

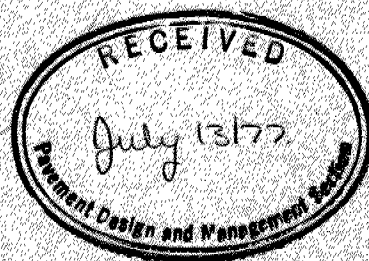
G.I.-30 SEPT. 1976

GEOCRES No. 40I14-98DIST. 2 REGION W.P. No. 41-66-05CONT. No. 77-61W. O. No. STR. SITE No. 19-547HWY. No. 402LOCATION Hwy 401 Interchange
OverpassNo. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 77-61



Ontario

Ministry of
Transportation and
Communications

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NOTE For purposes of the contract these reports supercede all other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

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

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS 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
w_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
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_i	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
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_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
β	ANGLE OF SLOPE TO HORIZONTAL

FOUNDATION INVESTIGATION REPORT

For

Hwy. 401 Interchange Overpass
Hwy. 402, Township of Westminster
Site No. 19-547, District 2, London
W.P. 41-66-05

INTRODUCTION

This report contains the results of a foundation investigation which was carried out at the site of the above mentioned project. Fieldwork was done during the period August 14th - 19th, 1975, utilizing a continuous flight auger machine equipped with 3¼ inch I.D. hollow stem augers.

SITE DESCRIPTION

The proposed site is located on Hwy. 401 approximately 1.5 miles southwest of Hwy. 135 interchange. The surrounding area is gently rolling farm land with an occasional mixed hardwood bush.

SUBSURFACE CONDITIONS

General

Reference should be made to the Record of Borehole Sheets which are contained in the report appendix and to Drawing 19-547-2 of the Contract Drawings on which is shown the locations and elevations of borings, together with the inferred subsoil stratigraphy. Subsoil at the site consists of 6 to 19 feet of fine uniform sand (Fig. 1) overlying a layer of silt which ranges from 4 to 15 feet in thickness. Beneath this is a deposit of clayey silt at least 75 feet in thickness.

Fine Sand

Fine uniform sand extends from the surface to a depth of from 6 to 19 feet. Standard penetration 'N' values range from 9 to 32 blows per foot indicating a loose to dense relative density. Generally, however, this stratum may be characterized as compact. The average moisture content is 20%.

Silt

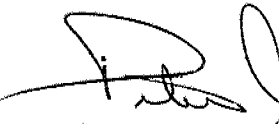
The silt layer ranges in thickness from 4 to 15 feet. It is loose to compact in relative density with 'N' values ranging from 5 to 27 blows per foot. The average moisture content is 21%.

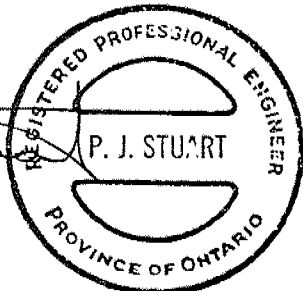
Clayey Silt

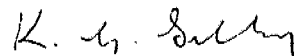
The clayey silt was encountered at depths ranging from 10 to 22 feet and extends from there to a depth in excess of 100 feet. It contains varying percentages of sand and gravel, indicating a glacial origin. Consistency ranges from stiff to hard with 'N' values ranging from 12 to in excess of 50 blows per foot for the upper portion of the deposit. Below elevation 775 the deposit is much harder with 'N' values in excess of 100 blows per foot.

Groundwater

Groundwater was encountered in the fine sand and silt strata at approximate elevations 850 - 854, some 5 to 11 feet below the ground surface.


P. J. Stuart, P. Eng.
Project Engineer





K.G. Selby, P. Eng.
Supervising Engineer

KGS/PS/gs
June, 1977

APPENDIX

RECORD OF BOREHOLE NO 1

WP 41-66-05 LOCATION Co-ords. 15,591,011 N; 1,339,005 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 14, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY *CP*

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		20	40	60	80	100	w_p	w	w_L		
856.1	Ground Level														
0.0	Fine Sand		1	SS	10										
849.1	Compact		2	SS	20										0 93 (7)
7.0	Silt, trace of clay.		3	SS	16										
			4	SS	20										
			5	SS	22										0 0 91 %
	Compact		6	SS	12										
834.1			7	SS	23										
22.0			8	SS	28										0 14 51 38
			9	SS	28										
	Clayey silt with sand		10	SS	27										
			11	SS	20										
	Very Stiff to Hard		12	SS	43										
			13	SS	52										
			14	SS	100/6"										0 40 50 10
			15	SS	115/3" 770 boulder										
			16	SS	100/5"										
759.6			17	SS	143/10" 760										
96.5	End of Borehole														
	Note: Water Level not established.														

RECORD OF BOREHOLE NO 2

W.P. 41-66-05

LOCATION Co-ords. 15,591,060N; 1,339,058 E.

ORIGINATED BY RD

DIST. 2 HWY. 402

BORING DATE August 15, 1975

COMPILED BY RD

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N VALUES		20	40	60	80	100			
855.5	Ground Level													
0.0	Fine Sand Trace of Silt Compact		1	SS	21	850						0		0 91 (9)
849.5			2	SS	15									
6.0	Silt Compact		3	SS	6									0 0 87 13
845.5			4	SS	13									
10.0	Clayey silt some sand		5	SS	9	840								0 3 61 36
			6	SS	11									
			7	SS	33									0 12 53 35
	Stiff to Hard		8	SS	35	830								
	Occ. layers of silty clay		9	SS	32	820								
			10	SS	24	810								
799.0			11	SS	34	800								
56.5	End of Borehole Note: Water Level not established.													

RECORD OF BOREHOLE NO 3

WP 41-66-05 LOCATION Co-ords. 15,591,161 N; 1,339,311 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 18, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N VALUES		20	40	60	80	100	w_p	w	w_L		
858.8	Ground Level															GR SA SI CL
0.0	Fine Sand		1	SS	25											0 80 (20)
	Compact to Dense		2	SS	32											0 92 (8)
			3	SS	23											
			4	SS	29											
			5	SS	30											
839.8																
19.0	Silt, some clay.		6	SS	14											0 2 84 14
835.8	Compact															
23.0	Clayey silt some		7	SS	12											
	sand and gravel.		8	SS	21											
	Stiff to		9	SS	19											29 28 28 15
	Very Stiff		10	SS	30											
			11	SS	15											
797.3			12	SS	28											0 12 78 10
61.5	End of Borehole															

RECORD OF BOREHOLE NO 4

WP 41-66-05 LOCATION Co-ords. 15,591,219 N; 1,339,375 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 19, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT		LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w		UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20 40 60 80 100		w_p w w_L			
857.6	Ground Level											
0.0	Fine Sand											
	Compact		1	SS	24							
846.6			2	SS	25	850						0 94 (6)
9.0	Silt, some clay.		3	SS	11							0 0 88 12
843.6	Loose to Compact		4	SS	5							0 0 71 29
14.0			5	SS	7							
	Clayey silt, some		6	SS	8	840						
	sand and gravel.		7	SS	34							
			8	SS	48	830						
	Stiff to Hard		9	SS	15	820						
			10	SS	21	810						
			11	SS	23	800						
			12	SS	84	790						12 22 42 24
			13	SS	100 6"	780						
			14	SS	115	770						0 15 36 49
756.1						760						
101.5	End of Borehole											

20
 15 ϕ 5 % STRAIN AT FAILURE
 10

RECORD OF BOREHOLE NO 5

WP 41-66-05 LOCATION Co-ords. 15,591,078 N; 1,339,161 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 19, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY CF

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
860.7	Ground Level					860										GR SA SI CL
0.0	Fine Sand															
	Loose to Compact		1	SS	4											
			2	SS	9											
847.7			3	SS	27	850										0 85 (15)
13.0	Silt, trace of clay.		4	SS	27											0 1 94 5
	Compact		5	SS	10	840										
837.7			6	SS	16											
23.0	Clayey Silt		7	SS	36	830										
	Very Stiff to Hard		8	SS	34	820										
			9	SS	24	810										
799.2			10	SS	42	800										
61.5	End of Borehole															

GRAIN SIZE DISTRIBUTION

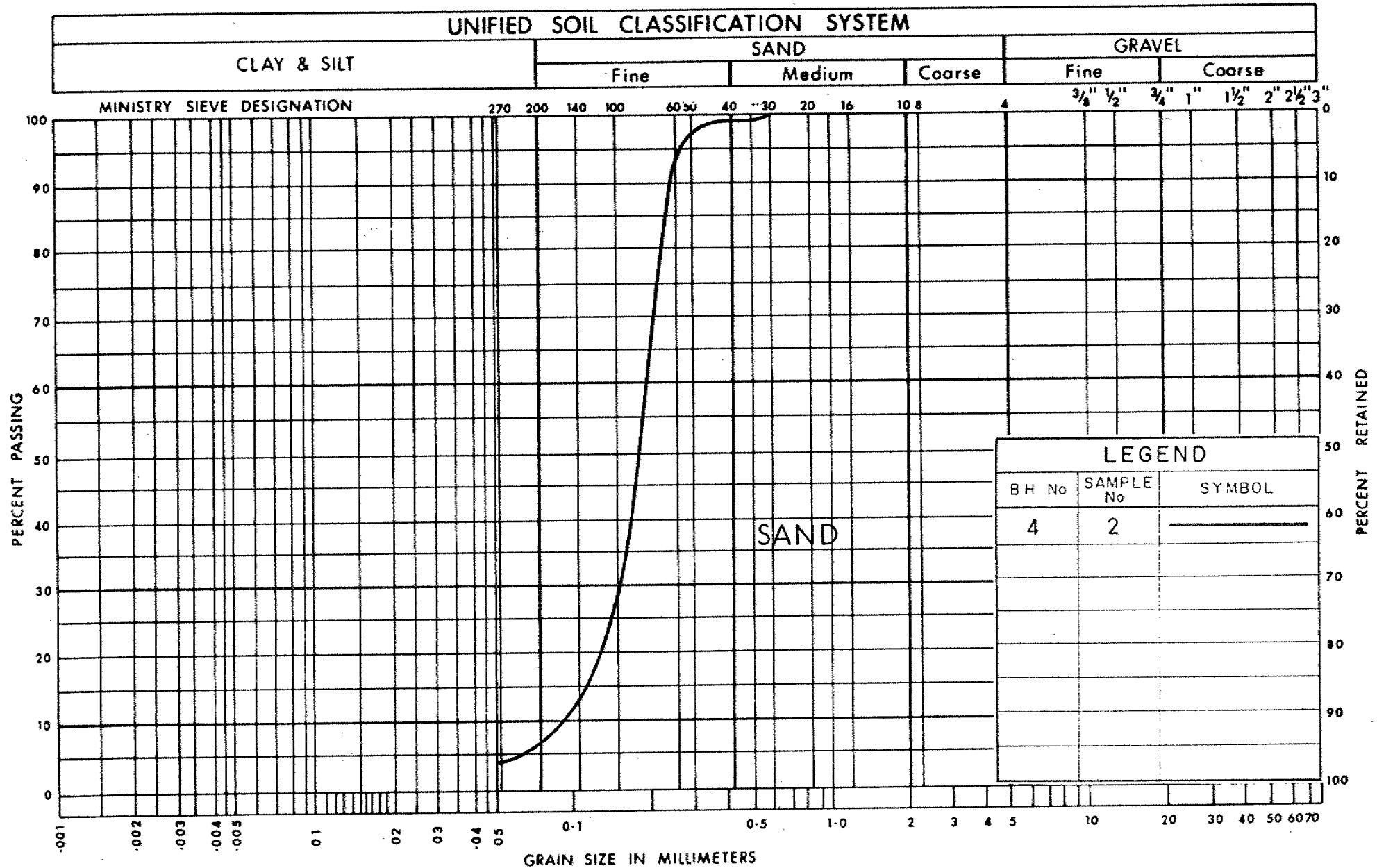


FIG. 1

W.P. 41-66-05

FOUNDATION INVESTIGATION REPORT

For

County Road 43 Underpass
Hwy. 402, Township of Westminster
Site 19-546, District 2, London
W.P. 41-66-06

INTRODUCTION

This report contains the results of a foundation investigation which was carried out at the site of the above mentioned project. Fieldwork was done during the period August 7th - 14th, 1975, utilizing a continuous flight auger machine equipped with 3¼ inch I.D. hollow stem augers.

