

G.I.-30 SEPT. 1976

GEOCRES No. 30M5-195DIST. 4 REGION W.P. No. 229-77-01CONT. No. 96-66W. O. No. STR. SITE No. HWY. No. 403LOCATION Hwy 403 from Sugar Rd.
to Main St. - H.M.L.No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO. 96-66



Ontario

**Ministry of
Transportation**

INDEX

<u>Page No:</u>	<u>DESCRIPTION</u>
1	Index
2	Abbreviations & Symbols
	Foundation Investigation Report for
3 - 23	High Mast Lighting Between Snake Road and Main Street W.P. 229-77-01 Hwy. 403, Central Region

Note: For purposes of the contract, this report supersedes all other Foundation Reports prepared by, or for the Ministry in connection with the above-mentioned project.

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 1" 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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
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

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	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 = $\frac{c_u}{\tau_r}$

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 ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

FOUNDATION INVESTIGATION REPORT
For
High Mast Lighting
Hwy. 403, Between Snake Rd and Main Street
W.P. 229-77-01
Hwy. 403, Central Region

INTRODUCTION

This report presents the soil information for the proposed high mast lights at the above mentioned sites. Soil information was obtained by drilling 15 boreholes (BH 1 through BH 15). This report is produced at the request of Central Region Structural Section.

SITE DESCRIPTION

The high mast lighting poles will be located along Hwy 403 between Snake Road and Main Street underpass. The site is located in Burlington, in the MTO Central Region.

INVESTIGATION PROCEDURES

The fieldwork was carried out between 94 12 12 and 94 12 19 and consisted of 15 sampled boreholes (BH 1 through BH 15) advanced to depths ranging from 3.5m to 9.6m below ground surface.

The boreholes were advanced using a CME 55 track mounted auger machines equipped with solid stem augers.

Sampling was carried out at each borehole location by means of a 50mm O.D. split spoon sampler driven into the soil according to the specifications of the Standard Penetration Test (ASTM D 1586).

Groundwater levels were obtained by monitoring the levels in the open boreholes throughout the duration of the field investigation. All boreholes were backfilled at the completion of the fieldwork.

SUBSURFACE CONDITIONS

General

Since, the site for the proposed high mast lighting poles is stretched within 4.3 km, and the boreholes are up to 400m apart, the soil condition throughout the site is quite variable. The soil condition ranges from silty clay within the entire depth of a borehole to entirely silty sand in some boreholes. Fill material was encountered in four boreholes, BH 1,2,4 and 5. The depth of fill material ranged from 2.3m (BH 1) to 8.7m (BH 4). The fill material consisted of silty sand to clayey silt material. However, in Borehole 4, where the fill was 8.7m deep, the fill consisted of mixture of silty sand, silty clay, wood chips, trace of glass and trace of wire etc. The fill material in Borehole 4 had strong garbage odour.

Subsurface conditions at the HML locations may be inferred from the closest boreholes.

The locations of the boreholes are shown on the attached Drawings 2297701-A & B.

Groundwater Conditions

Groundwater was encountered in six (BH 2,3,4,5,7 and 8) out of 15 boreholes. The groundwater table ranged from 74.5m (BH 3) to 83.2m (BH 7). The groundwater depth below ground surface ranged from 1.8m (BH 4) to 7.9m (BH 3). Six boreholes, BH 9,10,11,12,13 and 14 where the boreholes were terminated at shallow depths of 3.5m to 4.3m within shale bedrock, the boreholes remained dry. For groundwater information at each HML locations reference is made to the attached borehole logs.

MISCELLANEOUS

The fieldwork for the Foundation investigation was carried out under the supervision of Sameh Asaad, a trainee engineer using equipment owned and operated by Canadian Soil Drilling. This report was prepared by K.S.Q. Ahmad, Foundation Engineer, reviewed and approved by D. Dundas, Senior Foundation Engineer.



A handwritten signature in black ink that reads 'D. Dundas'.

D. Dundas, P. Eng.
Senior Foundation Engineer

APPENDIX

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 791 215, E 272 855 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 12 CHECKED BY KA

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	WATER CONTENT (%) w	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa 20 40 60 80 100 • UNCONFINED + FIELD VANE • QUICK TRIAXIAL * LAB VANE										
81.8	Ground Surface																	
0.0	Silty Sand to Sandy Silt Some Gravel, Trace of Glass Piece Brown, Dry Compact to Dense (Till)		1	SS	46	DRY *	81											
			2	SS	21		80											
79.3																		
2.3	Silty Clay to Clayey Silt Trace of Gravel, Trace of Sand Moist, Reddish Brown to Greyish Brown Firm to Stiff		3	SS	14		79											
			4	SS	7		78											
			5	SS	7		77											
			6	SS	11		76											
			7	SS	10		75											
			8	SS	8		74											
			9	SS	7		73											
72.0			10	SS	7													
9.6	End of Borehole																	

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 791 605, E 272 885 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 12 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
80.1	Ground Surface																
0.0	Gravelly Sand, Trace of Organic Some Silt, Some Sand Brown, Moist Loose (Fill)		1	SS	7												
			2	SS	7												
			3	SS	4												
			4	SS	11												
	Silty Clay to Clayey silt Trace of Organic, Piece of Wood Brown, Moist Soft (Fill)		5	SS	3												
			6	SS	2												
74.2			7	SS	3												
5.9			8	SS	5												
			9	SS	14												
	Silty Clay to Clayey Silt Moist, Brown Firm to Stiff																
70.5			10	SS	9												
9.6	End of Borehole																

