

DOCUMENT MICROFILMING IDENTIFICATIONGEOCRES No. 30M13-88DIST. 6 REGION W.P. No. 137-87-00-ACONT. No. W. O. No. STR. SITE No. N/AHWY. No. 400/407LOCATION 400/407 INTERCHANGEHIGH MAST LIGHTINGNo. of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:



Ministry
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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

F
RPN

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 137-87-00

DIST 6

HWY 400/407

STR SITE 37

High Mast Lighting
Hwy. #400/407 Interchange

DISTRIBUTION

G.C.E. Burkhardt (3)
G. Cautillo
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K. Bassi
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T. Yakutchik
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memorandum



To: G.C.E. Burkhardt
Head, Structural Section
Central Region

Date: 1989 02 24

Atten: R.A. Jeffries

RE: High Mast Lighting
Hwy. #400/407 Interchange
W.P. 137-87-00, Site 37
District 6 (Toronto)

The construction of 45 m high mast lighting is proposed at this location. The poles are required to provide lighting on the 4th level of the future interchange. The location of the poles are as follows:

<u>Pole No.</u>	<u>North Co-ord.</u>	<u>East Co-ord.</u>
C53	4848920.0	301741.7
C56	4848954.0	301838.7
C59	4849071.0	301824.0
C64	4849045.0	301692.0

The borings, which were carried out for other projects, indicate that the subsoil consists mainly of very stiff to hard clayey silt with some sand and traces of gravel. Randomly, silt and sand layers were also encountered within the main deposit.

The groundwater level was found to be at or slightly below the existing ground surface. For more detailed subsurface information, references should be made to the attached record of borehole sheets at a particular pole location:

<u>Pole No.</u>	<u>Boreholes</u>
C-53	9 - 4 and 9 - 7
C-56	11 - 7 and 12 - 8
C-59	7 - 2 and 10 - 6
C-64	11 - 4 and 12 - 2

The design of the high mast lighting foundation (single concrete caisson) should be in accordance with the method as outlined in the following papers:

Brohms, B.B. Lateral Resistance of Piles in Cohesive Soil Journal of the Soil Mechanics and Foundation Division
ASCE Vol. 90 No. SM2, Paper 3285, March 1964

Brohms, B.B. Lateral Resistance of Pile in Cohesionless Soil Journal of the Soil Mechanics and Foundation Division
ASCE Vol. 90. No. SM3, Paper 3909, May 1964

The design parameters as outlined in the attached Table 1 where

ϕ = Angle of Internal Friction (in degrees)
 q_u = Unconfined compressive strength (in kPa)
 γ = Bulk Unit Weight (in kN/m³)


The material for 1.2 m depth below finished ground line (frost penetration zone) should not be included in calculation of lateral resistance.

Some of the caissons in part will be located within layers of non-cohesive subsoil, and the groundwater level is at ground surface. In view of this, the following special provision should be included in the contract documents:

"The contractor shall install concrete footings in earth for high mast poles. At the various pole locations, soil deposits consist of mixtures of silts, sand and gravels with occasional cobbles and boulders. Groundwater is likely to be encountered at or slightly below ground surface.

The soil is highly susceptible to conditions of unbalanced hydrostatic head and seepage forces and is likely to 'boil' and become unstable under such conditions. The contractor shall maintain the stability of the soil in the sides and bases of the holes for the concrete footings at all times from commencement of their construction to the placing of concrete."

We believe the aforementioned recommendations will be adequate for your design requirements.


P. Payer, P. Eng.
Sr. Foundation Engineer

for

M. Devata, P. Eng.
Chief Foundation Engineer

PP/mmj

c.c. - G. Cautillo D. Aspinwall
 J. Smrcka T. Yakutchik
 A. Wittenberg G. Szekreny
 K. Bassi