SITE DESCRIPTION

County Road 43, also known as White Oaks Road, crosses the proposed alignment of Hwy. 402 0.5 miles west of the junction of Hwys. 401 and 402. The surrounding area is flat arable land engaged in mixed farming.

SUBSURFACE CONDITIONSGeneral

Reference should be made to the Record of Borehole Sheets which are contained in the report appendix and to Drawing No. 19-546-2 of the Contract Drawings on which is shown the locations and elevations of the borings, together with the inferred soil stratigraphy. A description of the soil types encountered during the investigation is given below.

Subsoil

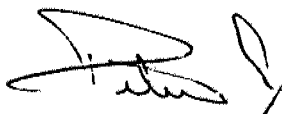
Subsoil at this site consists of about 10 feet of loose to compact silt to clayey silt overlying approximately 85 feet of very stiff to hard clayey silt. The average undrained shear strength of the upper portion of this clayey silt layer is assessed to be 2500 p.s.f. Underlying this layer some 95 feet below the ground surface is a layer of very dense sandy silt, some gravel and clay. Standard Penetration 'N' values for this layer, in which the two deepest boreholes were terminated, were generally in excess of 100 blows per foot.

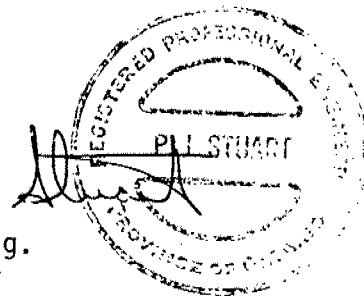
Groundwater

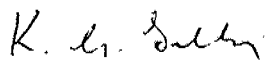
Very little groundwater was encountered in the silt to clayey silt layer during the field investigation carried out during August. It would, however, be reasonable to expect much more groundwater in this layer at other seasons of the year.

The clayey silt stratum is relatively impervious so that groundwater should not be a problem in this layer.

Water with a head to elevation $818\pm$ was encountered in the sandy silt layer at a depth in excess of 90 feet below the ground surface.


P. Stuart, P. Eng.
Project Engineer




K.G. Selby, P. Eng.
Supervising Engineer

KGS/PS/gs
June, 1977

APPENDIX

RECORD OF BOREHOLE NO 1

WP 41-66-06 LOCATION Co-ords. 15,591,250 N; 1,336,890 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 7-8, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Augers & Cone Test CHECKED BY dp

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100		
848.8	Ground Level												
0.0	Silt to clayey silt, trace of sand.												
	Loose to Compact		1	SS	9								
838.8			2	SS	19								
10.0			3	SS	19								
	Clayey silt, some sand, trace of gravel.		4	SS	20								
			5	SS	17								
			6	SS	18								
			7	SS	21								
			8	SS	31								
	Very Stiff to Hard		9	SS	14								
			10	SS	77								
			11	SS	46								
			12	SS	31								
755.8													
93.0	Sandy silt, some gravel and clay.												
	Very Dense		13	SS	327.6"								
744.8													
104.0													

20
15 0-5 % STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No 1 Continued

WP 41-66-06 LOCATION Co-ords. 15,591,250 N; 1,336,890 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 7-8, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Augers & Cone Test CHECKED BY JP.

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
744.8	continued															
104.0	Sandy silt, some gravel and clay. Very Dense		14	SS	100/4"	740						o				
730.5			15	SS	101/4"							o				27 31 31 11
118.3	End of Borehole W.L. not established															

RECORD OF BOREHOLE NO 2

WP 41-66-06

LOCATION Co-ords. 15,591,135 N; 1,336,926 E.

ORIGINATED BY RD

DIST 2 HWY 402

BORING DATE August 11, 1975

COMPILED BY RD

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY *EP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
849.1	Ground Level													
0.0	Silt to clayey silt, trace of sand.		1	SS	19									0 7 81 12
842.1	Compact		2	SS	22									10 15 50 25
7.0	Clayey silt, some sand, trace of gravel.		3	SS	21									
			4	SS	19									
			5	SS	20									
			6	SS	23									
			7	SS	21									
	Very Stiff to Hard		8	SS	24									
			9	SS	14									
			10	SS	37									
			11	SS	37									
782.6			12	SS	32									5 16 55 24
66.5	End of Borehole													
	Note: W.L. not established.													

RECORD OF BOREHOLE NO 3

WP 41-66-06 LOCATION Co-ords. 15,591,022 N; 1,336,962 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 11-13, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Augers & Cone Test CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
850.3	Ground Level															
0.0	Silt to clayey silt, trace of sand.					850										
843.3	Compact		1	SS	16											0 1 79 20
7.0			2	SS	16											0 5 54 41
			3	SS	15	840										
	Clayey silt, some		4	SS	13											
	sand, trace of		5	SS	14											
	gravel.		6	SS	18	830										
			7	SS	18											
			8	SS	22	820										
	Stiff to Hard		9	SS	17	810										
			10	SS	127	800										
			11	SS	67	790										
			12	SS	43	780										
			13	SS	44	770										
757.3						760										
93.0	Sandy silt, some gravel and clay. Very Dense		14	SS	62/3"	750										
746.3																
104.0																

20
 15 5 % STRAIN AT FAILURE
 10

Continued

WP 41-66-06 LOCATION Co-ords. 15,591,022 N; 1,336,962 E. ORIGINATED BY RD
DIST 2 HWY 402 BORING DATE Aug. 11-13, 1975 COMPILED BY RD
DATUM Geodetic BOREHOLE TYPE Hollow Stem Augers & Cone Test CHECKED BY SP

[illegible]

20
15 ϕ 5 % STRAIN AT FAILURE
10

FOUNDATION INVESTIGATION REPORT

For

Bostwick Road Underpass
Hwy. 402, Township of Westminster
Site No. 19-545, District 2, London
W.P. 41-66-07

INTRODUCTION

This report contains the results of a foundation investigation which was carried out at the site of the above mentioned project. Fieldwork was done during the period May 29th to June 4th, 1975, utilizing a continuous flight auger machine equipped with 3½ inch I.D. hollow stem augers.

SITE DESCRIPTION

The site is located 2 miles west of the junction of Hwys. 401 and 402 where Hwy. 402 crosses Bostwick Road. The surrounding area is flat farmland engaged in mixed farming.

SUBSURFACE CONDITIONSGeneral

Subsoil at this site consists of a deposit of approximately 20 feet of sand and silt overlying a deep deposit of over 100 feet of clayey silt. Reference should be made to the Record of Borehole Sheets which are contained in the report appendix and to Drawing No. 19-545-2 of the Contract Drawings on which is shown the locations and elevations of borings, together with the inferred soil stratigraphy. Descriptions of the different soil types encountered are given below.

Sand and Silt

This stratum consists of sand and silt in widely varying proportions. It has a compact to dense relative density with Standard Penetration 'N' values varying from 10 to 44. The average moisture content is 23%.

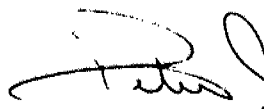
Clayey Silt

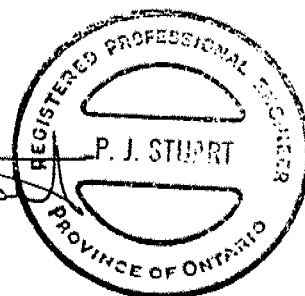
This stratum extends from a depth of approximately 20 feet to in excess of 135 feet. Its consistency ranges from firm to hard with Standard Penetration 'N' values ranging from 7 to in excess of 100 blows per foot. These high 'N' values are

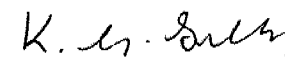
found in random occurrence and are probably indicative of the existence of large gravel sizes.

Groundwater

Groundwater was encountered in the sand and silt deposit approximately 3 to 5 feet below the surface.


P. J. Stuart, P. Eng.
Project Engineer




K.G. Selby, P. Eng.
Supervising Engineer

KGS/PS/gs
June, 1977

APPENDIX

RECORD OF BOREHOLE NO 1

W.P. 41-66-07 LOCATION Co-ords. 15,590,143 N; 1,329,465 E. ORIGINATED BY RD
 DIST. 2 HWY. 402 BORING DATE May 29, 1975 COMPILED BY PJS
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N° VALUES		20	40	60	80	100	w_p	w	w_L		
831.5	Ground Level															
0.0	Sandy silt, trace of clay.		1	SS	15	830										
			2	SS	24											0 35 62 3
	Compact to Dense		3	SS	20											0 39 60 1
			4	SS	44	820										
			5	SS	13											
			6	SS	23											
810.5			7	SS	8	810										
21.0	Clayey silt, some sand, trace of gravel		8	SS	45											3 17 52 28
			9	SS	36	800										
	Stiff to Hard		10	SS	30	790										2 10 51 37
			11	SS	51	780										
			12	SS	50											
	Clayey silt		13	SS	43	770										
			14	SS	36											0 0 71 29
	Hard		15	SS	70	760										
			16	SS	37											
			17	SS	43	750										
			18	SS	67	740										
735.0																0 0 67 33
96.5	End of Borehole															

RECORD OF BOREHOLE NO 2

W.P. 41-66-07 LOCATION Co-ords. 15,590,048 N; 1,329,499 E. ORIGINATED BY RD
 DIST. 2 HWY. 402 BORING DATE June 2, 1975 COMPILED BY PJS
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY OP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N VALUES		20	40	60	80	100	w_p	w	w_L	
830.3	Ground Level														
0.0	Sandy silt, trace of clay.		1	SS	10										0 18 71 11
	Compact		2	SS	15										0 38 60 2
			3	SS	15										
			4	SS	14										
813.3			5	SS	13										1 41 56 2
17.0	Clayey silt, some sand, trace of gravel.		6	SS	8										6 24 41 29
			7	SS	11										
			8	SS	104										
			9	SS	42										
	Stiff to Hard														
			10	SS	47										2 4 60 34
			11	SS	53										
768.8			12	SS	109										0 1 78 21
61.5	End of Borehole														

RECORD OF BOREHOLE NO 3

W.P. 41-66-07 LOCATION Co-ords. 15,589,937 N; 1,329,534 E.
 DIST. 2 HWY. 402 BORING DATE June 3 & 4, 1975
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test

ORIGINATED BY RD
 COMPILED BY PJS
 CHECKED BY CP.

