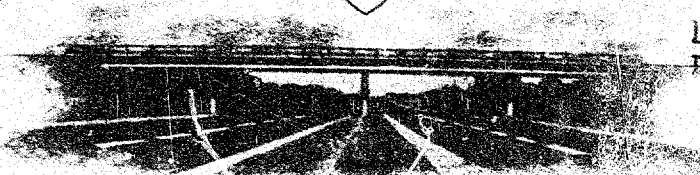
Yours truly,



A. G. Stemas  
Principal Foundation Engineer

AGS:mt

cc: H. Konings  
Foundation Files  
General Files



401 & Keesle Street  
Downsview, Ontario

DEPARTMENT OF HIGHWAYS

December 14, 1967

Canadian Longyear Limited  
35 Brydon Drive  
Rexdale, Ontario

Dear Sirs:

This is to confirm our request of November 27, 1967 for the supply of a Penn Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Hwy. 27 and Richview Side Rd., on November 29, 1967, and upon completion to Carling Rd. & Hwy. 401 & 27.

This project bears Job Number 66-F-102 and 67-F-68

Yours truly,

KGS:mt

K. G. Selby  
Supervising Foundation Engineer  
for: A. G. Stermac  
Principal Foundation Engineer

cc: H. Konings  
Foundation Files(2) //0  
General File

# 67 - F- 68

W. P. #201-62-1

HWY. #401 AND #27

RICHVIEW

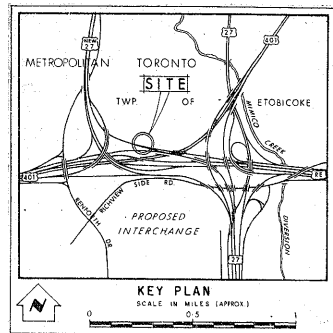
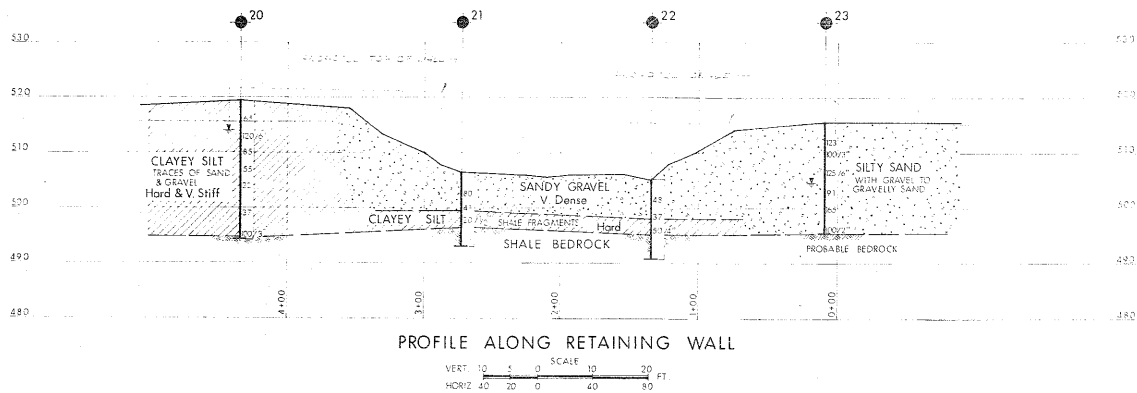
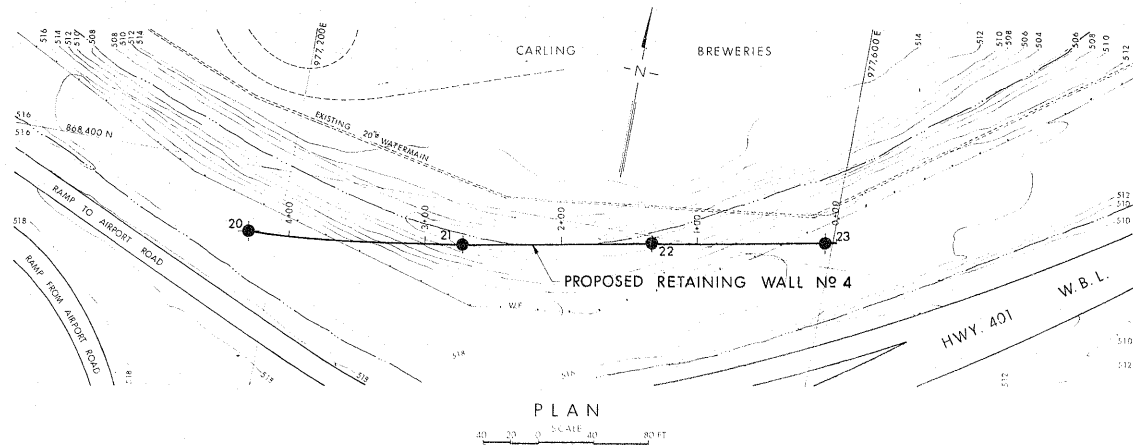
EXPRESSWAY

INTERCHANGE









LEGEND				
●	Bore Hole			
⊕	Cone Penetration Hole			
⊗	Bore & Cone Penetration Hole			
—	Water Levels established at time of field investigation, DEC 1967			
NO.	ELEVATION	NO.	INDICATES	
20	510.5	868.351	977.181	
21	507.5	868.362	977.338	
22	505.0	868.395	977.475	
23	515.7	868.418	977.598	

**- 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

**RETAINING WALL No. 4**

KING'S HIGHWAY NO. 401 & 27 INTERCHANGE DIST. NO. 6  
CO. YORK METRO TORONTO  
TWP. ETOBICOKE LOT. CON.

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBNO. A.B.	CHECKED	W.P. NO. 201-62-1	M.T. DRAWING NO.
DRAWN S.O.	CHECKED	JOB NO. 67-F-68	<b>67-F-68 C</b>
DATE 24 JAN 1968	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	DESIGNED	CONTRACT NO.	