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 791 970, E 272 915 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 12 CHECKED BY KA

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL * LAB VANE									
							20 40 60 80 100					WATER CONTENT (%) 10 20 30					
82.4	Ground Surface																
0.0							82										
	Silty Clay, Moist Reddish Brown Stiff to Hard		1	SS	11		81										
			2	SS	35		80										
80.0																	
2.4			3	SS	81												
	Silty sand Occ. Silty Clay Pockets Brown, Moist Compact to V. Dense		4	SS	35		79										
			5	SS	10		78										
78.0																	
4.4			6	SS	21		77										
	Clayey silt, Some Sand Brown, Moist V. Stiff																
76.9			7	SS	95	/28cm	76										
5.5			8	SS	61		75										
	Silty Sand Brown, Damp Compact to V. Dense		9	SS	35		74										
72.8			10	SS	28		73										
9.6	End of Borehole																

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords: N 4 792 360 E 272 940 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 14 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
78.8	Ground Surface																
0.0	Mixture of Silty Sand and Silty Clay Some Wood, Trace of Glass, Trace of Wire, Some Shale Fragments Brown, Dry to Wet Loose/Soft to Firm (Strong Garbage Odour) (Fill)		1	SS	23												
			2	SS	5												
			3	SS	2												
			4	SS	3												
			5	SS	8												
			6	SS	2												
			7	SS	4												
			8	SS	3												
			9	SS	3												
			10	SS	5												
70.1																	
8.7	Cloey Silt, Brown Moist, Firm																
69.2																	
9.6	End of Borehole																

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

W.P. 229-77-01

LOCATION Coords.: N 4 792 755, E 272 905

ORIGINATED BY SA

DIST 4 HWY 403

BOREHOLE TYPE Solid Stem Auger

COMPILED BY SA

DATUM Geodetic

DATE 1994 12 19

CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
83.1	Ground Surface																
0.0			1	SS	40												
			2	SS	18												
			3	SS	10												
			4	SS	12												
			5	SS	16												
			6	SS	47												
77.9	Gravelly Sand		7	SS	19												
5.2			8	SS	34												
			9	SS	65												
			10	SS	110	/21cm											
73.5																	
9.6	End of Borehole																

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords: N 4 793 102, E 272 970 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 14 CHECKED BY KA

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
85.5	Ground Surface													
0.0	Silty Sand to Sandy Silt Trace of Gravel Brown, Moist Loose to V. Dense		1	SS	8	DRY *	85							
			2	SS	7		84							
			3	SS	11		83							
			4	SS	6		82							
			5	SS	5		81							
			6	SS	5		80							
			7	SS	5		79							
			8	SS	8		78							
			9	SS	28		77							
75.9			10	SS	55		76							
9.6	End of Borehole													

RECORD OF BOREHOLE No 7

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords: N 4 793 460, E 272 907 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 14 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
90.0	Ground Surface																
0.0			1	SS	42		89										
			2	SS	29		88										
	Silty Sand to Sandy Silt Brown, Moist Compact to V. Dense		3	SS	46		87										
			4	SS	44		86										
			5	SS	68		85										
			6	SS	69		84										
84.5			7	SS	84	/26cm	83										
5.5			8	SS	80		82										
	Clayey Silt Brown, Moist Hard		9	SS	52		81										
81.5																	
8.5																	
	Silty Sand Brown, Moist V. Dense		10	SS	87												
80.4																	
9.6	End of Borehole																

RECORD OF BOREHOLE No 8

1 OF 1

METRIC

W.P. 229-77-01

LOCATION Coords.: N 4 793 775, E 272 655

ORIGINATED BY SA

DIST 4 HWY 403

BOREHOLE TYPE Solid Stem Auger

COMPILED BY SA

DATUM Geodetic

DATE 1994 12 19

CHECKED BY KA

SOIL PROFILE

SAMPLES

GROUND WATER CONDITIONS

ELEVATION SCALE

DYNAMIC CONE PENETRATION RESISTANCE PLOT

20 40 60 80 100

SHEAR STRENGTH kPa

• UNCONFINED + FIELD VANE

• QUICK TRIAXIAL * LAB VANE

20 40 60 80 100

PLASTIC
LIMIT

NATURAL
MOISTURE
CONTENT

LIQUID
LIMIT

W_p

W

W_L

WATER CONTENT (%)

10 20 30

UNIT
WEIGHT

γ

KN/m³

REMARKS
&
GRAIN SIZE
DISTRIBUTION
(%)

GR SA SI CL

ELEV
DEPTH

DESCRIPTION

STRAT PLOT

NUMBER

TYPE

'N' VALUES

82.4

Ground Surface

0.0

Silty Clay With Traces of
Shale Fragments
Reddish Gray to Reddish Brown
Moist to Wet
Stiff to Hard

1

SS

24

2

SS

32

3

SS

25

4

SS

20

5

SS

15

6

SS

22

7

SS

18

8

SS

19

9

SS

19

72.8

End of Borehole

9.6

RECORD OF BOREHOLE No 9

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 125, E 272 575 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 19 CHECKED BY KA