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N° VALUES		20	40	60	100	w_p	w	w_L		
830.9	Ground Level														
0.0	Sandy silt, trace of clay.		1	SS	15	830									0 13 84 3
	Compact		2	SS	20										
			3	SS	16	820									
			4	SS	11										
813.9			5	TW	PH										0 67 (33)
17.0	Clayey silt, some sand, trace of gravel.		6	SS	7										
			7	SS	10	810									6 18 49 27
	Firm to Hard		8	SS	44										
			9	SS	36	800									
			10	SS	33										
			11	SS	45	790									1 26 45 28
			12	SS	49	780									
			13	SS	170	770									0 0.75 25
	Clayey silt		14	SS	150/6"	760									
	Hard		15	SS	44	750									
			16	SS	78	740									
726.9						730									
104.0															

RECORD OF BOREHOLE No 3 Continued

W.P. 41-66-07 LOCATION Co-ords. 15,589,937 N; 1,329,534 E. ORIGINATED BY RD
 DIST. 2 HWY. 402 BORING DATE June 3 & 4, 1975 COMPILED BY BJS
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY DT

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
726.9	continued															
104.0	Clayey Silt Hard		17	SS	129	720										
						710										
						700										
694.4			18	SS	43											
136.5	End of Borehole Note: Water Level not established.															

FOUNDATION INVESTIGATION REPORT

For

Hwy. 4 Interchange Underpass
Hwy. 402, Township of Westminster
Site No. 19-544, District 2, London
W.P. 41-66-08

INTRODUCTION

This report contains the results of a foundation investigation which was carried out at the site of the above mentioned project. Fieldwork was done during the period May 1st - 7th, 1975, utilizing a continuous flight auger machine equipped with 3¼ inch I.D. hollow stem augers.

SITE DESCRIPTION

The site is located 1 mile south of the Town of Lambeth in an area of mixed farming. The land is gently rolling and in the immediate vicinity of the underpass, slopes predominantly to the East.

Physiographically, the site is situated in an area referred to as the Mount Elgin Ridges.

SUBSURFACE CONDITIONSGeneral

Subsoil at this site consists of a deep deposit of clayey silt in excess of 145 feet in thickness. Contained within this deposit at depths between 25 and 65 feet is a deposit of fine sand and silt. Reference should be made to the Record of Borehole Sheets which are contained in the report appendix and to Drawing 19-544-2 of the Contract Drawings on which is shown the locations and elevations of borings, together with the inferred soil stratigraphy. Descriptions of the different soil types encountered during the investigation are given below.

Clayey Silt, Trace of Sand

Based on Atterberg Limit tests and Mechanical Analyses tests, the material in this deposit is classified as clayey silt, trace of sand. The upper portion of the deposit with a thickness of about 15 feet is dessicated. It is brown in colour and has a very stiff to hard consistency. Beneath the dessicated zone the clayey silt is grey and, between the depth of 15 feet and 40 feet, has a stiff to very

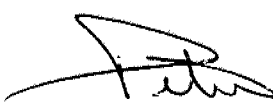
stiff consistency. At depths greater than 40 feet the consistency is very stiff to hard with Standard Penetration 'N' values ranging from 25 to 90.

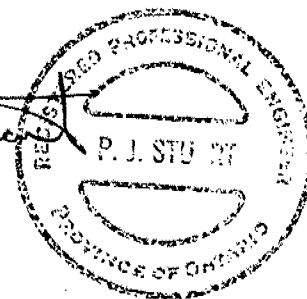
Sand and Silt

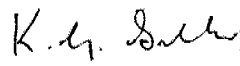
A layer of compact to very dense sand and silt was found to extend over a portion of the site. Its thickness varies from zero to greater than 30 feet. This sand and silt stratum was encountered in boreholes 2, 3 and 6 at depths ranging between 25 and 55 feet. It was not, however, encountered in borehole 2 which was terminated at a depth of 75 feet. This deposit has a compact to very dense consistency with Standard Penetration Test 'N' values ranging from 26 to in excess of 200. The average moisture content is about 20%.

Groundwater

Groundwater was encountered in the sand and silt stratum and slowly rose in the boreholes to within 3 feet of the ground surface or approximate elevation 832.


P. Stuart, P. Eng.
Project Engineer




K.G. Selby, P. Eng.
Supervising Engineer

KGS/PS/gs
June, 1977

APPENDIX

RECORD OF BOREHOLE NO 1

W.P. 41-66-08

LOCATION Co-ords. 15,586,404 N; 1,323,643 E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE May 5, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

 CHECKED BY *UJ*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
835.3	Ground Level															
0.0	Clayey Silt															
	trace of sand		1	SS	16	830										
	Occ. layers of silty clay		2	SS	47											
			3	SS	24											
	Stiff to Hard		4	TW	PH											
			5	TW	PH	820										
			6	SS	10											
			7	SS	48	810										
803.8	End of Borehole															
31.5																

 20
15 \diamond 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 2

W.P. 41-66-08

LOCATION Co-ords. 15,586,372 N; 1,323,567 E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE May 7, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

 CHECKED BY *dlj*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L WATER CONTENT %	UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
840.1	Ground Level													
	Clayey Silt trace of sand, gravel Very Stiff to Hard		1	SS	17									
			2	SS	34									
			3	SS	41	830								
			4	SS	34									
			5	SS	27									
	Occ. layers of silty clay		6	TW	PH	820							132	1 4 59 36
			7	SS	24									
			8	SS	23	810								
			9	SS	24	800								
			10	SS	26	790								
			11	SS	33	780								
			12	SS	32									
						770								
763.6			13	SS	35									
76.5	End of Borehole Note - Water level not established													

RECORD OF BOREHOLE NO 3

W.P. 41-66-08

LOCATION Co-ords. 15,586,513 N; 1,323,610 E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE May 1st, 2nd, and 5th, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE 3/4" Hollow Stem Auger & Cone Test

 CHECKED BY *[Signature]*

SOIL PROFILE		STRAT. PLOT	SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS			
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	'N' VALUES		20	40	60	80	100	SHEAR STRENGTH					WATER CONTENT %		
												○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					w_p — w — w_L		
836.0	Ground Level																		
	Clayey Silt trace of sand stiff to hard		1	SS	40	830										0 5 58 37			
			2	SS	31														
			3	SS	45														
			4	SS	27														
			5	SS	18														
			6	SS	14	820													
814.0			7	SS	19											0 48 (52)			
22.0	Sandy Silt Compact to Very Dense		8	SS	31	810													
			9	SS	52														
			10	SS	64	800													
			11	SS	26	790													
780.0						780										0 1 74 25			
56.0	Clayey Silt trace of sand very stiff to hard		12	SS	27	770													
						760													
						750													
				13	SS	50	740												

 20
15 5 % STRAIN AT FAILURE
10

(Continued)

RECORD OF BOREHOLE NO 3 (Continued)

W.P. 41-66-08 LOCATION Co-ords. 15,586,513 N; 1,323,610 E. ORIGINATED BY PJS
 DIST. 2 HWY. 402 BORING DATE May 1st, 2nd, and 5th, 1975 COMPILED BY PJS
 DATUM Geodetic BOREHOLE TYPE 3/4" Hollow Stem & Cone Test CHECKED BY WJ

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
732.0	Continued															
104.0	Clayey Silt trace of sand Very Stiff to Hard		14	SS	79	730										
						720										
						710										
			15	SS	55	700										
689.5						690										
146.5	End of Borehole		16	SS	89											

RECORD OF BOREHOLE NO 4

W.P. 41-66-08

LOCATION Co-ords. 15,586,483 N; 1,323,533 E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE May 7, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY *a.f.*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p	w	w_L		
839.2	Ground Level															GR 5A SI CL
0.0	Clayey Silt		1	SS	36											
			2	SS	42	830										
			3	SS	42											
	Trace of Sand & Gravel		4	SS	23											
			5	SS	17											
	Very Stiff to Hard		6	SS	16	820										
			7	SS	18											
			8	SS	23	810										
			9	SS	33											
			10	SS	41	790										
784.2			11	SS	100											
55.0	Silt Very Dense		12	SS	171	780										
	Trace of Sand, Clay		13	SS	221											
772.7																0 1 89 10
66.5	End of Borehole Note - Water level not established															

20
15 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 5

W.P. 41-66-08

LOCATION Co-ords. 15,586,627 N: 1,323,572 E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE May 5, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY J.F.

SOIL PROFILE		SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	20	40	60	80	100	w_p	w	w_L		
836.8	Ground Level														
0.0	Clayey silt		1	SS	39										
	trace of sand		2	SS	63										
	Stiff to Hard		3	SS	39										
			4	SS	34										
			5	SS	29										
			6	SS	19										
			7	SS	17										
			8	SS	20										
			9	SS	20										
795.3	Silt		10	SS	77										
41.5	End of Borehole														

RECORD OF BOREHOLE NO 6

W.P. 41-66-08

LOCATION Co-ords. 15,586,588 N; 1,323,491 E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE May 6, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE 3/4" Hollow Stem Auger & Cone Test

CHECKED BY *usf*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w	UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100	w_p — w — w_L WATER CONTENT %		
839.0	Ground Level						1000 2000	10 20 30		GR. SA SI. C.
0.0	Clayey Silt trace of sand Very Stiff to Hard		1	SS	57					1 4 56 39
			2	SS	45					
			3	SS	21					
			4	TW	PH					
			5	SS	17					
			6	SS	20					
798.0			7	SS	132					
41.0	Fine Sand and Silt Dense to Very Dense		8	SS	41					
			9	SS	205					
781.0	Clayey Silt									0 1 97 2
777.5	trace of sand		10	SS	35					
61.5	End of Borehole Note: Water level not established.									

OFFICE REPORT ON SOIL EXPLORATION

FOUNDATION INVESTIGATION REPORT

For

Townline Road Underpass
Hwy. 402, Township of Delaware
Site No. 19-543, District 2, London
W.P. 41-66-09

INTRODUCTION

This report contains the results of a foundation investigation which was carried out at the site of the above mentioned project. Fieldwork was done during the period March 19th - 20th, 1975, utilizing a continuous flight auger machine equipped with 2 3/4 inch I.D. hollow stem augers.

SITE DESCRIPTION

The site is located at the boundary of Delaware and Westminster Townships, 1.9 miles west of Hwy. 4 where an existing gravel road crosses Hwy. 402. The area surrounding this crossing is gently rolling cultivated farmland.

Physiographically, the site is located in an area referred to as the Mount Elgin Ridges.

SUBSURFACE CONDITIONS

General

Subsoil at the site consists of a deposit of silty clay to clayey silt extending to depths in excess of 100 feet. Reference should be made to the Record of Borehole Sheets contained in the report appendix on which are summarized the results of field and laboratory tests and to Drawing 19-543-2 which contains the locations and elevations of borings, together with the inferred soil stratigraphy. A description of the soil types encountered during the investigation is given below.

Silty Clay to Clayey Silt, Trace of Sand

Based on the results of Atterberg Limit tests and Mechanical Analyses tests the material in this deposit is classified as silty clay to clayey silt, trace of sand.

The deposit may be divided into three zones according to strength characteristics. The upper zone with a thickness of approximately 15 feet is a desiccated crust.

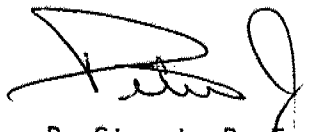
It is brown in colour and apart from the upper 3 to 5 feet which has been affected by frost action, has a consistency of very stiff to hard. Based on Standard Penetration Test results which range from 20 to 69, and on unconfined compression tests, it is estimated that the undrained shear strength of this layer varies with depth from in excess of 10,000 psf to 3,000 psf.

