

# 65-F-50

W.P. # 85-59-4

HWYS. # 400

& 401

INTERCHANGE

## MEMORANDUM

23-63-216.

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: May 26, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

ADDITIONAL  
FOUNDATION INVESTIGATION REPORT  
For  
Hwy. #400/Hwy. #401 Interchange  
W-S Ramp Retaining and Toe Wall,  
District #6 (Toronto)  
W.J. 65-F-50 - W.P. 85-59-4

The Foundation Section have recently carried out a number of borings at the site of the above-mentioned proposed retaining walls. Following is a summary of subsoil conditions, together with recommendations pertaining to the foundations for the proposed walls.

Soil Conditions:

The existing 15 feet high embankment is composed generally of stiff to hard clayey silt with traces of sand and gravel. The range of consistency is fairly wide since 'N' values as determined from standard penetration tests, ranged from 14 to 53 blows per foot with an average of about 30. The natural moisture content ranges from 12% to 20% with an average of about 15%.

Below the fill material, the subsoil consists of hard to firm clayey silt to silty clay with the upper 10 to 14 feet in a desiccated and stiff condition. Underneath the desiccated zone, the

cont'd. /2 ...

May 26, 1965

Soil Conditions: (cont'd.) ...

material changes in colour from brown to grey and has a very stiff to firm consistency. The overall deposit was found to extend for a depth of at least 60 feet below original ground level to el. 365.0. Physical properties of this material as determined from field and laboratory tests, are as follows:

<u>Desiccated Zone</u>	'N' Values .....	17 - 46	blows/ft.
	Moisture Content .....	18 - 26	per cent
	Liquid Limit .....	31 - 43	per cent
	Plastic Limit .....	17 - 24	per cent
<u>Below Desiccated Zone</u>	Undrained Shear Strength	600 - 3,000	p.s.f.
	Moisture Content .....	20 - 32	per cent
	Liquid Limit .....	28 - 40	per cent
	Plastic Limit .....	16 - 25	per cent
	Bulk Density .....	120 - 131	p.c.f.

The complete results of all tests are plotted on the borelog sheets attached to this memo, and the location of all borings are shown on the accompanying Drawing #65-F-50A.

Recommendations:

The W-S Ramp Retaining Wall will be constructed to retain the embankment of Hwy. #400 on the west side of the S.B.L. The height of the wall will range from about 15 feet at the north end to about 2 feet at the south end. The length of the wall will be approximately 450 feet. Since the existing embankment fill shows a wide variation in relative density and hence, strength, it is recommended

cont'd. /3 ...

May 26, 1965

Recommendations: (cont'd.) ...

that the proposed wall be supported on spread footings founded in the desiccated material some 4 feet below original ground level, or on piled foundations. In the case of spread footings, a net allowable pressure of 2 t.s.f. may be assumed for design purposes, at depths 4 feet below original ground level. In the case of piled foundations, previous experience in this type of subsoil has shown that timber piles can be twice and even three times as efficient as steel piles. Assuming that the bases of the pile caps would be located some 4 feet below the grade of the W-S Ramp, it is estimated that No. 14 timber piles driven some 35 feet below footing formation level, would achieve a design load of 20 tons/pile. Due to the hardness of the fill material and upper subsoil, it may be necessary to pre-auger some or all of the piles from 10 to 15 feet below the footing base and for this purpose, a 10-inch diameter hole should suffice. It will be necessary to use treated timber piles since they will be partially above ground water level in this case.

For the proposed Toe Wall, spread footings may be constructed approximately 4 feet below finished ground level at approximate elevation 421.0. A net safe pressure of 2 t.s.f. may be assumed for design purposes. Any soft material observed during construction, below el. 421.0, should be removed and replaced with mass concrete. It is possible that some localized soft conditions may exist, particularly in the vicinity of B.H. #7.

For backfill to the retaining walls, we refer you to a memo from Mr. A. Rutka, Materials and Testing Engineer, to

contd. /4 ....

Mr. A. M. Toye  
Attn: Mr. S. McCombie

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May 26, 1965

Recommendations; (cont'd.) ...

Mr. A. M. Toye, Bridge Engineer, dated March 27, 1963, the subject being, "Hwy. #401 Toronto By-Pass Retaining Wall Backfill".

If you have any queries in connection with this project, please contact this Office.