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
91.5	Ground Surface																
0.0	Silty Clay					DRY *											
90.7																	
0.8	Weathered Shale Red, Dry		1	SS	70	/21cm											
			2	SS	70	/8cm											
88.0			3	SS	70	/3cm											
3.5	End of Borehole																

RECORD OF BOREHOLE No 10

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 410, E 272 740
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger
 DATUM Geodetic DATE 1994 12 15
 ORIGINATED BY SA
 COMPILED BY SA
 CHECKED BY KA

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 kPa										WATER CONTENT (%)
								20 40 60 80 100										
100.5	Ground Surface																	
0.0	Silty Clay Reddish Brown, Dry V. Stiff (Glacial Till)					DRY *	100											
			1	SS	20													
			2	SS	18													
97.6			3	SS	21		98											
2.9	Weathered Shale Red to Grey, Dry					/15cm	97											
			4	SS	55													
			5	SS	100													
96.2						/13cm												
4.3	End of Borehole																	

RECORD OF BOREHOLE No 11

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords: N 4 794 610, E 272 955 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 15 CHECKED BY KA

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80
104.6	Ground Surface															
0.0	Silty Clay					DRY *										
103.8							104									
0.8																
	Weathered Shale Grey to Red, Dry		1	SS	100	/13cm										
			2	SS	85		103									
							102									
101.1			3	SS	70	/15cm										
3.5	End of Borehole															

RECORD OF BOREHOLE No 12

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 820, E 273 115
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger
 DATUM Geodetic DATE 1994 12 16
 ORIGINATED BY SA
 COMPILED BY SA
 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa								
104.0	Ground Surface															
0.0	Silty Clay					DRY *										
103.2																
0.8			1	SS	70	/3cm	103									
	Weathered Shale Grey to Red, Dry		2	SS	100	/8cm	102									
100.5			3	SS	100	/5cm	101									
3.5	End of Borehole															

RECORD OF BOREHOLE No 13

1 OF 1

METRIC

W.P. 229-77-01

LOCATION Coords: N 4 794 935, E 273 420

ORIGINATED BY SA

DIST 4 HWY 403

BOREHOLE TYPE Solid Stem Auger

COMPILED BY SA

DATUM Geodetic

DATE 1994 12 15

CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	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 80 100	W _p W W _L	10 20 30		
105.5	Ground Surface												
0.0	Silty Clay With Shale Fragments Grey, Dry		1	SS	55	DRY *							
104.1													
1.4	Weathered Shale Red, Dry		2	SS	100	/15cm							
102.0													
3.5	End of Borehole		3	SS	90	/15cm							

RECORD OF BOREHOLE No 14

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 690, E 272 885
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger
DATUM Geodetic DATE 1994 12 16
ORIGINATED BY SA
COMPILED BY SA
CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE (kPa)					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
101.4	Ground Surface																
0.0	Silty Clay					DRY *	101										
100.6							100										
0.8	Weathered Shale Grey to Red, Dry		1	SS	70	/0cm											
			2	SS	70	/0cm											
							99										
97.9			3	SS	70	/3cm	98										
3.5	End of Borehole																

RECORD OF BOREHOLE No 15

1 OF 1

METRIC

W.P. 229-77-01

LOCATION Coords: N 4 794 910, E 272 740

ORIGINATED BY SA

DIST 4 HWY 403

BOREHOLE TYPE Solid Stem Auger

COMPILED BY SA

DATUM Geodetic

DATE 1994 12 16

CHECKED BY KA

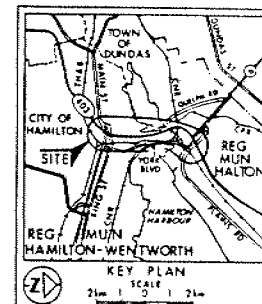
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
116.9	Ground Surface													
0.0						DRY *								
			1	SS	20		116							
			2	SS	21		115							
			3	SS	17		114							
			4	SS	36		113							
			5	SS	18		112							
			6	SS	36		111							
			7	SS	19		110							
			8	SS	20		109							
			9	SS	90	/15cm	108							
107.3			10	SS	34									
9.6	End of Borehole													

Silty Clay, Trace of Gravel
Red, Moist
(Glacial Till)

CONT No
WP No 229-77-01

HIGH MAST LIGHTING
HWY 403, BETWEEN SNAKE RD & MAIN ST
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- ◆ Bare Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ◆ Bare Hole & Cone
- N Blows/0.3m (Sid Pen Test, 475 l/blow)
- CONE Blows/0.3m (60° Cone, 425 l/blow)
- ◆ Wt at time of investigation 1998/2

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	81.6	4 791 215	272 855
2	80.3	4 791 605	272 885
3	82.4	4 791 790	272 915
4	78.8	4 792 360	272 960
5	81.1	4 792 755	272 905
6	85.5	4 793 102	272 970
7	90.0	4 793 460	272 907
8	82.4	4 793 775	272 655
9	91.5	4 798 125	272 575

—NOTES—

NOTE
The boundaries between soil types have been established only at Bare Hills locations. Between Bare Hills 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 restricted in accordance with the conditions of Section 93.2(1) of the Access to Information Act.