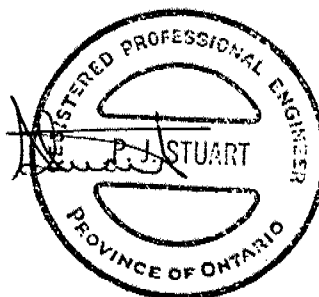
The second zone, found from approximately 15 to 35 feet below the ground surface, has a stiff to very stiff consistency. Standard Penetration 'N' values range from 12 to over 20 blows per foot. Based on these values, and on field vane tests, the undrained shear strength of the soil is estimated to be in the order of 2000 to 3000 psf.

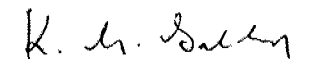
The third and deepest zone penetrated extends from a depth of approximately 35 to over 100 feet. Standard Penetration 'N' values for this zone range from 40 to in excess of 60 blows per foot, indicating a hard consistency and shear strength in the order of 7000 to 10,000 psf.

Groundwater

No groundwater was observed in any boreholes, probably because of the low permeability of the subsoil and the short duration of the fieldwork. The actual groundwater level in this area probably lies around elevation 808 in the lower portion of the dessicated zone.


P. Stuart, P. Eng.
Project Engineer




K.G. Selby, P. Eng.
Supervising Engineer

KGS/PS/gs
June, 1977

APPENDIX

RECORD OF BOREHOLE NO 1

W.P. 41-66-09

LOCATION CO-ORDS. 15,583,926N; 1,313,810E.

ORIGINATED BY PJS


DIST. 2 HWY. 402

BORING DATE MARCH 19, 1975

COMPILED BY PJS

DATUM GEODETIC

BOREHOLE TYPE 2 3/4" HOLLOW STEM AUGER & CONE TEST

CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES						
820.1	GROUND LEVEL										
0.0	Silty Clay to Clayey Silt Trace of Sand Stiff to Hard Some Sand Trace of Gravel		1	SS	27					0 6 54 40	
			2	SS	69						
			3	SS	47						
			4	SS	32						
			5	SS	19						
			6	SS	16						
			7	SS	12						0 5 49 46
			8	SS	26						
			9	SS	68						0 14 51 35
			10	SS	56						
			11	SS	44						8 10 50 32
			12	SS	39						
721.1				13	SS	46					0 9 45 46
99.0	End of Borehole										
NOTE:	Water level not established										

 20
 15 ϕ 5 % STRAIN AT FAILURE
 10

RECORD OF BOREHOLE NO 2

W.P. 41-66-09

LOCATION CO-ORDS. 15,583,829N: 1,313,845E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE March 20, 1975

COMPILED BY PJS

DATUM GEODETIC

BOREHOLE TYPE 2 3/4" HOLLOW STEM AUGER & CONE TEST

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT %	UNIT WEIGHT γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
819.8	GROUND LEVEL									
0.0	Silty Clay to Clayey Silt Trace of Sand		1	SS	26					
			2	SS	60					
			3	SS	66					
			4	SS	57					
			5	SS	39					
			6	SS	23					
	Stiff to Hard		7	TW	PH					
			8	TW	PH					
790.8			9	TW	PH					
29.0	End of Borehole									
	NOTE: Water level not established									

20
15 ϕ 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 3

W.P. 41-66-09

LOCATION CO-ORDS. 15,583,734N; 1,313,881E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE MARCH 20, 1975

COMPILED BY PJS

DATUM GEODETIC

BOREHOLE TYPE 2 3/4" HOLLOW STEM AUGER & CONE TEST

CHECKED BY *ep*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ P.C.F.	REMARKS % GR SA. SI. CL.
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
817.8	GROUND LEVEL															
0.0	Silty Clay to Clayey Silt		1	SS	45											
			2	SS	59											
	Trace of Sand		3	SS	37											
			4	SS	23											
	Stiff to Hard		5	SS	15											
			6	SS	24											
			7	SS	13											
778.8			8	SS	27											
39.0	End of Borehole															
	NOTE: WATER LEVEL NOT ESTABLISHED															

20
15 \diamond 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

To: A.P. Watt (2)
Regional Structural Planning Eng.
Southwestern Region, London

FROM: Soil Mechanics Section
Geotechnical Office
West Building, Downsview

ATTENTION:

DATE: October 6, 1975

OUR FILE REF.

IN REPLY TO

OCT 14 1975

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Highways 401 and 402 Interchange Bridge
Twp of Westminster, Dist 2, London
W.P. - 41-66-05 Site 19-547

Attached we are forwarding to you our detailed Foundation Investigation Report on the subsoil conditions existing at the above mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our office.

K.G. Selby
K.G. Selby
Supervising Engineer

cc: E.J. Orr
B.R. Davis
B.J. Giroux
G.A. Wrong
A. Wittenberg
J.R. Roy
L.E. Walker
R. Hore
J. Anderson)
A. Crowley) memo only
G. Sloan)
Files
Record Services

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2. DESCRIPTION OF THE SITE
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 - 3.2 Fine Sand
 - 3.3 Silt
 - 3.4 Clayey Silt
 - 3.5 Groundwater
4. RECOMMENDATIONS
 - 4.1 Structure Footings
 - 4.2 Dewatering
 - 4.3 Settlement
 - 4.4 Approach Embankments
 - 4.5 Frost Protection

FOUNDATION INVESTIGATION REPORT
for
Highways 401 and 402 Interchange Bridge
Twp of Westminster, Dist 2, London
W.P. - 41-66-05 Site 19-547

1. INTRODUCTION

This report is to provide information for the design of the proposed structure at this interchange. The subsoil information is based on five sampled boreholes and four dynamic cone penetration tests. The structure as proposed will have four spans and approach embankments approximately 32 feet in height.

2. DESCRIPTION OF THE SITE

The proposed site is located on Hwy. 401 approximately 1.5 miles southwest of Hwy 135 interchange. The surrounding area is gently rolling farm land with an occasional mixed hardwood bush.

3. SUBSOIL

3.1 General

Subsoil consists of 6 to 19 feet of fine uniform sand (Fig. 1) overlying a layer of silt which ranges from 4 to 15 feet in thickness. Beneath this is a deposit of clayey silt at least 75 feet in thickness.

3.2 Fine Sand

Fine uniform sand extends from the surface to a depth of from 6 to 19 feet. Standard penetration "N" values range from 9 to 32 blows per foot indicating a loose to dense relative density. Generally, however, this stratum may be characterized as compact.

3.3 Silt

The silt layer ranges in thickness from 4 to 15 feet. It is loose to compact in relative density with "N" values ranging from 5 to 27 blows per foot.

3.4 Clayey Silt

The clayey silt was encountered at depths ranging from 10 to 22 feet and extends from there to a depth in excess of 100 feet. It contains varying percentages of sand and gravel, indicating a glacial origin. Consistency ranges from stiff to hard with "N" values ranging from 12 to in excess of 50 blows per foot for the upper portion of the deposit. Below elevation 775 the deposit is much harder with "N" values in excess of 100 blows per foot.

3.5 Groundwater

Groundwater was encountered in the fine sand and silt strata at approximate elevation 853.

4. RECOMMENDATIONS

4.1 Structure Footings

It is recommended that the bridge footings be supported on steel H piles. It is estimated that these piles will achieve a design load equal to their allowable structural capacity at approximate tip elevation 760.

4.2 Dewatering

A dewatering scheme will be required if foundations are placed below the prevailing groundwater level. Pumping from sumps should prove adequate due to the relatively shallow depth of excavation below groundwater level.

4.3 Settlement

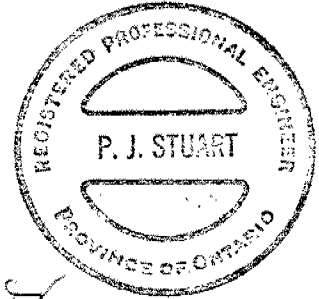
Settlement of the structure will be less than 1 inch. The subsoil under the approach embankment however, will settle about 4 inches with more than 50 per cent taking place in the first six months after construction.

4.4 Approach Embankments

No stability problems are anticipated with embankment fills (32 ft) if 2:1 slopes are employed.

4.5 Frost Protection

All pile caps should be protected against frost action by a minimum 4 feet of cover.



P. J. Stuart
P.J. Stuart, P. Eng.
For Project Engineer

K. G. Selby
K.G. Selby, P. Eng.
Supervising Engineer

APPENDIX

RECORD OF BOREHOLE NO 1

WP 41-66-05

LOCATION Co-ords. 15,591,011 N; 1,339,005 E.

ORIGINATED BY RD

DIST 2 HWY 402

BORING DATE August 14, 1975

COMPILED BY RD

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
856.1	Ground Level															
0.0	Fine Sand		1	SS	10											
	Compact		2	SS	20											0 93 (7)
849.1			3	SS	16											
7.0	Silt, trace of clay.		4	SS	20											0 0 91 9
	Compact		5	SS	22											
			6	SS	12											
834.1			7	SS	23											0 14 51 35
22.0			8	SS	28											
	Clayey silt with sand		9	SS	28											
			10	SS	27											
	Very Stiff to Hard		11	SS	20											
			12	SS	43											
			13	SS	52											
			14	SS	100/6"											0 40 50 10
			15	SS	115/3" 77	boulder										
			16	SS	100/5"											
759.6			17	SS	143/10" 760											
96.5	End of Borehole															
	Note: Water Level not established.															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

W.P. 41-66-05 LOCATION Co-ords: 15,591,060N; 1,339,058 E. ORIGINATED BY RD
 DIST. 2 HWY. 402 BORING DATE August 15, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY OP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
855.5	Ground Level															
0.0	Fine Sand															
849.5	Compact		1	SS	21	850										0 91 (9)
6.0	Silt		2	SS	15											
845.5	Compact		3	SS	6											0 0 87 13
10.0	Clayey silt		4	SS	13	840										0 3 61 36
	some sand		5	SS	9											
			6	SS	11											
			7	SS	33											0 12 53 35
	Stiff to Hard		8	SS	35	830										
			9	SS	32	820										
			10	SS	24	810										
799.0			11	SS	34	800										
56.5	End of Borehole															
	Note: Water Level not established.															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 3

WP 41-66-05

LOCATION

Co-ords. 15,591,161 N; 1,339,311 E.