TABLE 1

Pole No.	Ground Elevation		Soil Boundary Elevation		Soil Type	Design Parameters			Remarks
	Original	Finished	Upper	Lower		ϕ Degree	q_u kPa	γ kN/m ³	
C-53	192.5	184.4	184.4	157.4	Cohesive	-	450	22.8	Boreholes
									9-4 } W.P. 137-87-06 9-7 } W.L. E1. 191.8
C-56	192.6	192.6	192.6	189.5	Cohesive	-	300	22.0	Boreholes
			189.5	187.0	Non-Cohesive	43	-	21.2	11-7 W.P. 137-87-03
			187.0	180.5	Cohesive	-	450	22.8	12-8 W.P. 137-87-04
			180.5	179.0	Cohesive	-	400	22.5	W.L. E1. 191.5
			179.0	168.5	Cohesive	-	450	22.8	
			168.5	161.0	Cohesive	-	400	22.5	
			161.0	158.0	Cohesive	-	450	22.8	
C-59	192.7	182.8	182.8	180.5	Non-Cohesive	43	-	21.2	Boreholes
			180.5	178.5	Non-Cohesive	39	-	20.4	7-2 W.P. 137-87-01
			178.5	177.0	Non-Cohesive	43	-	21.2	10-6 W.P. 137-87-05
			177.0	160.0	Cohesive	-	450	22.8	W.L. E1. 191.0
C-64	193.2	192.0	192.0	190.0	Cohesive	-	100	19.6	Boreholes
			190.0	189.5	Non-Cohesive	32	-	20.4	11-4 W.P. 137-87-03
			189.5	186.5	Non-Cohesive	41	-	21.2	12-2 W.P. 137-87-04
			186.5	182.5	Cohesive	-	450	22.8	
			182.5	179.0	Non-Cohesive	43	-	21.2	W.L. E1. 192.0
			179.0	176.0	Cohesive	-	450	22.8	
			176.0	175.5	Non-Cohesive	32	-	20.4	
			175.5	174.5	Non-Cohesive	43	-	21.2	
			174.5	171.0	Cohesive	-	450	22.8	

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_a	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{\min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	KN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	KN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	KN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	KN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	KN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{\max}	1, %	VOID RATIO IN LOOSEST STATE	j	KN/m^2	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						



Formerly WP 137-87-06

RECORD OF BOREHOLE No 9-4 (HML) C-53) METRIC

W P 137-87-00 LOCATION Co-ords. N 4 848 889.0; E 301 763.0 ORIGINATED BY DD
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY DD
DATUM Geodetic DATE 87 10 29 & 87 11 19 - 24 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
191.8	Ground Surface												
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		1	SS	18		190						3 17 37 43
189.4			2	SS	15		188						1 22 69 8
2.4	Silt to Sandy Silt Compact to Dense (Lacustrine)		3	SS	32		186						0 40 54 6
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense Very Stiff to Hard (Glacial Till)		4	SS	100/25 cm		184						1 15 63 21
			5	SS	80		182						
			6	SS	88		180						
			7	SS	101/28 cm		178						
			8	SS	102/28 cm		176						
			9	SS	90/10 cm		174						
180.4			10	SS	76		172						
11.4			11	SS	55		170						
			12	SS	51		168						
			13	SS	100		166						
	Silty Clay to Clay With Thin Silt Seams		14	SS	50		164						
	Hard (Lacustrine)		15	SS	85		162						
			16	SS	72								
			17	SS	100								
			18	SS	94								
			19	SS	100/25 cm								
			20	SS	100								
			21	SS	97								
			22	SS	66								
161.6													

30.2

Continued

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

Continued



Formerly WP 137-87-06

RECORD OF BOREHOLE No 9-4 (HML C-53)

METRIC

W P 137-87-00 LOCATION Co-ords. N 4 848 889.0; E 301 763.0 ORIGINATED BY DD
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tri-Cone COMPILED BY MS
DATUM Geodetic DATE 87 10 29 & 87 11 19 - 24 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
161.6	Continued												
30.2	Silty Clay to Clay With Thin Silt Seams Hard (Lacustrine)		23	SS	84		160						
157.4							158						
34.4	Sandy Silt to Silty Sand *		24	SS	120	8 cm							
156.6													
35.2	End of Borehole												
	* Very Dense (Lacustrine)												