KGS/MdeF

*K. G. Selby*

K. G. Selby,  
SENIOR FOUNDATION ENGR.  
For:

K. Y. Lo,  
SUPERVISING FOUNDATION ENGR.

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 ✓

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-50

LOCATION Sta 195+50 (48' Rt.)

ORIGINATED BY P. McG

W.P. 85-59-4

BORING DATE May 11, 1965

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ● Unconfined Shear Strength					WATER CONTENT %			
							500	1000	1500	2000	2500	20	40	60	
443.8	Groundlevel														
0.0	Clayey silt with traces of sand and gravel Stiff brown (Fill Material)		1	SS	25	440									
			2	SS	18										
			3	SS	20										
			4	SS	14	430									
428.3			5	SS	21										
15.5	Silty clay to clayey silt. Hard to firm.		6	SS	21										
			7	SS	28	420									
			8	SS	19										
			9	SS	36	410									
			10	TW	PH										
			11	TW	PH	400									
			12	TW	PH										
392.3															
51.5	End of borehole.					390									
						380									

Gr 1%  
Sa 14  
Si 53  
Cl 32  
Sa6%Si140%  
Cl 50  
WL @ 423.6  
20.2  
Sa9%Si153%  
Cl 38%

122.0  
123.0  
126.0  
127.0  
124.0

FOUNDATION SECTION

CHECKED BY K.G.S

[illegible]



DEPARTMENT OF HIGHWAYS - ONTARIO

# RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-50

LOCATION Sta 193+77 (45' Lt.)

ORIGINATED BY P.McG

W.P. 85-59-4

BORING DATE May 12, 1965.

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Penn-drill

CHECKED BY K.G.S. *[Signature]*

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		20	40	60	80	100	WP	W	WL		
41.6	Groundlevel															
0.0	Clayey silt with traces of sand and gravel. Stiff brown (Fill Material)		1	SS	22	440										
			2	SS	39											
			3	SS	37	430										
428.1	Silty clay to clayey silt with traces of fine sand. Stiff to hard		4	SS	23											
13.5			5	SS	44											
			6	SS	24	420										
			7	SS	53											
			8	SS	47	410										
410.1	End of borehole.															
31.5						400										

Gr 3%  
Sa 7  
Si 48  
Cl 42

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-50

LOCATION Sta 193704 (47' Lt.)

ORIGINATED BY P. McG

W.P. 85-59-4

BORING DATE May 14, 1965.

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.

[illegible]

CHECKED BY K.G.S.

Gr 3%  
Sa 9%  
Si )  
Cl ) 88%

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-50

LOCATION Sta 196+06 (115' Lt.)

ORIGINATED BY P. McG

W.P. 85-59-4

BORING DATE May 12, 1965

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S. *AK*

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		20	40	60	80	100	WP	W	WL		
426.4	Groundlevel															
0.0																
	Silty clay to clayey silt.		1	SS	35											
	Hard to firm.		2	SS	46	420										
			3	SS	38											
			4	TW	PH											
			5	TW	PH	410										
			6	TW	PH											
400.9			7	TW	PH	400										
25.5	End of borehole															
						390										

W.L. @  
413.4  
= 13.0

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

JOB 65-F-50

LOCATION Sta 195+52 (120' Lt.)

ORIGINATED BY P. McG

W.P. 85-59-4

BORING DATE May 13, 1965

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Penetration Only

CHECKED BY K.G.S.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

# RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-50

LOCATION Sta 195+02 (119' Lt.)