ORIGINATED BY RD

DIST 2 HWY 402

BORING DATE

August 18, 1975

COMPILED BY RD

DATUM Geodetic

BOREHOLE TYPE


Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
858.8	Ground Level															
0.0	Fine Sand		1	SS	25											0 80 (20)
	Compact to Dense		2	SS	32											0 92 (8)
			3	SS	23											
			4	SS	29											
			5	SS	30											
839.8																
19.0	Silt, some clay.		6	SS	14											0 2 84 14
835.8	Compact															
23.0			7	SS	12											
	Clayey silt with		8	SS	21											
	sand and gravel.		9	SS	19											29 28 28 15
	Stiff to		10	SS	30											
	Very Stiff															
			11	SS	15											
797.3			12	SS	28											0 12 78 10
61.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 4

WP 41-66-05 LOCATION Co-ords. 15,591,219 N; 1,339,375 E. ORIGINATED BY RD
 DIST 2 HWY 402 BORING DATE August 19, 1975 COMPILED BY RD
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	w_p w w_L WATER CONTENT % 10 20 30		
857.6	Ground Level									
0.0	Fine Sand									
	Compact		1	SS	24					
846.6			2	SS	25	850				0 94 (6)
9.0	Silt, some clay.		3	SS	11					0 0 88 12
843.6	Loose to Compact		4	SS	5					0 0 71 29
14.0			5	SS	7					
	Clayey silt, some		6	SS	8	840				
	sand and gravel.		7	SS	34					
			8	SS	48	830				
	Stiff to Hard									
			9	SS	15	820				
			10	SS	21	810				
			11	SS	23	800				
						790	Harder Augering			
			12	SS	84	780				12 22 42 24
			13	SS	100	770				
						760				
756.1			14	SS	115					0 15 36 49
101.5	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 41-66-05 LOCATION Co-ords. 15,591,078 N; 1,339,161 E. ORIGINATED BY RD
DIST 2 HWY 402 BORING DATE August 19, 1975 COMPILED BY RD
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
860.7	Ground Level															
0.0	Fine Sand					860										
	Loose to Compact		1	SS	4											
			2	SS	9											
			3	SS	27	850										0 85 (15)
847.7	Silt, trace of clay.															
13.0	Compact		4	SS	27											0 1 94 5
837.7			5	SS	10	840										
23.0	Clayey Silt		6	SS	16											
	Very Stiff to Hard		7	SS	36	830										
			8	SS	34	820										
			9	SS	24	810										
799.2			10	SS	42	800										
61.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

GRAIN SIZE DISTRIBUTION

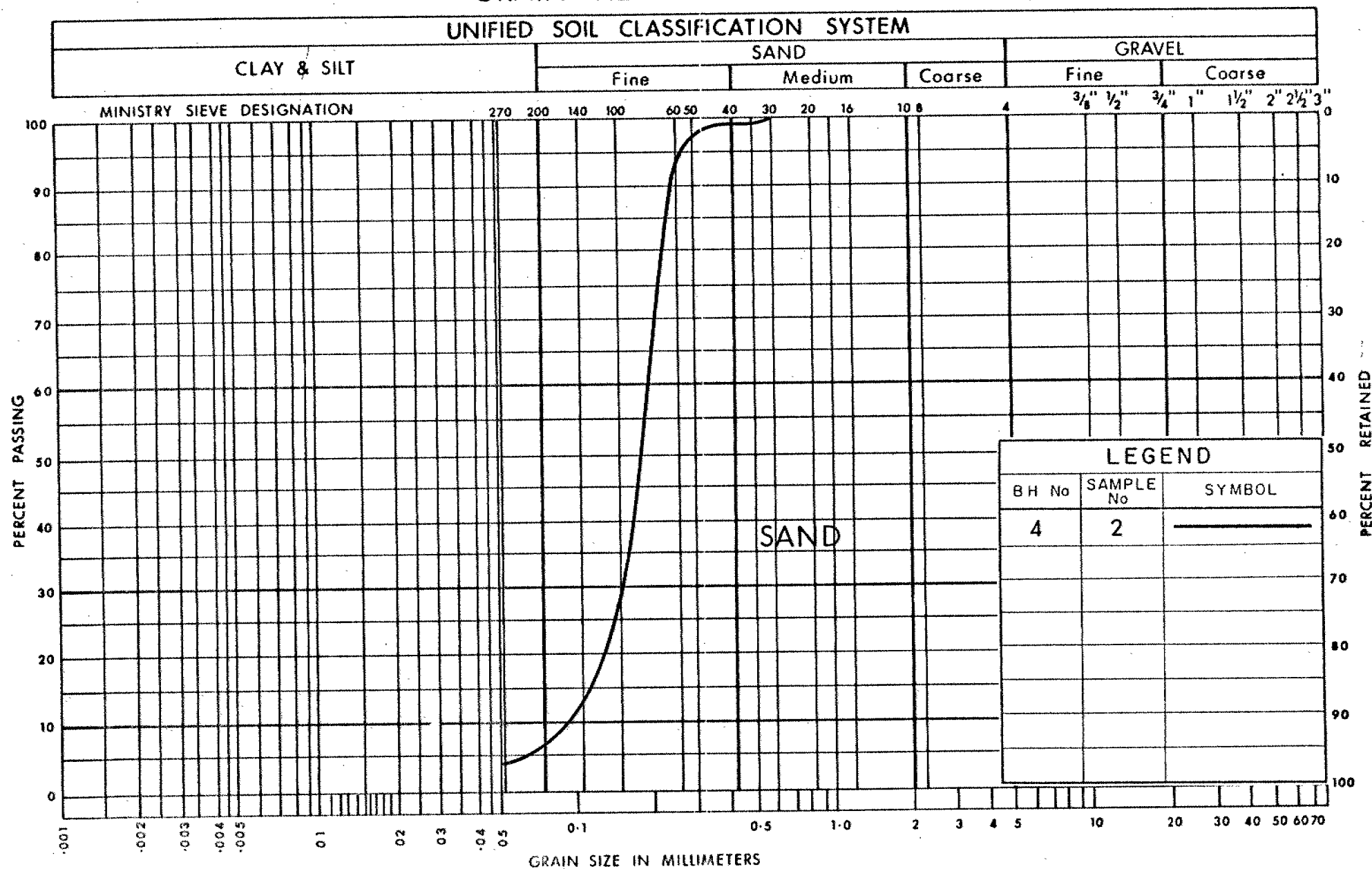


FIG. 1

W.P. 41-66-05

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION RESISTANCE

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

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS 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
w_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
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

$$\tau_f = c' + \sigma' \tan \phi'$$

$$\tau_f = c_u + \sigma \tan \phi$$

GENERAL

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

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

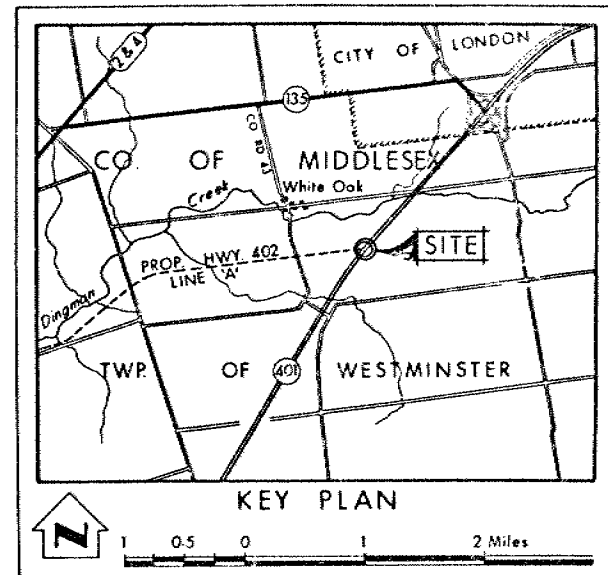
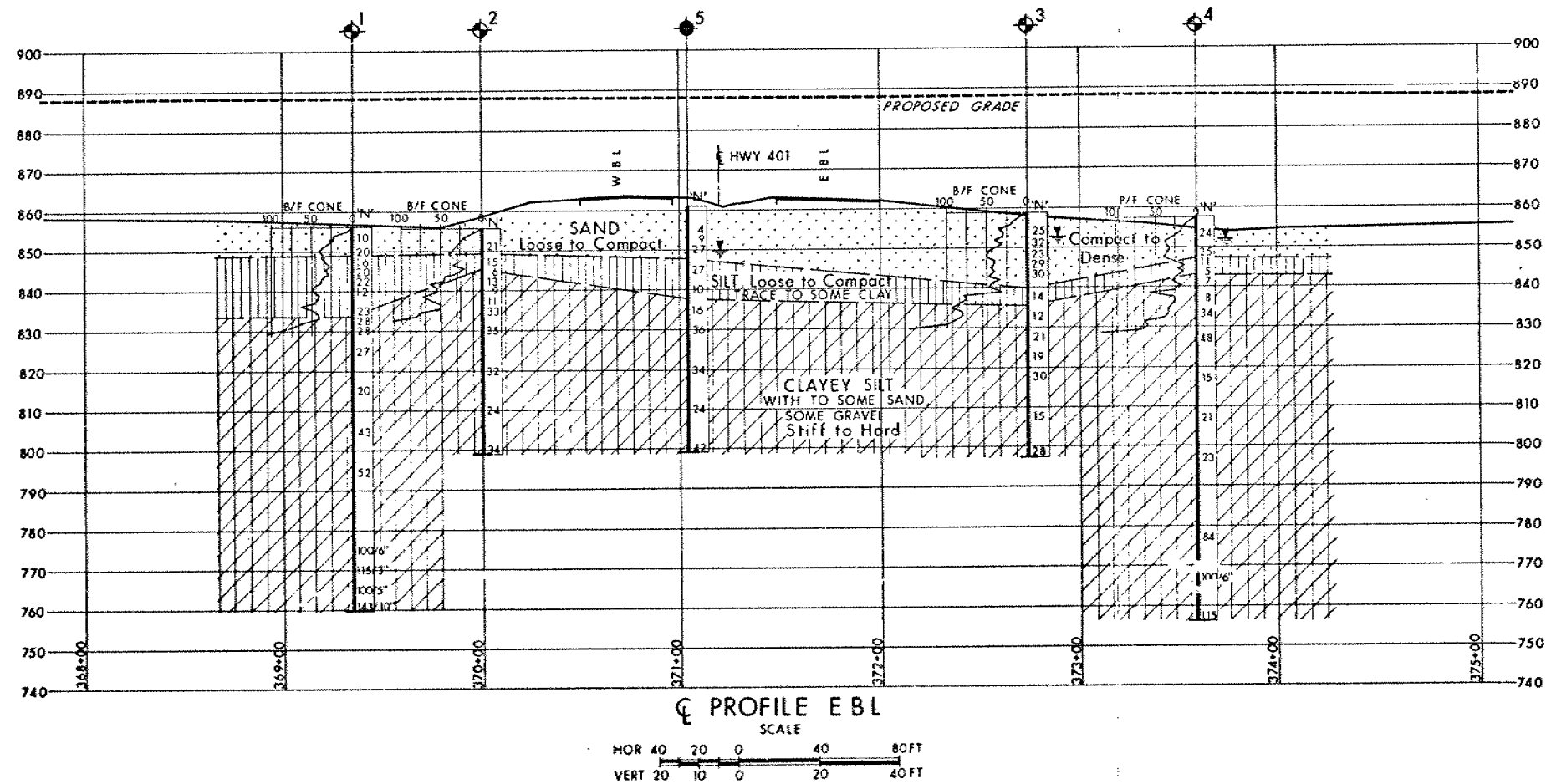
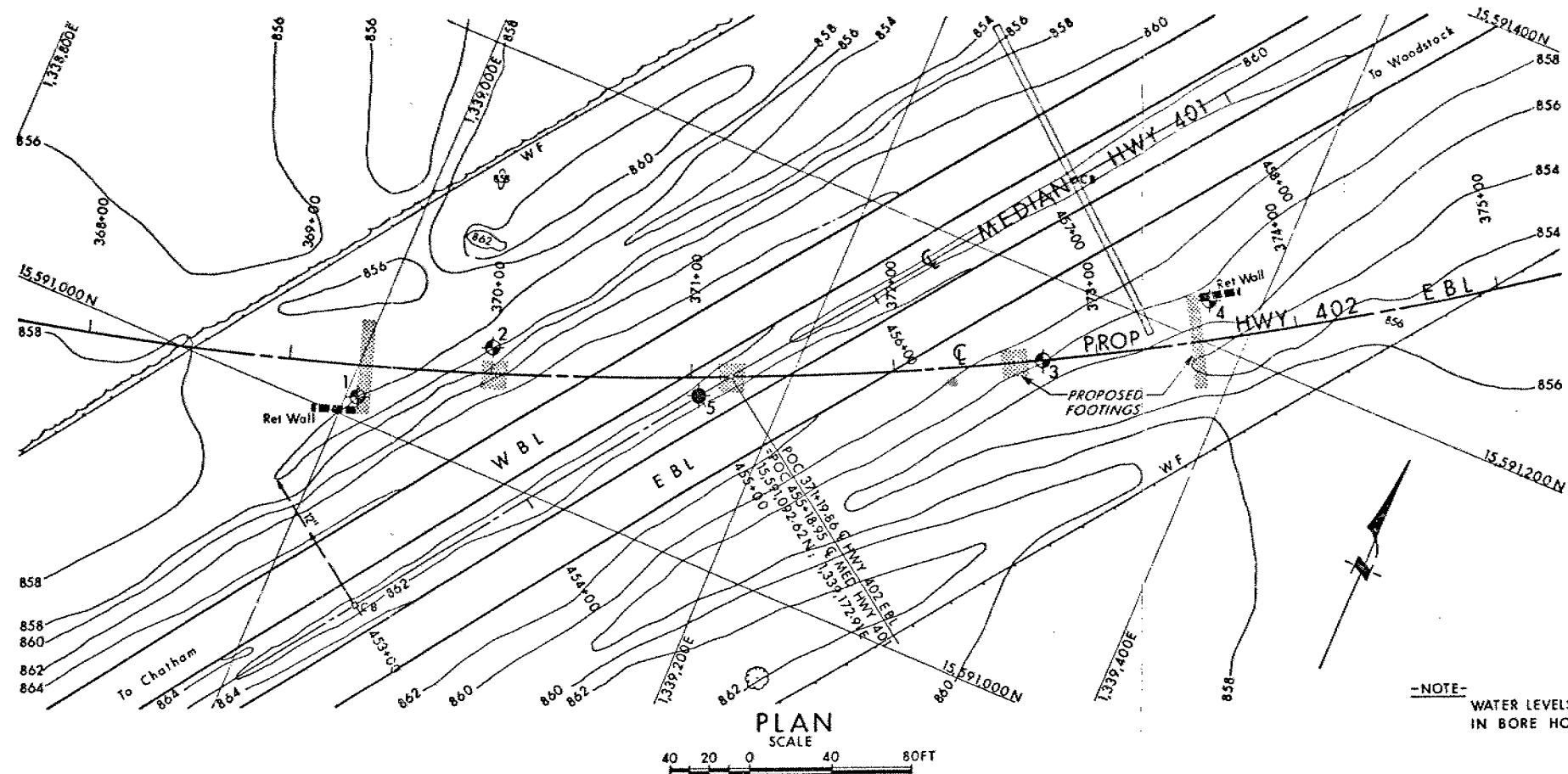
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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
β	ANGLE OF SLOPE TO HORIZONTAL



LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Resistance Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, Aug. 1975		
NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	856.1	15,591,011	1,339,005
2	855.5	15,591,060	1,339,058
3	858.8	15,591,161	1,339,311
4	857.6	15,591,219	1,339,375
5	860.7	15,591,078	1,339,161

NOTE: FOR CONTRACT DOCUMENT
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the LONDON District Office.

NOTE:
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

4014-98

REVISIONS	DATE	BY	DESCRIPTION

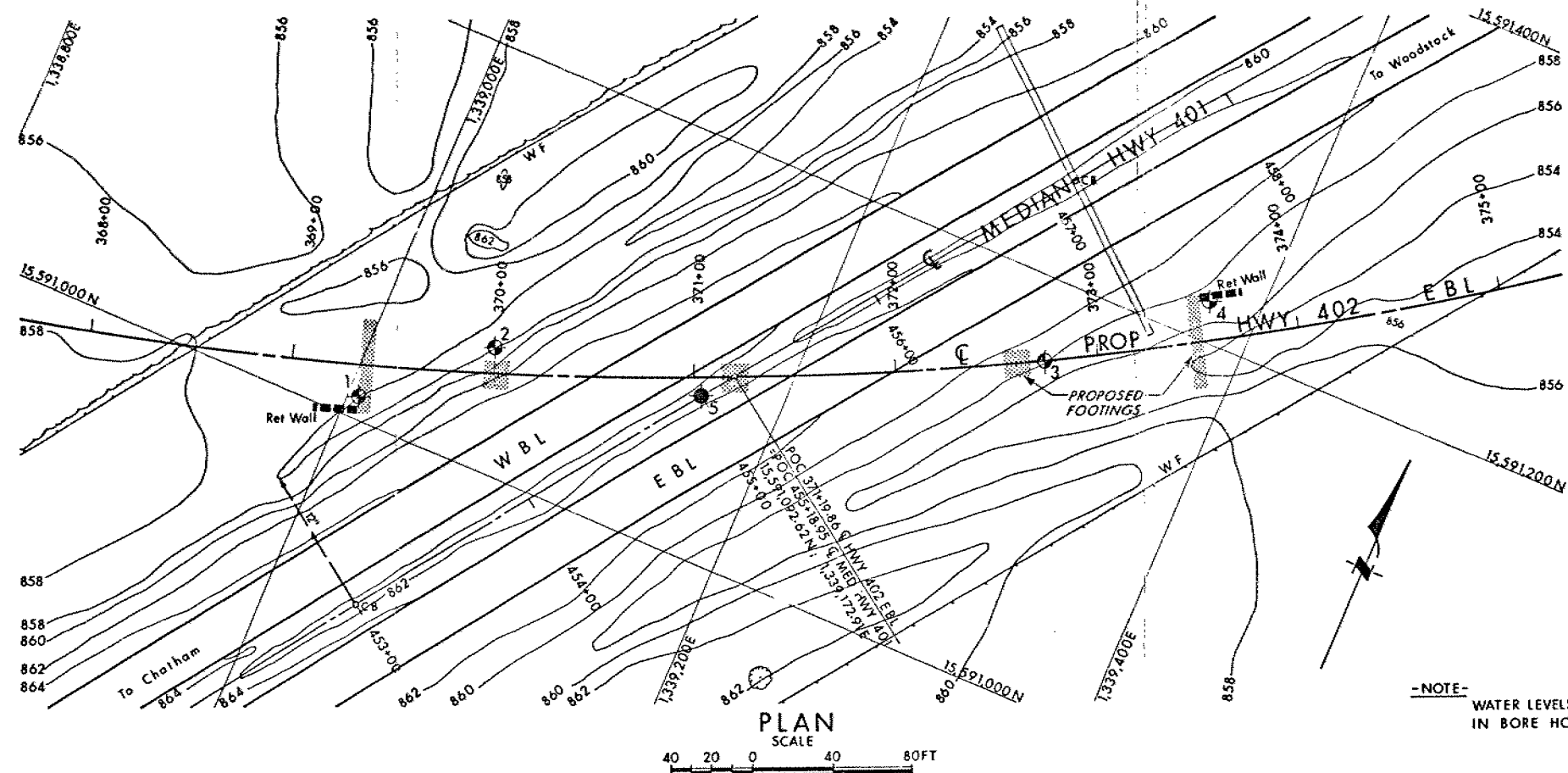
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

HIGHWAY 401

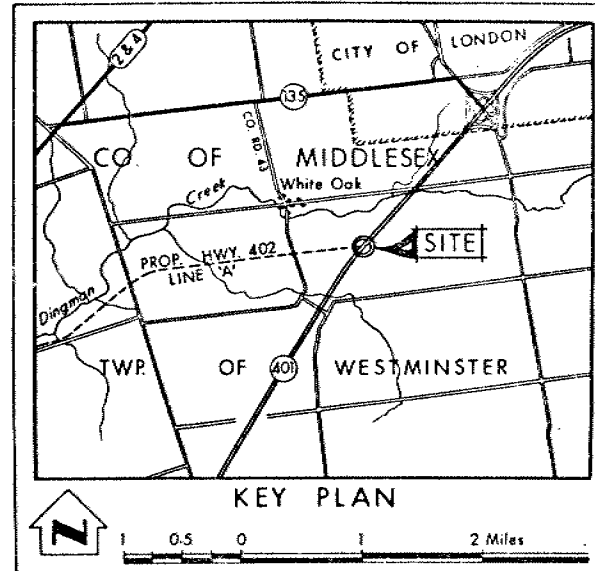
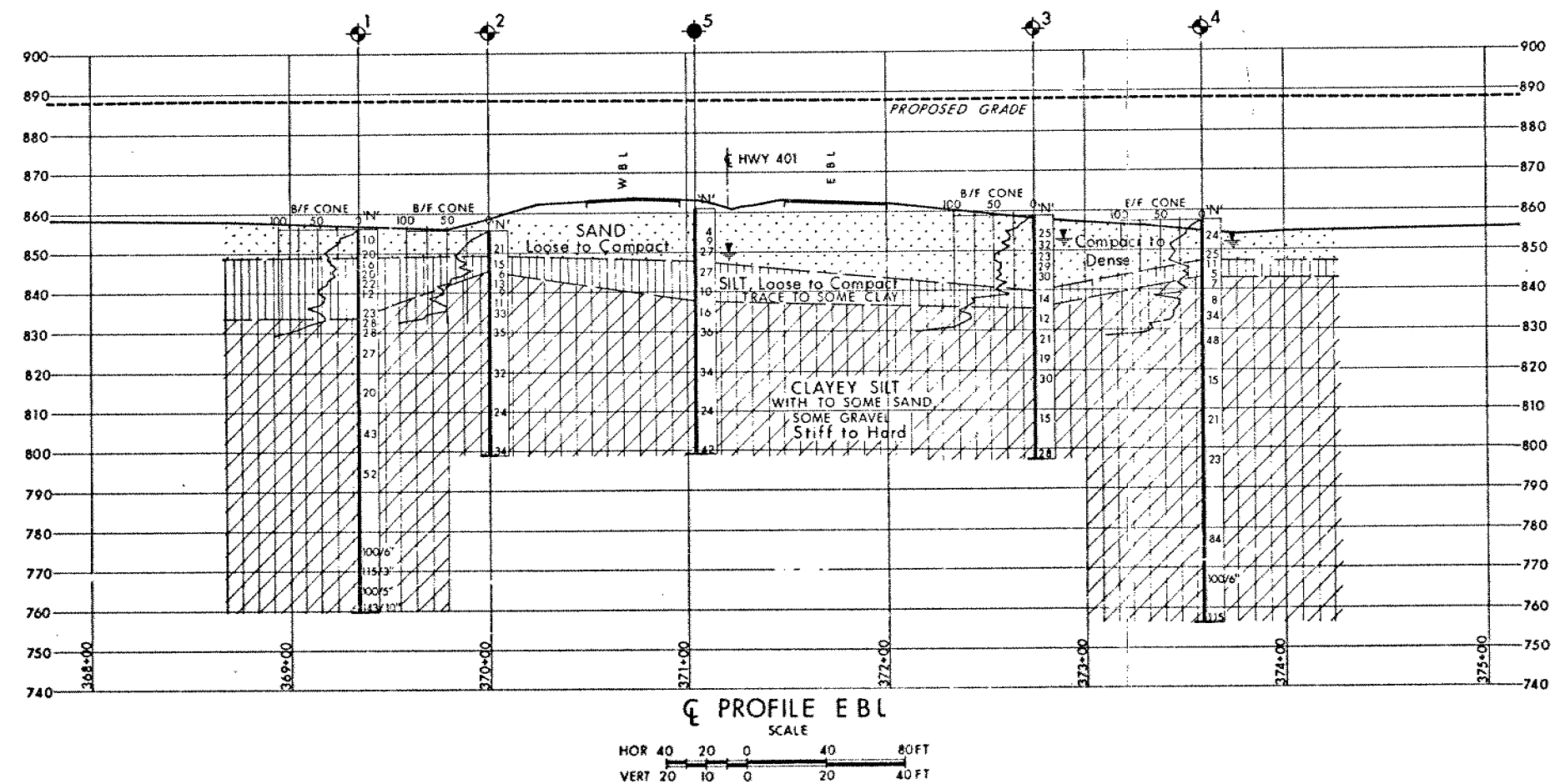
HIGHWAY NO Prop. 402 EBL DIST NO 2
CO MIDDLESEX
TWP WESTMINSTER LOT 19 & 20 CON IV