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



Formerly WP 137-87-06

RECORD OF BOREHOLE No 9-7 (HML) C-53

METRIC

W P 137-87-00 LOCATION Co-ords. N 4 848 952.5; E 301 751.0 ORIGINATED BY MS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY MS
DATUM Geodetic DATE 87 10 30 & 87 11 20 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
191.9	Ground Surface							20 40 60 80 100						GR SA SI CL	
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		1	SS	18										
189.9			2	SS	15										
2.0	Silt Compact (Lacustrine)		3	SS	100	28 cm								1 19 69 11	
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense/ Stiff to Hard (Glacial Till)		4	SS	92										
			5	SS	52	15 cm								1 21 65 13	
			6	SS	97									0 6 54 40	
			7	SS	69	15 cm								1 4 51 44	
180.0			8	SS	60	15 cm									
11.9	Silty Clay to Clay With Thin Silt Seams Hard (Lacustrine)		9	SS	84									0 0 29 71	
			10	SS	100										
			11	SS	82									8 20 38 34	
173.2			12	SS	100										
18.7	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



Formerly WP 137-87-03

RECORD OF BOREHOLE No 11-7 (HML C-56) METRIC

W P 137-87-00 LOCATION Co-ords. N 4 848 945.5; E 301 823.0 ORIGINATED BY MS
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY MS
DATUM Geodetic DATE 87 11 09 CHECKED BY MS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES							
192.1	Ground Surface											
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		1	SS	19		192					
			2	SS	26		190					
189.4			3	SS	21							
2.7	Silt Very Dense (Lacustrine)		4	SS	66							
			5	SS	110	28 cm	188					2 13 76 9
			6	SS	74							
			7	SS	103		186					1 21 62 16
			8	SS	100	28 cm						
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Very Dense/Hard (Glacial Till)		9	SS	120	23 cm	184					
			10	SS	115	25 cm	182					0 3 96 1
			11	SS	100		180					0 12 61 27
180.2			12	SS	39							
11.9	Silty Clay to Clay With Thin Silt Seams Hard (Lacustrine)		13	SS	100	23 cm	178					
176.6			14	SS	108	30 cm						6 25 49 20
15.5	End of Borehole											

OFFICE REPORT ON SOIL EXPLORATION



Formerly WP 137-87-04

RECORD OF BOREHOLE No 12-8 (HML C-56)

METRIC

W P 137-87-00

LOCATION Co-ords: N 4 848 967.5; E 301 839.0

ORIGINATED BY MS

DIST 6 HWY 400/407

BOREHOLE TYPE Cone Test, H-S Auger, Tricone

COMPILED BY MS

DATUM Geodetic

DATE 87 10 23-26

CHECKED BY MS

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE								
192.7	Ground Surface										
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff to Hard (Glacial Till)	1	SS	48							
		2	SS	24							
		3	SS	21							
		4	SS	33							
188.6		5	SS	110	30 cm						
4.1	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Very Dense/Hard	6	SS	95	25 cm						
		7	SS	89							
		8	SS	76							
		9	SS	100	23 cm						
		10	SS	100	25 cm						
		11	SS	91							
180.2		12	SS	58							
12.5		13	SS	100							
		14	SS	100	18 cm						
		15	SS	100	25 cm						
	Occ. Clayey Silt Zones	16	SS	100	20 cm						
	Silty Clay to Clay With Thin Silt Seams	17	SS	100	28 cm						
	Hard	18	SS	82							
	Lacustrine	19	SS	66							
		20	SS	68							
		21	SS	48							
		22	SS	62							
		23	SS	42							
162.5											
30.2											

Continued

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

Continued

OFFICE REPORT ON SOIL EXPLORATION



Formerly WP 137-87-04			RECORD OF BOREHOLE No 12-8 (HML C-56)			METRIC											
W P 137-87-00			LOCATION Co-ords. N 4 848 967.5; E 301 839.0			ORIGINATED BY MS											
DIST 6 HWY 400/407			BOREHOLE TYPE Cone Test, H-S Auger, Tricone			COMPILED BY MS											
DATUM Geodetic			DATE 87 10 23 - 26			CHECKED BY MS											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)	Y	GR SA SI CL					
162.5	Continued																
30.2	Silty Clay to Clay With Thin Silt Seams Hard (Lacustrine)		24	SS	51		162										
							160										
158.0							158										
34.7	Sandy Silt*		25	SS	108	5 cm											
157.4	End of Borehole																
35.3	* to Silty Sand Very Dense (Lacustrine)																