ORIGINATED BY P. McG

W.P. 85-59-4

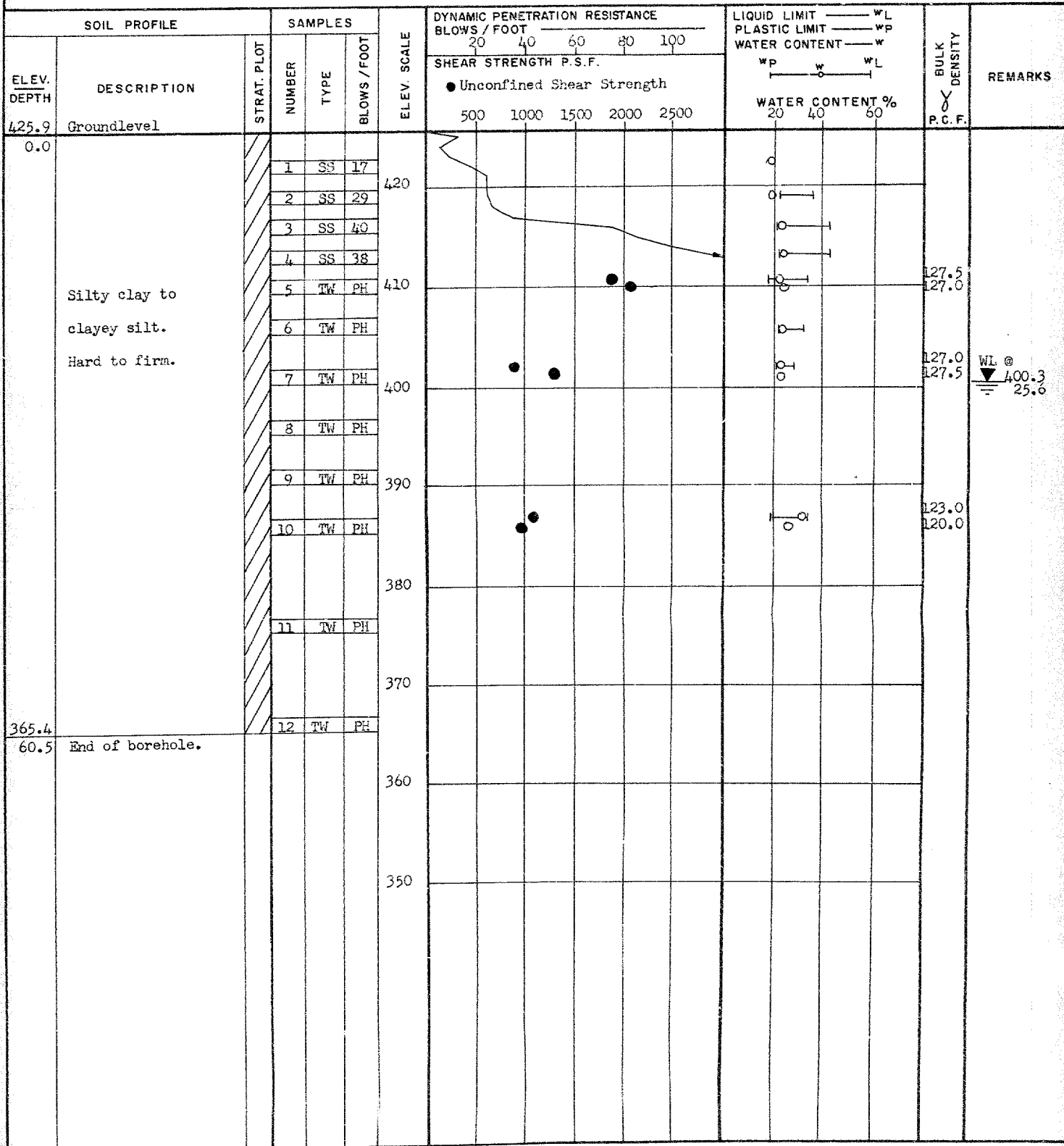
BORING DATE May 13, 1965.

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.