DATE	BT	DESCRIPTION
GORDON, NIP 30MS-195		
PART No. 603		10 SF 4
SUBORD EA CHECKED BY DATE 1995 04 14 1515		
DRAWING DT CHECKED BY 11/11/95		THICK 1.500000

NOTE
For Soil details refer to
Record of Borehole Sheets



REF. FROM PARKER CONSISTANTS. Page No. 403-1 to 403-17

PLANS
SCALES
40m 0 40m

DESIGNED BY: S. S. AHMAD, CIVIL ENGINEER, P.E. 1997, A.S.C.E.

METRIC

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

CONT No
WP No 229-77-01



HIGH MAST LIGHTING
HWY 403, BETWEEN SNAKE RD & MAIN ST
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

SEE DWG No 2297701-A

KEY PLAN
SCALE

LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ◆ Bore Hole & Cone
- N Blows/0.3m (5/6 Pen Test, 475 1/blow)
- CONE Blows/0.3m (60" Cone, 475 1/blow)
- ⬇ W.L. at time of investigation 1994 12

No.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
10	100.5	4 794 410	272 740
11	104.5	4 794 610	272 955
12	104.0	4 794 820	273 175
13	105.5	4 794 935	273 420
14	101.4	4 794 690	272 885
15	116.9	4 794 910	272 740

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 obtained at the Engineering Department Office, Government Information Centres in this report and related documents is specifically excluded in accordance with the conditions of Section 2.01 of OPS Can Code.

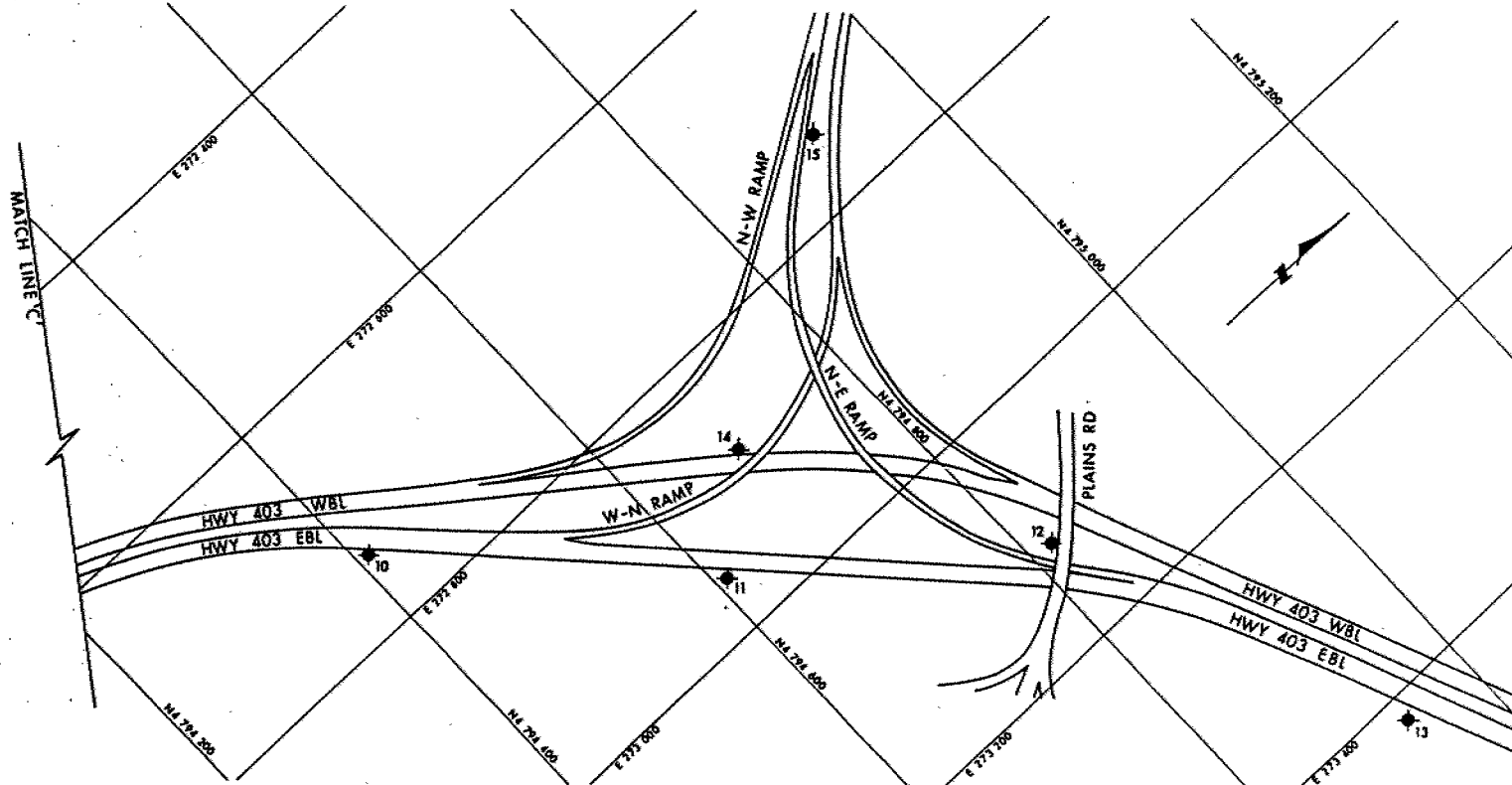
DATE	BY	DESCRIPTION
1995 04 08	S.S. AHMAD	Geotechnical - 30M5 - 193
1995 04 08	S.S. AHMAD	SWR No. 203
1995 04 08	S.S. AHMAD	SUBMITTAL CHECKED BY DATE 1995 04 08 SITE
1995 04 08	S.S. AHMAD	CHIEF OF CHIEFED BY DATE 1995 04 08 SITE