BORE HOLE LOCATIONS & SOIL STRATA

SUBMOPJ5	CHECKED	WP NO 41-66-05	DRAWING NO
DRAWN	CHECKED	AD NO	416605-A
DATE Sept 26, 1975	STE NO 19-547		BRIDGE DRAWING NO
APPROVED	CONT NO		



-NOTE- WATER LEVELS WERE NOT ESTABLISHED IN BORE HOLES 1 & 2



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Resistance Test
B/F CONE - Blows/Ft. Cone Test (150 ft. lbs. energy/blow)
- ⊕ Bore Hole & Cone Test
- ⊕ Water Levels established at time of field investigation, Aug. 1975

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	856.1	15,591,011	1,339,005
2	855.5	15,591,060	1,339,058
3	858.8	15,591,161	1,339,311
4	857.6	15,591,219	1,339,375
5	860.7	15,591,078	1,339,161

NOTE: FOR CONTRACT DOCUMENT
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the LONDON District Office.

- NOTE -

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

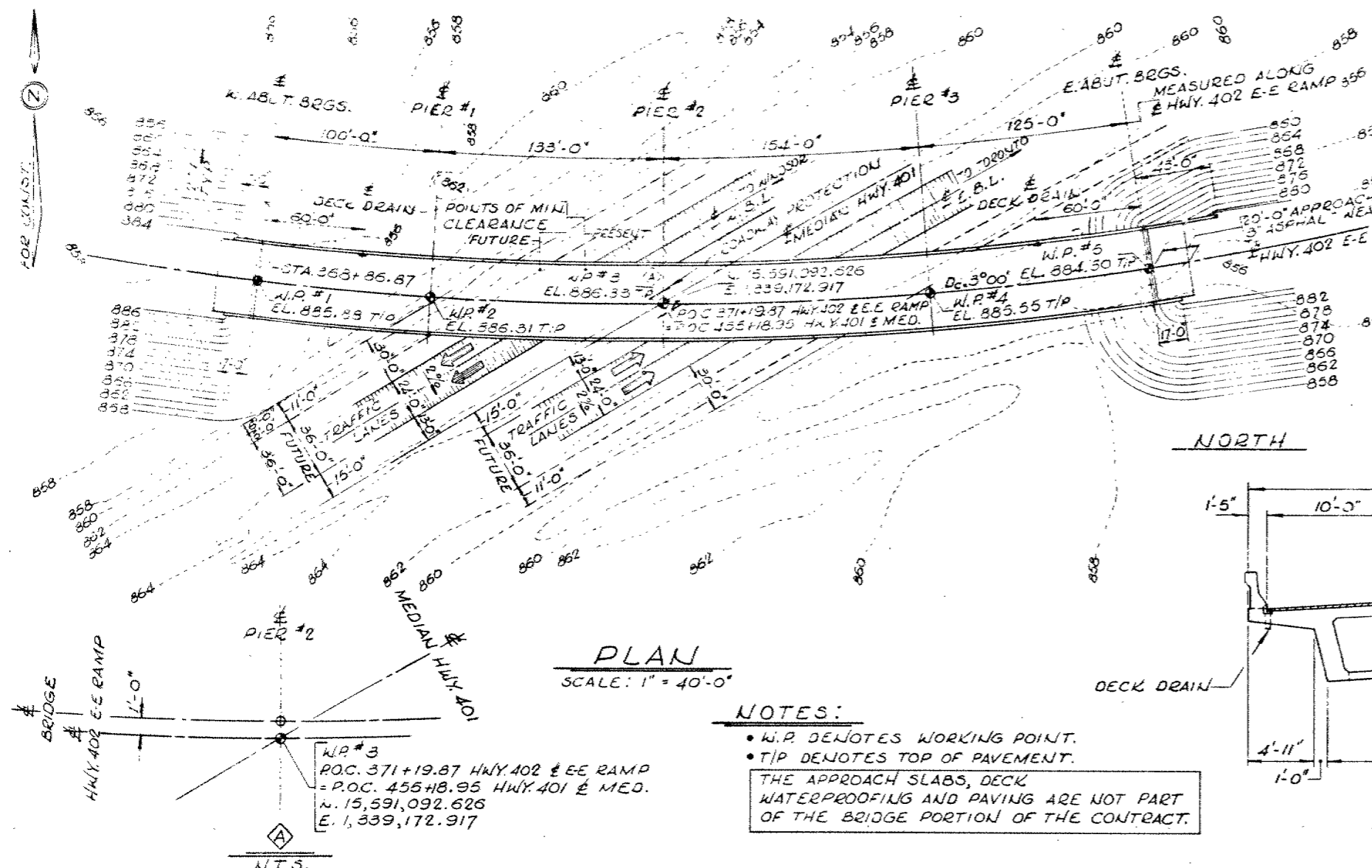
HIGHWAY 401

HIGHWAY NO Prop. 402 EBL DIST. NO. 2
CO MIDDLESEX
TWP WESTMINSTER LOT 19 & 20 CON IV

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTED	CHECKED	WP NO 41-66-05	DRAWING NO
DRAWN	CHECKED	WO NO	416605-A
DATE Sept 26, 1975	SITE NO 19-547	BRIDGE DRAWING NO	
APPROVED	CONF NO		

REF No E-5387-1, July 1975

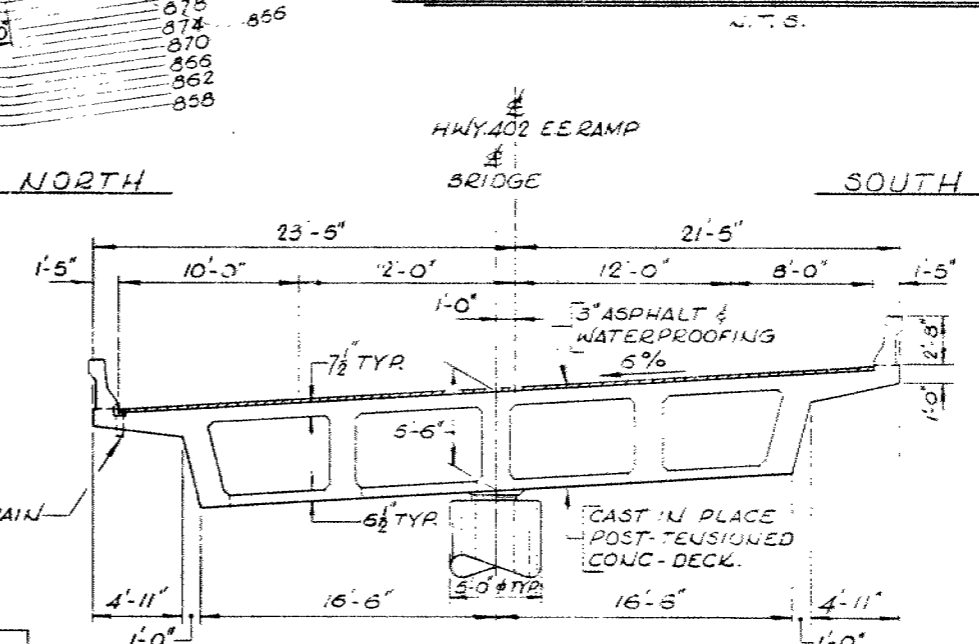


PLAN
SCALE: 1" = 40'-0"

NOTES:

- W.P. DENOTES WORKING POINT.
- T.P. DENOTES TOP OF PAVEMENT.
- THE APPROACH SLABS, DECK WATERPROOFING AND PAVING ARE NOT PART OF THE BRIDGE PORTION OF THE CONTRACT.

PROFILE OF HWY 402 E-E RAMP



TYP DECK SECTION
SCALE: 3/8" = 1'-0"

NOTES:

CLASS OF CONCRETE:

- DECK, PIER COLUMNS & BARRIER WALLS 5000 P.S.I.
- REMAINDER 3000 P.S.I.
- REINFORCING STEEL: GRADE 50

CLEAR COVER TO REINF. STEEL:

- FTGS. ABUTS. & RET. WALL 3"
- TOP OF DECK 2" BOTTOM 1 1/2"
- BARRIER WALLS 1 1/2"
- APPROACH SLABS 2"
- COLUMNS 2"
- UNLESS NOTED OTHERWISE ON DRAWINGS.

CONSTRUCTION NOTES:

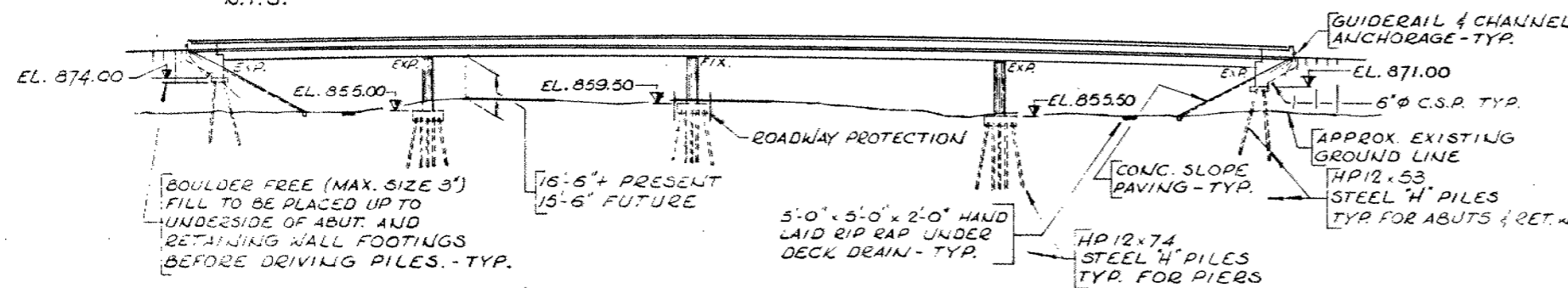
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF $\pm 3/8$ "

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN DECK HAS BEEN PLACED, STRESSED AND GROUTED.

TO ACHIEVE THE MIN. CLEAR COVER OF 2" SPECIFIED IN THE DECK THE TOP LAYER OF REINFORCING STEEL SHALL BE PLACED PRIOR TO CONCRETING, WITH A CLEAR COVER OF $2 \pm 1/2$ " TOLERANCE.

LIST OF DRAWINGS

1. GENERAL PLAN
2. BORE HOLE LOCATION & SOIL STRATA
3. FOUNDATION LAYOUT
4. W. ABUT. & FTG. REINF.
5. E. ABUT. & FTG. REINF.
6. PIERS, RET. WALL & FTGS. REINF.
7. DECK DETAILS
8. LONGIT. CABLE DETAILS
9. TRANS. CABLE DETAILS
10. DECK REINFORCEMENT I
11. DECK REINFORCEMENT II
12. DECK REINFORCEMENT III
13. CONCRETE BARRIER WALL (2'-8" HIGH)
14. STEEL PARAPET RAILING (SINGLE TUBE)
15. 10 FT. APPROACH SLAB (BARRIER WALL)
16. DETAILS OF CONC. SLOPE PAVING
17. STANDARD DETAILS I
18. STANDARD DETAILS II
19. AS CONSTRUCTED ELEV. & DIM.