FOUNDATION SECTION

CHECKED BY K.G.S. *[Signature]*

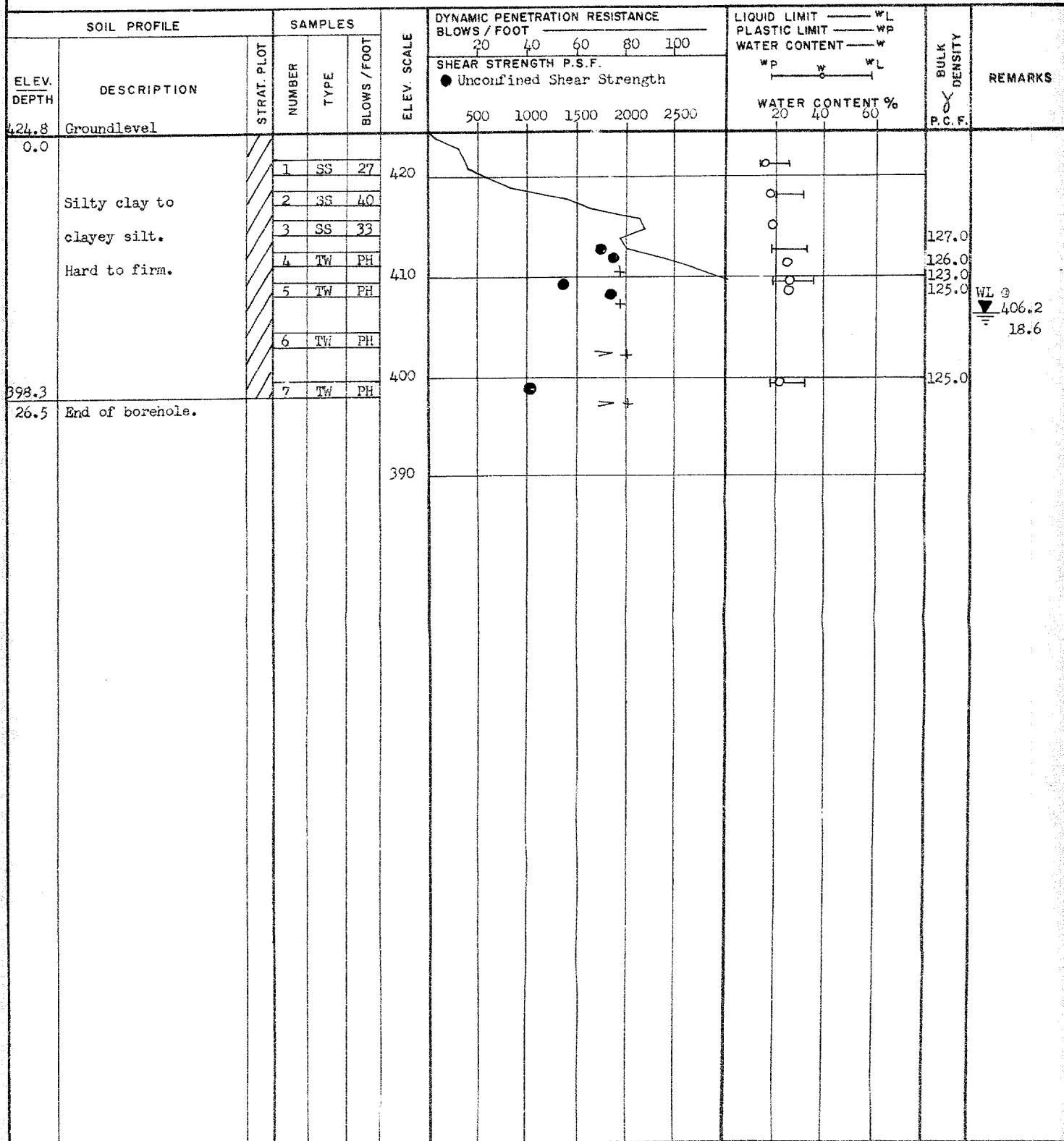
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DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION  
JOB 65-F-50  
W. 85-59-4  
DATUM Geodetic

# RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

LOCATION Sta 192+12 (117' Lt.) ORIGINATED BY P. McG  
BORING DATE May 14, 1965 COMPILED BY H.S.  
BOREHOLE TYPE Pennndrill CHECKED BY K.G.S.





DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-50

LOCATION Sta 191+35 (135' Lt.)

ORIGINATED BY P. McG

W. P. 85-59-4

BORING DATE May 14, 1965

COMPILED BY H.S.

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Penetration Only

CHECKED BY K.G.S.O/A

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 12		FOUNDATION SECTION
MATERIALS & TESTING DIVISION				
JOB <u>65-F-50</u>	LOCATION <u>Sta 190+62 (134' Lt.)</u>	ORIGINATED BY <u>P. McG</u>		
W. P. <u>85-59-4</u>	BORING DATE <u>May 14, 1965</u>	COMPILED BY <u>H.S.</u>		
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>Penndrill</u>	CHECKED BY <u>K.G.S. <i>[Signature]</i></u>		

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT			WATER CONTENT				
						20	40	60	80	100	W <sub>p</sub>		
25.5	Ground level					SHEAR STRENGTH P.S.F.			WATER CONTENT %				
0.0	Silty clay to clayey silt. Hard to stiff.		1	SS	30	● Unconfined Shear Strength							
			2	SS	43								
			3	SS	35								
			4	SS	30								
			5	TW	PH								
			6	TW	PH								
			7	TW	PH								
			8	TW	PH								
			9	SS	28								
385.0			End of borehole.		10	SS	21						
40.5													

FOUNDATION SECTION

CHECKED BY K.G.S.