NOTE

For Soil details refer to
Record of Borehole Sheets



REF Plan from PARKER CONSULTANTS Plans No's 403-12 to 403-17



PLAN

SCALE
0 10m



Ministry
of
Transportation

FILE

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

**ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION**

CONT 96-66
WP 229-77-01 REGION Central
HWY 403 STR SITE -

High Mast Lighting
Hwy. 403, Between Snake Rd. and Main Street

DISTRIBUTION

V.F. Boehnke (3)
D. Billings
W. Peck (2)
B. Peltier (3)
M. Holowka
J. Robinson
E.A. Joseph
F. Bacchus (Cover Only)
File ✓

GEOCRES 30M5-195

DATE

APR 27 1995

FOUNDATION INVESTIGATION REPORT
For
High Mast Lighting
Hwy. 403, Between Snake Rd and Main Street
W.P. 229-77-01
Hwy. 403, Central Region

INTRODUCTION

This report presents the soil information for the proposed high mast lights at the above mentioned sites. Soil information was obtained by drilling 15 boreholes (BH 1 through BH 15). This report is produced at the request of Central Region Structural Section.

SITE DESCRIPTION

The high mast lighting poles will be located along Hwy 403 between Snake Road and Main Street underpass. The site is located in Burlington, in the MTO Central Region.

INVESTIGATION PROCEDURES

The fieldwork was carried out between 94 12 12 and 94 12 19 and consisted of 15 sampled boreholes (BH 1 through BH 15) advanced to depths ranging from 3.5m to 9.6m below ground surface.

The boreholes were advanced using a CME 55 track mounted auger machines equipped with solid stem augers.

Sampling was carried out at each borehole location by means of a 50mm O.D. split spoon sampler driven into the soil according to the specifications of the Standard Penetration Test (ASTM D 1586).

Groundwater levels were obtained by monitoring the levels in the open boreholes throughout the duration of the field investigation. All boreholes were backfilled at the completion of the fieldwork.

SUBSURFACE CONDITIONS

General

Since, the site for the proposed high mast lighting poles is stretched within 4.3 km, and the boreholes are up to 400m apart, the soil condition throughout the site is quite variable. The soil condition ranges from silty clay within the entire depth of a borehole to entirely silty sand in some boreholes. Fill material was encountered in four boreholes, BH 1,2,4 and 5. The depth of fill material ranged from 2.3m (BH 1) to 8.7m (BH 4). The fill material consisted of silty sand to clayey silt material. However, in Borehole 4, where the fill was 8.7m deep, the fill consisted of mixture of silty sand, silty clay, wood chips, trace of glass and trace of wire etc. The fill material in Borehole 4 had strong garbage odour.

Subsurface conditions at the HML locations may be inferred from the closest boreholes.

The locations of the boreholes are shown on the attached Drawings 2297701-A & B.

Groundwater Conditions

Groundwater was encountered in six (BH 2,3,4,5,7 and 8) out of 15 boreholes. The groundwater table ranged from 74.5m (BH 3) to 83.2m (BH 7). The groundwater depth below ground surface ranged from 1.8m (BH 4) to 7.9m (BH 3). Six boreholes, BH 9,10,11,12,13 and 14 where the boreholes were terminated at shallow depths of 3.5m to 4.3m within shale bedrock, the boreholes remained dry. For groundwater information at each HML locations reference is made to the attached borehole logs.

DISCUSSION AND RECOMMENDATIONS

It is proposed to install 30 high mast lighting poles (P1 through P30) along Hwy 403 between west of Snake Road and Main Street underpass. The details of high mast lighting poles locations and elevations are attached to this report in Appendix A. For soil condition details at any high mast light location, reference is made to the attached log sheets and Table 1 (Reference Borehole Numbers).

The High Mast Lighting poles will be founded on single reinforced concrete caissons. The foundations for HML should be designed in accordance with the methods described by B.B. Broms in the following two papers:

Broms, B.B.; Lateral Resistance of Piles in Cohesive Soils,
Journal of the Soil Mechanics and Foundations Division,
ASCE, Vol.90, No.SM2, Paper 3825, March 1964.

Broms, B.B.; Lateral Resistance of Piles in Cohesionless Soils,
Journal of the Soil Mechanics and Foundations Division,
ASCE, Vol.90, No.SM3, Paper 3909, May 1964.

It is understood that there will be minor grade changes at the HML pole locations. However, some of the poles will be installed on top of tall wall barrier.

Cut Considerations

If the grade is to be lowered at the pole locations then, the most critical lowest surface elevations should be assumed for design purposes.

Fill Considerations

It should be assumed that the existing or proposed fill will not provide any lateral resistance unless it is carefully engineered.

For any proposed fill, any organic and soft material should be removed before placing the fill material. The fill material should consist of acceptable soil free of organic. The fill should be placed and compacted as per MTO standard.

For design purposes following parameters should be used taking into consideration that only half of the fill height would provide lateral support:

$$\phi = 30^\circ$$

$$\gamma = 20 \text{ kN/m}^3$$

It should be assumed that soil in the zone of frost penetration does not provide any lateral resistance. The depth of frost penetration at this site is 1.2m.