OFFICE REPORT ON SOIL EXPLORATION



Formerly WP 137-87-01

RECORD OF BOREHOLE No 7-2 (HML C-59) METRIC

W P 137-87-00 LOCATION Co-ords. N 4 849 055.0; E 301 814.5 ORIGINATED BY DD
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY DD
DATUM Geodetic DATE 87 10 19-20 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60	Wp	W	Wl		
192.6	Ground Surface													
0.0	Clayey Silt Some Sand Trace Gravel Firm to Very Stiff (Glacial Till)		1	SS	22									
190.2			2	SS	27									5 37 39 19
2.4	Sand Very Dense (Lacustrine)		3	SS	70									0 91 8 1
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense/ Very Stiff to Hard (Glacial Till)		4	SS	120									2 25 58 15
			5	SS	120	25 cm								
			6	SS	120	18 cm								
			7	SS	120	25 cm								1 27 63 9
			8	SS	100	28 cm								5 36 48 11
			9	SS	78									
			10	SS	55									4 22 54 20
178.9			11	SS	43									8 12 52 28
13.7			12	SS	32									
	Sand and Gravel Very Dense (Lacustrine)		13	SS	110									
	Silty Clay to Clay with Thin Silt Seams Very Stiff to Hard (Lacustrine)		14	SS	103	23 cm								
			15	SS	95									
173.9			16	SS	118									
18.7	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

Formerly WP 137-87-05

RECORD OF BOREHOLE No 10-6 (HML C-59) METRIC

W P 137-87-00 LOCATION Co-ords. N 4 849 084.0; E 301 789.5 ORIGINATED BY MS
 DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger, Tricone COMPILED BY MS
 DATUM Geodetic DATE 87 10 19 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
192.8	Ground Surface													GR SA SI CL
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff (Glacial Till)		1	SS	29		192							
190.4			2	SS	47		190							3 37 43 17
2.4			3	SS	15		188							9 64 23 4
	Sandy Silt to Silty Sand		4	SS	80		186							1 16 62 21
			5	SS	120	23 cm	186							2 29 57 12
			6	SS	120	23 cm	186							
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense/ Stiff to Hard (Glacial Till)		7	SS	120	23 cm	184							
			8	SS	120	23 cm	184							4 20 51 25
			9	SS	120	23 cm	184							1 20 56 23
			10	SS	120	25 cm	182							
			11	SS	120	20 cm	182							
			12	SS	120	25 cm	180							
179.1			13	SS	27		178							2 4 43 51
13.7			14	SS	81		176							0 24 72 4
	Sandy Silt		15	SS	120	25 cm								
	Silty Clay to Clay With Thin Silt Seams Very Stiff to Hard (Lacustrine)		16	SS	120	27 cm								
174.2														
18.6	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION



Formerly WP 137-87-03

RECORD OF BOREHOLE No 11-4 (HML) METRIC

W P 137-87-00 LOCATION Co-ords. N 4 849 026.0; E 301 686.5 (C-64)
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger
DATUM Geodetic DATE 87 11 24 - 26
ORIGINATED BY TS
COMPILED BY TS
CHECKED BY MS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
193.1	Ground Surface													
0.0	Clayey Silt Some Sand Trace Gravel With Organics Stiff (Glacial Till)		1	SS	9	*	192							2 24 42 32
190.1			2	SS	16		190							4 39 56 1
3.0			3	SS	41									
	Sandy Silt to Silt Compact to Very Dense (Lacustrine)		4	SS	47		188							
			5	SS	52									
			6	SS	50									0 2 85 13
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Compact to Very Dense/ Very Stiff to Hard (Glacial Till)		7	SS	94		186							
			8	SS	100									
			9	SS	85		184							2 22 57 19
182.4			10	SS	110									
10.7			11	SS	70		182							0 15 75 10
	Silt to Sand Very Dense		12	SS	60		180							0 55 44 1
			13	SS	80									0 77 22 1
			14	SS	64		178							
			15	SS	14		176							1 50 44 5
	Silt to Sand Compact to Very Dense		16	SS	110									
	Silty Clay to Clay With Thin Silt Seams Hard (Lacustrine)		17	SS	90	28 cm	174							
171.3			18	SS	80		172							
21.8	End of Borehole													
	* Groundwater Elevation Not Determined													