SOIL PROFILE		STRAT. PLT	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		NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	WP	WL	W		
44.2	Groundlevel					440						
0.0	Silty sand with traces of gravel.		1	SS	20							
	Clayey silt with traces of sand and fine gravel. (Fill Material)		2	SS	31							
			3	SS	50	430						
			4	SS	29							
24.7			5	SS	25							
16.5	End of borehole.					420						

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## RECORD OF BOREHOLE NO. 15

FOUNDATION SECTION

LOCATION Sta. 434/33 W-N Ramp Control Line, 105.0' Lt.

ORIGINATED BY R.P.

BORING DATE July 5, 1965.

COMPILED BY \_\_\_\_\_ *HC*

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL	PLASTIC LIMIT ——— WP	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	WATER CONTENT ——— W		
							+ Field Vane	WP ——— W ——— WL		
								WATER CONTENT %		
433.1	Groundlevel						500 1000 1500 2000 2500			
0.0	Silty clay.					430				
	Very stiff to hard.		1	SS	43					
	Brown coloured.		2	SS	27					
423.6			3	SS	22					
9.5	Clayey silt to silty clay.		4	TW	PM	420				
	Stiff to very stiff.						+ S=2.3			
	Grey coloured.		5	SS	12		+ S=2.6			
			6	TW	PM		> +			
						410				
			7	SS	16					
			8	TW	PM		+ S=2.6			
			9	SS	12	400				
391.6			10	TW	PM					
41.5	End of borehole					390				

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

JOB 65-F-50

LOCATION Sta. 197+47 Control Line 400 S.B. 140.0' Lt.

ORIGINATED BY R.P.

W.P. 85-59-4

BORING DATE July 6, 1965.

COMPILED BY *gze*

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT		
429.6	Groundlevel										
	Silty clay. Stiff. Brown coloured.		1	SS	9						
421.6			2	SS	15						
8.0	Clayey silt to silty clay. Stiff to hard. Grey coloured.		3	SS	35						
			4	SS	26						
			5	SS	30						
			6	TW	PH						
			7	SS	9						
398.1			8	TW	PH						
31.5	End of borehole.										

W.L. 4260

+ S-2.3

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-50

LOCATION Sta. 433/56 W-N Ramp Control Line, 143.0' Lt.

ORIGINATED BY R.P.

W.P. 85-59-4

BORING DATE July 6, 1965.

COMPILED BY *JK*

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
432.5	Groundlevel											
0.0	Silty clay. Hard. Brown coloured.		1	SS	31	430						
			2	SS	36							
422.0			3	SS	35							
10.5	Clayey silt to silty clay. Very stiff. Grey coloured.		4	SS	21	420						
			5	SS	17							
			6	SS	17							
21.5	End of borehole.					410						

## 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
$\phi'$	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
$\sigma'$	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