Slope Considerations

For HML poles near slopes, the caisson should be a minimum 3m from the crest of the 2H:1V down slope. The upper 50% of the embedment length within the embankment (taken from frost penetration depth) should be disregarded for lateral resistance. If the caisson for HML foundations are constructed at a distance of 3m from the crest of a 3H:1V and 4H:1V slopes the reduction in embedment length would be 25% and 0% respectively.

The design values at each of the HML locations are as follows:

SOIL PARAMETERS AT EACH HIGH MAST LIGHT POLES

HML Poles	W.L. Elev (m)	Elev (m) From - To	Soil Type	ϕ (Deg)	Q_u kPa	γ kN/m ³
P1	Dry	116.9 - 107.3	Cohesive	0	300	20.4
P2	Dry	116.9 - 107.3	Cohesive	0	300	20.4
P3	Dry	101.4 - 100.6 Below 100.6	Cohesive Shale BR	0 0	100 600	19.6 22.5

P4	Dry	101.4 - 100.6 Below 100.6	Cohesive Shale BR	0 0	100 600	19.6 22.5
P5	Dry	105.5 - 104.1 Below 104.1	Cohesive Shale BR	0 0	200 600	20.0 22.5
P6	Dry	105.5 - 104.1 Below 104.1	Cohesive Shale BR	0 0	200 600	20.0 22.5
P7	Dry	104.0 - 103.2 Below 103.2	Cohesive Shale BR	0 0	100 600	19.6 22.5
P8	Dry	104.0 - 103.2 Below 103.2	Cohesive Shale BR	0 0	100 600	19.6 22.5
P9	Dry	104.6 - 103.8 Below 103.8	Cohesive Shale BR	0 0	100 600	19.6 22.5
P10	Dry	104.6 - 103.8 Below 103.8	Cohesive Shale BR	0 0	100 600	19.6 22.5
P11	Dry	100.5 - 97.6 Below 97.6	Cohesive Shale BR	0 0	200 600	20.0 22.5
P12	Dry	100.5 - 97.6 Below 97.6	Cohesive Shale BR	0 0	200 600	20.0 22.5
P13	Dry	91.5 - 90.7 Below 90.7	Cohesive Shale BR	0 0	100 600	19.6 22.5
P14	Dry	91.5 - 90.7 Below 90.7	Cohesive Shale BR	0 0	100 600	19.6 22.5
P15	75.7	82.4 - 72.8	Cohesive	0	200	20.2
P16	75.7	82.4 - 72.8	Cohesive	0	200	20.2
P17	83.3	90.0 - 84.5 84.5 - 81.5 Below 81.5	Non Cohesive Cohesive Non Cohesive	32 0 35	0 500 0	20.2 21.2 21.2
P18	83.3	90.0 - 84.5 84.5 - 81.5 Below 81.5	Non Cohesive Cohesive Non Cohesive	32 0 35	0 500 0	20.2 21.2 21.2
P19	Dry	85.5 - 78.3 78.3 - 75.9	Non Cohesive Non Cohesive	28 32	0 0	19.6 20.2

P20	Dry	85.5 - 78.3 78.3 - 75.9	Non Cohesive Non Cohesive	28 32	0 0	19.6 20.2
P21	76.3	83.1 - 77.9 77.9 - 73.5	Fill Non Cohesive	* 32	* 0	* 20.2
P22	76.3	83.1 - 77.9 77.9 - 73.5	Fill Non Cohesive	* 32	* 0	* 20.2
P23	77.0	78.8 - 70.1 Below 70.1	Fill Cohesive	** 0	** 50	** 19.2
P24	77.0	78.8 - 70.1 Below 70.1	Fill Cohesive	** 0	** 50	** 19.2
P25	74.5	82.4 - 80.0 80.0 - 72.8	Cohesive Non Cohesive	0 32	150 0	19.6 20.2
P26	74.5	82.4 - 80.0 80.0 - 72.8	Cohesive Non Cohesive	0 32	150 0	19.6 20.2
P27	77.9	80.1 - 74.2 Below 74.2	Fill Cohesive	* 0	* 80	* 19.2
P28	77.9	80.1 - 74.2 Below 74.2	Fill Cohesive	* 0	* 80	* 19.2
P29	Dry	81.6 - 79.3 79.3 - 72.0	Fill Cohesive	* 0	* 80	* 19.2
P30	Dry	81.6 - 79.3 79.3 - 72.0	Fill Cohesive	* 0	* 80	* 19.2

Where:

HML = High Mast Lighting

ϕ = Apparent angle of internal friction for non-cohesive Soils

Q_u = Unconfined Compressive Strength (kPa)

γ = Unit Weight (kN/m³)

Notes:

- * Foundation design for HML footing within the 'fill' will be as outlined in section 'Fill Consideration'.
- ** The 'fill' will not provide any lateral resistance. Borehole 4 which encountered 8.7m of bad fill, was put down between HML 23 and 24 locations and represents soil conditions at those two locations. Although, the soil condition may be different at HML 23 and 24 from what encountered in BH4, the HML foundations for HML 23 and 24 should be designed assuming that the soil within 8.7m will not provide any lateral support.