+3, x5: Numbers refer to
Sensitivity

20
15
10
5
0
(%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



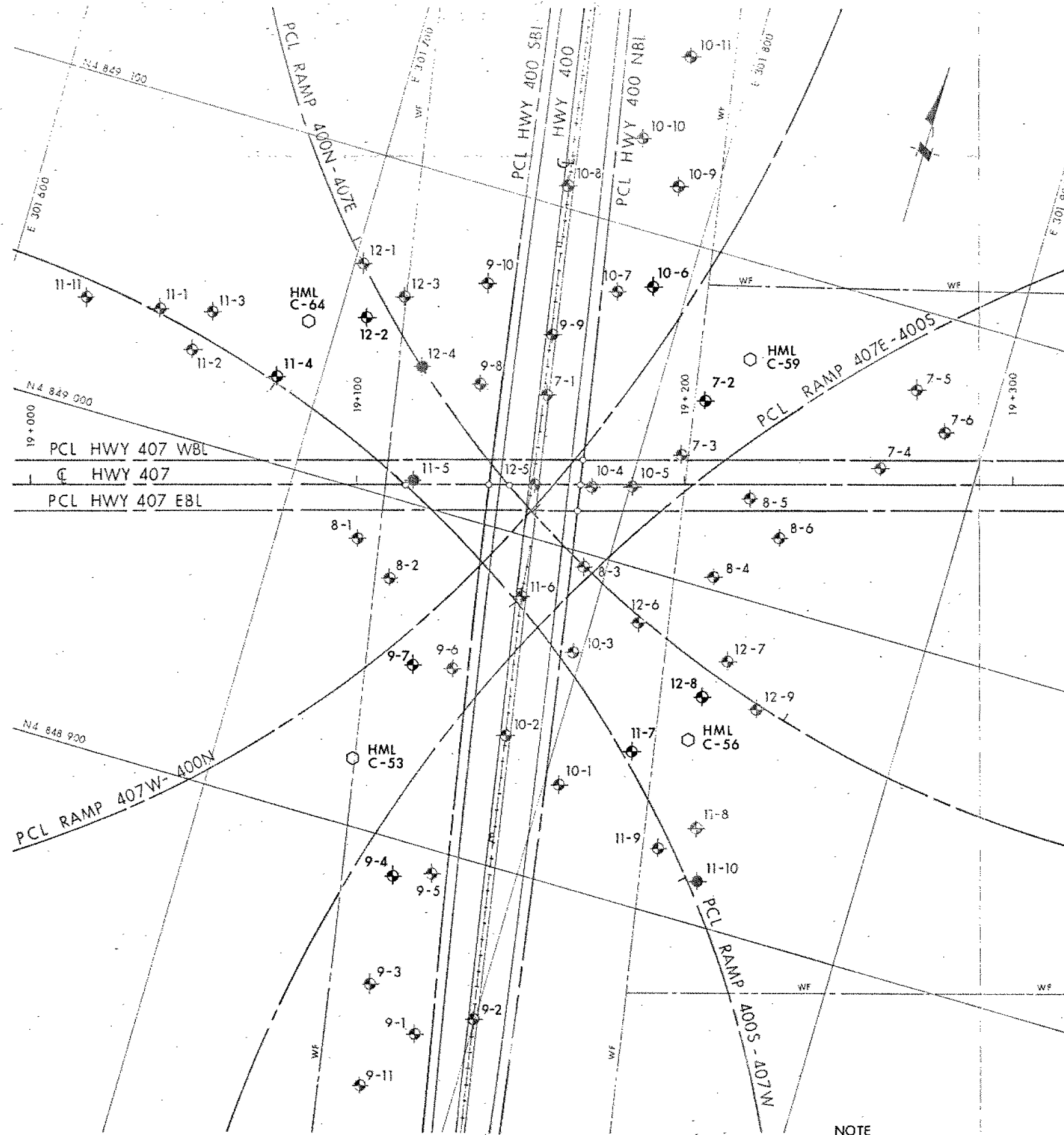
Formerly WP 137-87-04

RECORD OF BOREHOLE No 12-2 (HML) METRIC

W P 137-87-00 LOCATION Co-ords: N 4 849 051.0; E 301 708.0 ORIGINATED BY KZ
DIST 6 HWY 400/407 BOREHOLE TYPE Cone Test, H-S Auger COMPILED BY KZ
DATUM Geodetic DATE 87 11 19 CHECKED BY MS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
193.4	Ground Surface										
0.0	Clayey Silt Some Sand Trace Gravel Very Stiff to Hard (Glacial Till)		1	SS	31		192				
			2	SS	20						
			3	SS	24						
189.9			4	SS	64		190				
3.5	Sand to Silt Very Dense (Lacustrine)		5	SS	43	25 cm	188				
			6	SS	115						
			7	SS	100						
			8	SS	114						
	Silt/Clayey Silt Some Sand Trace Gravel Random Silt and Sand Pockets Occ. Boulders Dense to Very Dense/ Hard (Glacial Till)		9	SS	108	28 cm	186				
			10	SS	106	20 cm	184				
			11	SS	116	28 cm	182				
181.2			12	SS	63		180				
12.2	Silty Clay to Clay With Thin Silt Seams Hard		13	SS	60	15 cm					
	Sand and Gravel (Lacustrine)		14	WS	--		178				
177.9											
15.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION



PLAN
SCALE
20m 10 0 10 20m

NOTE