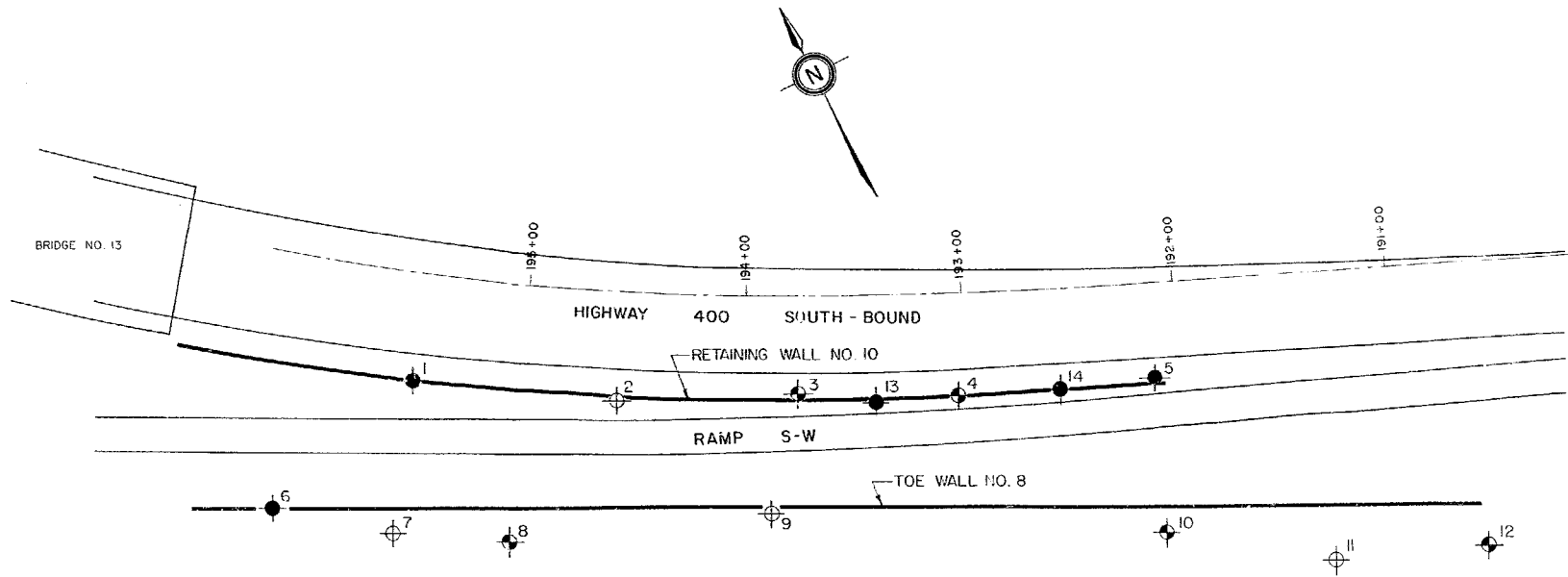
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### 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



# LEGEND

-  Bore Hole
-  Cone Penetration Hole
-  Bore & Cone Penetration Hole


## PLAN

SCALE 1" = 40'



DATE MAY 26, 1965

W.P. 85-59-4

APPROVED 

DIST. 6

DRAWING NO. 65-F-50A

HWY. 400 & 401 INTERCHANGE  
RETAINING WALL NO. 10 & TOE WALL NO. 8

JOB 65-F-50

MEMORANDUM

To: Mr. M. Devata,  
Sr. Foundation Engineer,  
Foundation Section,  
Material and Testing Division,  
Lab. Building.

FROM: Bridge Division,  
Downsview, Ontario.

DATE: May 6, 1965.

65-F-50

OUR FILE REF.

IN REPLY TO

SUBJECT: Additional Foundation Investigation,  
for Highway 401 and 400 Interchange,  
W.P. 85-59-4, District #6,  
a) W-S Ramp Retaining and Toe Wall  
b) Relocation of North York Hydro Transformer Station

- a) The W-S Ramp will merge with the south bound lanes of Highway 400 from the south side instead of from the north side as originally planned. This change calls for a retaining wall extending approximately 500' SE from the existing bridge structure #11.

The retaining wall will follow roughly the SW top edge of the existing fill of the southbound lanes of Hwy. 400 and its height will range from about 12 to 15' at the bridge to zero near the above mentioned merge.

The depth of the footings will have to be at least 4' below ground or the up-coming W-S Ramp. However piles may have to be considered to be driven through the existing fill. Elevations are shown on the plans submitted for your information.

On the south side of the W-S Ramp about 5' inside the D.H.O. property line a toe wall of approximately 650' length becomes necessary. Elevations and heights are indicated on the plans.

The decision for the types of retaining structures to be used will be made after the receipt of your foundation recommendation.

- b) It is proposed to relocate a North York Transformer Station to a property owned by the D.H.O. (as shown in yellow on the submitted plan) north of Pelmo Cres. at Gary Drive. Existing ground elevations are shown. The extent, size and type of structure as well as its exact location on the marked property is not yet available.

RE: W.P. 85-59-4

b) continued -

Yesterday we received from De Leuw Cather, Consultants, approximate locations of utility lines in the vicinity of the proposed structures as shown on a plan submitted for your information.

We trust, this and the plans left with you last Monday, will cover the information you need.