Construction Consideration:

It is recommended that a non-standard special provision for the construction of HML foundations, should be incorporated in the contract. A copy of the latest NSSP is appended in this report (Appendix 'B') for reference. The contractor should be advised that variable types of subsurface material may be encountered at the high mast light pole locations; and that the soil descriptions in this report are generalized and not site specific. For construction planning purposes it may be assumed that;

- Groundwater is at or near the surface.
- Cohesionless material may be encountered and it would be susceptible to disturbance under conditions of unbalanced hydrostatic head.
- Glacial deposits are anticipated and there is a probability that occasional cobbles and boulders may be encountered within the deposit.

The Contractor is responsible for constructing the high mast pole foundations without disturbing the material at the sides or bases of the foundations. His proposal should be capable of dealing with the above-noted site condition. The Contractor shall submit eight copies of his proposed construction method to the Engineer for review a minimum of 15 working days prior to the commencement of construction of these foundation elements.

Miscellaneous

The fieldwork for the Foundation investigation was carried out under the supervision of Sameh Asaad, a trainee engineer using equipment owned and operated by Canadian Soil Drilling. This report was prepared by K.S.Q. Ahmad, Foundation Engineer, reviewed and approved by D. Dundas, Senior Foundation Engineer.



A handwritten signature in cursive script, appearing to read "K.S.Q. Ahmad".

K.S.Q. Ahmad, P. Eng.
Foundation Engineer



A handwritten signature in cursive script, appearing to read "D. Dundas".

D. Dundas, P. Eng.
Senior Foundation Engineer

W.P. 229-77-01

TABLE 1

REFERENCE BOREHOLE NUMBERS AND GRADE DETAILS

HML Pole Nos	Reference B.H. No	Ground Elev at Boreholes (m)	HML Pole Nos	Reference B.H. No	Ground Elev at Boreholes (m)
P1	15	116.9	P16	8	82.4
P2	15	116.9	P17	7	90.0
P3	14	101.4	P18	7	90.0
P4	14	101.4	P19	6	85.5
P5	13	105.5	P20	6	85.5
P6	13	105.5	P21	5	83.1
P7	12	104.0	P22	5	83.1
P8	12	104.0	P23	4	78.8
P9	11	104.6	P24	4	78.8
P10	11	104.6	P25	3	82.4
P11	10	100.5	P26	3	82.4
P12	10	100.5	P27	2	80.1
P13	9	91.5	P28	2	80.1
P14	9	91.5	P29	1	81.6
P15	8	82.4	P30	1	81.6

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 791 215, E 272 855 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 12 CHECKED BY KA

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					
81.8	Ground Surface																
0.0	Silty Sand to Sandy Silt Some Gravel, Trace of Glass Piece Brown, Dry Compact to Dense (Till)		1	SS	46	DRY *	81										
			2	SS	21		80										
79.3																	
2.3	Silty Clay to Clayey Silt Trace of Gravel, Trace of Sand Moist, Reddish Brown to Greyish Brown Firm to Stiff		3	SS	14		79										
			4	SS	7		78										
			5	SS	7												
			6	SS	11		77										
			7	SS	10		76										
			8	SS	6		75										
			9	SS	7		74										
72.0			10	SS	7		73										
9.6	End of Borehole																

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 791 605, E 272 885 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 12 CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	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			20	40	60	80	100	W _p	W	W _L		
80.1	Ground Surface															
0.0																
	Gravelly Sand, Trace of Organic Some Slag, Some Sand Brown, Moist Loose (Fill)		1	SS	7											
			2	SS	7											
			3	SS	4											
			4	SS	11											
	Silty Clay to Clayey silt Trace of Organic, Piece of Wood Brown, Moist Soft (Fill)		5	SS	3											
			6	SS	2											
			7	SS	3											
74.2																
5.9			8	SS	5											
	Silty Clay to Clayey Silt Moist, Brown Firm to Stiff		9	SS	14											
70.5			10	SS	9											
9.6	End of Borehole															

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 791 970, E 272 915 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 12 CHECKED BY KA

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					
82.4	Ground Surface																
0.0							82										
	Silty Clay, Moist Reddish Brown Stiff to Hard		1	SS	11		81										
			2	SS	35		80										
80.0			3	SS	61		79										
2.4	Silty sand Occ. Silty Clay Pockets Brown, Moist Compact to V. Dense		4	SS	35		78										
			5	SS	10		77										
78.0			6	SS	21		76										
4.4	Clayey silt, Some Sand Brown, Moist V. Stiff		7	SS	95	/28cm	75										
76.9			8	SS	61		74										
5.5			9	SS	35		73										
	Silty Sand Brown, Damp Compact to V. Dense		10	SS	28												
72.8																	
9.6	End of Borehole																

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 792 360, E 272 940 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 14 CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W			W _L
78.8	Ground Surface																
0.0	Mixture of Silty Sand and Silty Clay Some Wood, Trace of Glass, Trace of Wire, Some Shale Fragments Brown, Dry to Wet Loose/Soft to Firm (Strong Garbage Odour) (Fill)		1	SS	23												
			2	SS	5												
			3	SS	2												
			4	SS	3												
			5	SS	8												
			6	SS	2												
			7	SS	4												
			8	SS	3												
			9	SS	3												
70.1																	
8.7	Clayey Silt, Brown Moist, Firm																
69.2			10	SS	5												
9.6	End of Borehole																