For Subsurface details refer to
Record of Borehole sheets
(BH 7-2, 9-4, 9-7, 10-6
11-4, 11-7, 12-2 and 12-8)

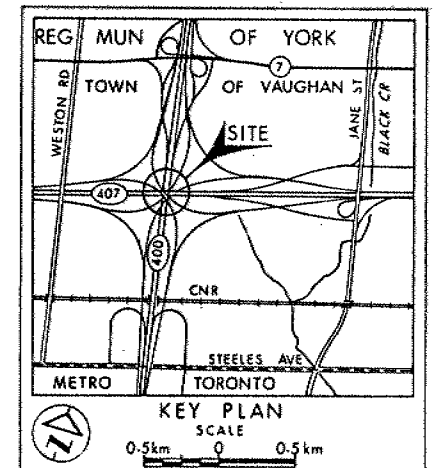
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES - METRES.

CONT No
WP No 137-87-00

HIGH MAST LIGHTING
HWY 400/407 INTERCHANGE
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
1987 10 and 1987 11
- High Mast Lighting Poles

HML	BOREHOLES			
	No	ELEVATION	CO-ORDINATES NORTH	EAST
C-53	9-4	191.8	4 848 889.0	301 763.0
	9-7	191.9	4 848 952.5	301 751.0
C-56	11-7	192.1	4 848 945.5	301 823.0
	12-8	192.7	4 848 967.5	301 839.0
C-59	7-2	192.6	4 849 055.0	301 814.5
	10-6	192.8	4 849 084.0	301 789.5
C-64	11-4	193.1	4 849 026.0	301 686.5
	12-2	193.4	4 849 051.0	301 708.0

NOTE

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

NOTE: The complete foundation investigation and design report for
this project and other related documents may be examined at the
Engineering Materials Office, Downsview. Information contained in
this report and related documents is specifically excluded in
accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION
Geocres No 30M13-88			
HWY No 400 & 407		DIST 6	
SUBWD DD CHECKED		DATE 1989 03 01 SITE	
DRAWN DT CHECKED		APPROVED DWG 1378700-A	