ELEVATION
SCALE: 1" = 40'-0"

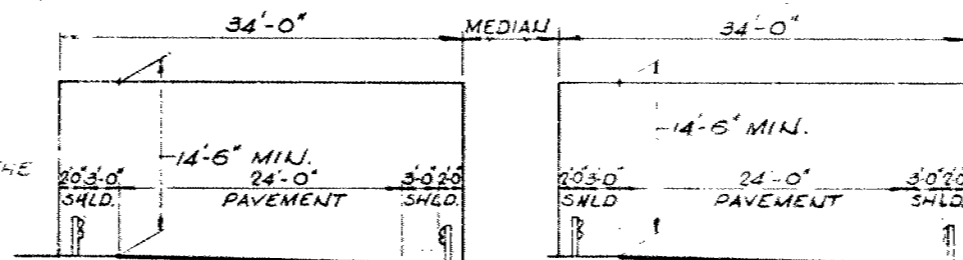
REFERENCE BENCH MARK

B.M. 863.49
GEODETIC DATUM
N. & W. IN N.E. ROOT OF 3'-0" MAPLE
134'-0" RT. 454+50 HWY. 401.

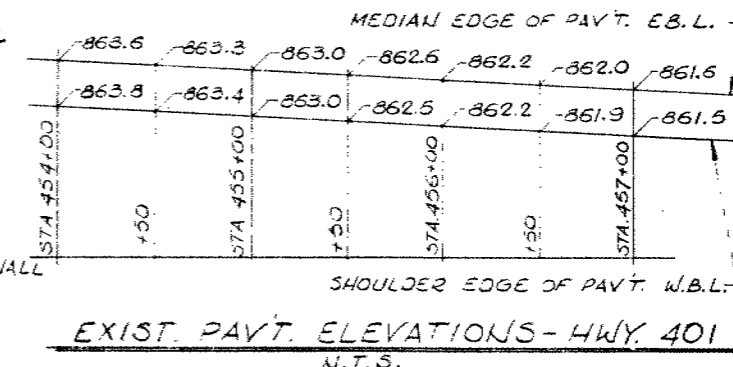
LIST OF CONC. QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE LUMP SUM TENDER ITEMS: CUYDS P.S.I.

1. CONCRETE IN ABUTMENTS, WINGWALLS, PIERS & RETAINING WALLS.	156	3000
2. CONCRETE IN DECK.	50	5000
3. CONCRETE IN BARRIER WALLS.	97	
4. CONCRETE IN APPROACH SLABS.	53	
5. CONCRETE IN SLOPE PAVING	64	



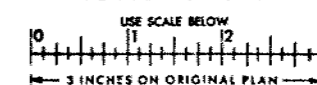
MIN. CLEARANCES DURING CONSTRUCTION
N.T.S.



EXIST. PAVT. ELEVATIONS - HWY. 401
N.T.S.



FOR REDUCED PLAN



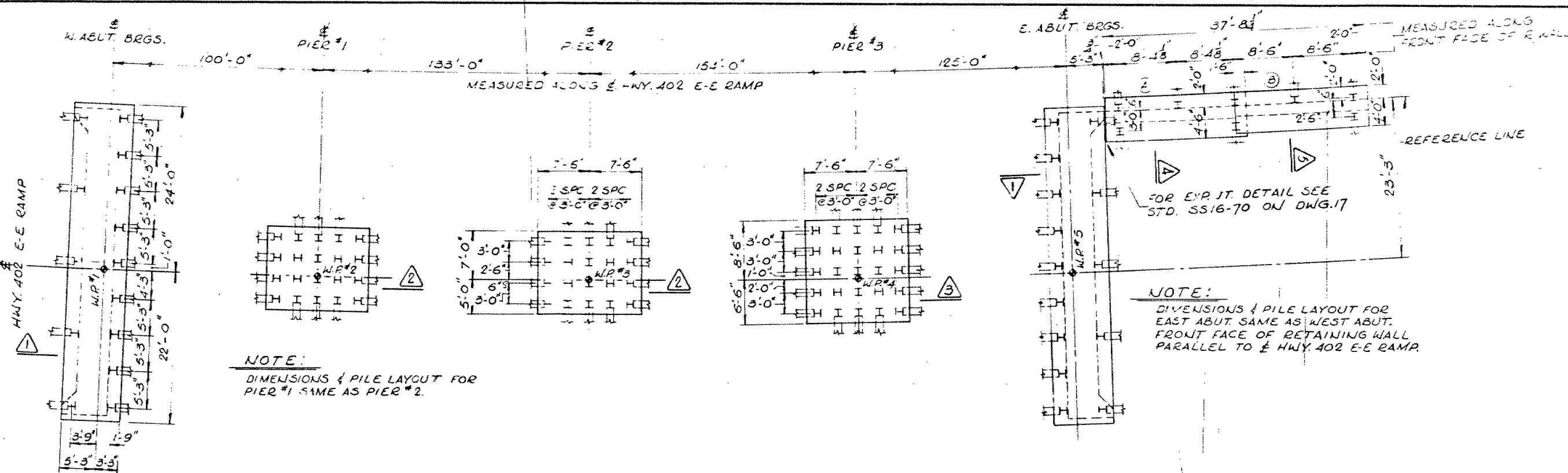
REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			

CONT No
WP No 41-55-35

HWY. 401 INTERCH. OVERPASS
E-E RAMP
FOUNDATION LAYOUT



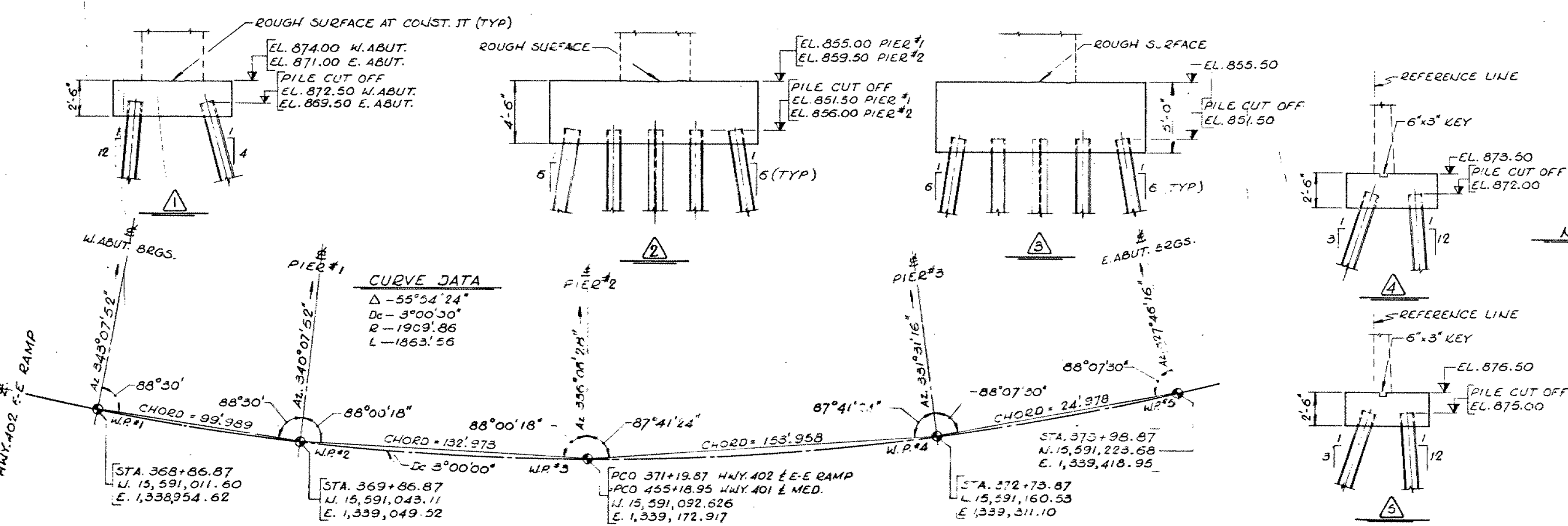
SHEET



P L A N
SCALE: 1/8" = 1'-0"

PILE DATA

LOCATION	BATTER	NO	TYPE	LENGTH
W. ABUT.	1:4	9	HP12x53	117'-0"
	1:12	5		114'-0"
PIER #1	1:6	14		94'-0"
	VERT.	6		94'-0"
PIER #2	1:6	14	HP12x74	98'-0"
	VERT.	6		98'-0"
PIER #3	1:6	16		94'-0"
	VERT.	9		94'-0"
E. ABUT.	1:4	9	HP12x53	117'-0"
	1:12	5		114'-0"
RET. WALL	1:3	3		119'-0"
	1:12	2	HP12x53	114'-0"
	1:3	2		122'-0"
	1:12	1		117'-0"



LOCATION OF WORKING POINTS

- NOTES:
- PILES TO BE DRIVEN IN ACCORDANCE WITH STANDARD S33-11 USING DESIGN LOAD OF 95 TONS PER PILE FOR HP12x74 AND 70 TONS PER PILE FOR HP12x53.
 - PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTINGS.
 - SCALE: 1/4" = 1'-0" UNLESS OTHERWISE NOTED.



REVISION	DATE	DESCRIPTION

DESIGN: [] CHECK: [] LOADING: [] DATE: []
DRAWING: [] CHECK: [] SITE No: [] DWG: []

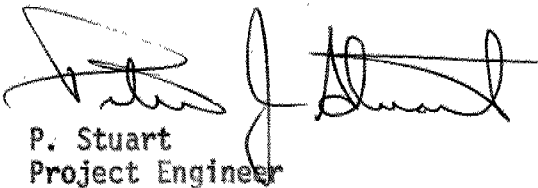
Mr. C.S. Grebski
Structural Design Engineer
Structural Design Office
West Building, Downsview

Soil Mechanics Section
Geotechnical Office
West Building, Downsview

September 8, 1976

Hwy. 401 Interchange Overpass E-E Ramp
W.P. 41-66-05, Site 19-547
Hwy. 401, District 2, London

A review of the final bridge drawings for this site shows the plans to be adequate from a foundation viewpoint.



P. Stuart
Project Engineer

For: K.G. Selby
Supervising Engineer

KGS/PS/gs

cc: Files /
Record Services

Mr. K.C. Bassi
Regional Structural Design Engineer
Structural Design Section
West Building, Downsview

Soil Mechanics Section
Geotechnical Office
West Building, Downsview

May 28, 1976

W.P. 41-66-05
Retaining Wall Foundations
Hwys. 401 & 402 Interchange

The walls retaining the approach fills may be supported on steel tube piles (12 3/4" x 1/4") with a design load of 30 tons per pile. Pile driving should be controlled through the use of the Hiley Formulae. It is estimated that these tube piles will achieve their design capacity at approximate elevation 830.

Differential settlement between the structure and the retaining wall will occur due to the difference in foundation types. The amount of this settlement will depend on the time period between the construction of the fill and the retaining wall. It may, however, be as much as 3 inches.

P. Stuart
Project Engineer

For: K.G. Selby
Supervising Engineer

cc: J. Keen
Files
Record Services