Top priority of this work is required since the interchange is already under contract. Preliminary verbal foundation recommendations would be acceptable as soon as possible.



K. B. Jorns,  
for J. B. Curtis,  
Regional Bridge Location Engineer.

KBJ/bm

c.c. R. Barr  
R. Fitzgibbon

## MEMORANDUM

*Foundation Investigation  
Report. 65 F-50.*

To: Mr. B. P. Davis,  
Bridge Engineer,  
Bridge Division.

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

Attention: Mr. S. McCombie

DATE: July 12, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

ADDITIONAL  
FOUNDATION INVESTIGATION REPORT  
For

Hwy. #400 to Hwy. #401 Interchange,  
W-S Ramp Retaining Wall #11,  
District #6 (Toronto)  
W.J. 65-F-50 -- W.P. 85-59-4v

Further to our report of May 26, 1965, three more boreholes (#15, 16 & 17) were drilled. These were located on the site of the proposed new retaining wall #11.

SOIL CONDITIONS:

The top 3.0 to 4.0 feet of soil is desiccated, hard, silty clay, except in the region of borehole #16, where the ground water level was only 3.5 feet below ground level. The soil here was stiff. The range of consistency as determined from the standard penetration tests, was fairly wide since 'N' values varied between 9 and 43 blows/foot.

Below the bed of brown silty clay is a deep bed of stiff to hard, grey clayey silt to silty clay, extending to a depth of at least 41.5 feet below ground level, to elevation 391.6 feet.

cont'd. /2 ...

SOIL CONDITIONS: (cont'd.) ...

The consistency is fairly wide since 'N' values as determined from the standard penetration tests, ranged from 9 to 35 blows/foot.

RECOMMENDATIONS:

Toe wall #11 will be constructed to retain the embankment on the west side of the W-S ramp, and will be approximately 220.0 feet long.

Spread footings may be constructed 4.0 feet below the invert level of the ditch adjacent to the wall and a net safe pressure of 1.25 t.s.f. may be assumed for design purposes.

MISCELLANEOUS:

Field work was carried out on July 5 and 6, 1965, by Canadian Longyear Ltd., under the supervision of Mr. R. Pratt, who also prepared this report. The investigation was carried out under the general supervision of Mr. K. G. Selby, Senior Foundation Engineer, who also reviewed this report.

If you have any queries regarding this project, please contact this Office.

Please attach this additional report and the enclosed log sheets for B.H.'s 15, 16, & 17, to your copy of our original report W.J. 65-F-50.

RP/MdeF  
Attach.

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

  
K. Y. Lo,  
SUPERVISING FOUNDATION ENGINEER

Foundations Office  
Gen. Files ✓



## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

JOB 65-F-50LOCATION Sta. 197+47 Control Line 400 S.B. 140.0' Lt.ORIGINATED BY R.P.W.P. 85-59-4BORING DATE July 6, 1965.COMPILED BY gzeDATUM GeodeticBOREHOLE TYPE PennndrillCHECKED BY K.G.S.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. + Field Vane 500 1000 1500 2000 2500	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W WATER CONTENT % WP — W — WL	BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE					
429.6	Groundlevel							
	Silty clay. Stiff. Brown coloured.	1	SS 9					
421.6		2	SS 15					
8.0								
	Clayey silt to silty clay. Stiff to hard. Grey coloured.	3	SS 35	420				
		4	SS 26					
		5	SS 30					
		6	TW PH	410				
		7	SS 9					
398.1		8	TW PH	400				
31.5	End of borehole.							

W.L.

+ S=2.3



RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

JOB 65-F-50

LOCATION Sta. 433+56 W-N Ramp Control Line, 143.0' Lt.

ORIGINATED BY R.P.

W. P. 85-59-4

BORING DATE July 6, 1965.

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

DATUM Geodetic

BOREHOLE TYPE Penndrill

CHECKED BY K.G.S.

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 <sub>L</sub>		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	W <sub>P</sub>	W <sub>L</sub>		
432.5 0.0	Groundlevel										
	Silty clay. Hard. Brown coloured.		1	SS	31						
			2	SS	36						
422.0 10.5	Clayey silt to silty clay. Very stiff. Grey coloured.		3	SS	35						
			4	SS	21						
			5	SS	17						
21.5	End of borehole.		6	SS	17						