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 792 755, E 272 905 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 19 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ KN/m ³	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 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	W _p	W	W _L		
83.1	Ground Surface																
0.0			1	SS	40		82										
			2	SS	18		81										
			3	SS	10		80										
			4	SS	12		79										
			5	SS	16		78										
			6	SS	47		77										
77.9	Gravelly Sand		7	SS	19		76										
5.2			8	SS	34		75										
			9	SS	65		74										
			10	SS	110	/21cm											
73.5																	
9.6	End of Borehole																

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 793 102, E 272 970 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 14 CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W			W _L
85.5	Ground Surface																
0.0	Silty Sand to Sandy Silt Trace of Gravel Brown, Moist Loose to V. Dense		1	SS	8	DRY *											
			2	SS	7												
			3	SS	11												
			4	SS	6												
			5	SS	5												
			6	SS	5												
			7	SS	5												
			8	SS	8												
			9	SS	28												
			10	SS	55												
75.9																	
9.6	End of Borehole																

RECORD OF BOREHOLE No 7

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 793 480, E 272 907 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 14 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
90.0	Ground Surface																
0.0			1	SS	42												
			2	SS	29												
			3	SS	46												
			4	SS	44												
			5	SS	68												
			6	SS	69												
84.5			7	SS	84												
5.5			8	SS	80												
			9	SS	52												
81.5																	
8.5																	
80.4			10	SS	87												
9.6	End of Borehole																

RECORD OF BOREHOLE No 9

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 125, E 272 575 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 19 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
91.5	Ground Surface																
0.0	Silty Clay					DRY *											
90.7																	
0.8			1	SS	70	/21cm											
			2	SS	70	/8cm											
	Weathered Shale Red, Dry																
88.0			3	SS	70	/3cm											
3.5	End of Borehole																

RECORD OF BOREHOLE No 10

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 410, E 272 740 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 15 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	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 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	W _p	W	W _L		
100.5	Ground Surface																
0.0						DRY *	100										
	Silty Clay Reddish Brown, Dry V. Stiff (Glacial Till)		1	SS	20		99										
			2	SS	18		98										
97.6			3	SS	21		97										
2.9	Weathered Shale Red to Grey, Dry		4	SS	55	/15cm											
96.2			5	SS	100	/13cm											
4.3	End of Borehole																

RECORD OF BOREHOLE No 11

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 610, E 272 955 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 15 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
104.6	Ground Surface																
0.0	Silty Clay					DRY *											
103.8																	
0.8	Weathered Shale Grey to Red, Dry		1	SS	100	/13cm											
			2	SS	85												
101.1			3	SS	70	/15cm											
3.5	End of Borehole																

RECORD OF BOREHOLE No 12

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 820, E 273 115 ORIGINATED BY SA
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
DATUM Geodetic DATE 1994 12 16 CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
104.0	Ground Surface															
0.0	Silty Clay															
103.2																
0.8	Weathered Shale Grey to Red, Dry		1	SS	70	/3cm	103									
			2	SS	100	/8cm	102									
							101									
100.5			3	SS	100	/5cm										
3.5	End of Borehole															

RECORD OF BOREHOLE No 13

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 935, E 273 420 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 15 CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
105.5	Ground Surface															
0.0	Silty Clay With Shale Fragments Grey, Dry		1	SS	55	DRY *										
104.1																
1.4	Weathered Shale Red, Dry		2	SS	100	/15cm										
102.0			3	SS	90	/15cm										
3.5	End of Borehole															

RECORD OF BOREHOLE No 14

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 690, E 272 885 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 16 CHECKED BY KA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
101.4	Ground Surface															
0.0	Silty Clay					DRY *										
100.6																
0.8	Weathered Shale Grey to Red, Dry		1	SS	70	/0cm										
			2	SS	70	/0cm										
97.9			3	SS	70	/3cm										
3.5	End of Borehole															

RECORD OF BOREHOLE No 15

1 OF 1

METRIC

W.P. 229-77-01 LOCATION Coords.: N 4 794 910, E 272 740 ORIGINATED BY SA
 DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger COMPILED BY SA
 DATUM Geodetic DATE 1994 12 16 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _P	W	W _L		
116.9	Ground Surface																
0.0						DRY											
			1	SS	20												
			2	SS	21												
			3	SS	17												
			4	SS	36												
			5	SS	18												
			6	SS	36												
			7	SS	19												
			8	SS	20												
			9	SS	90	/15cm											
			10	SS	34												
107.3																	
9.6	End of Borehole																

APPENDIX 'A'

DETAILS OF HIGH MAST POLES

W.P. NO. 229-77-01

Highway 403 - Highway 6 to Main Street

High Mast Lighting Pole Locations - From Highway 6 to York Boulevard

Pole No.	Coordinates		Location	Station	Offset (m)	Side	Notes
	Easting	Northing					
P1	272675.0	4794950.0	N-E Ramp	10+550	23.1	LT	1
P2	272790.0	4794860.0	N-E Ramp	10+408	13.5	RT	1
P3	272927.0	4794795.0	N-E Ramp	10+242	26	RT	1
P4	272840.0	4794731.0	W-N Ramp	10+225	51.5	LT	1
P5	273525.5	4795013.2	Hwy. 403	10+629.6	0	-	1,5
P6	273341.7	4794934.4	Hwy. 403	10+429.6	0	-	1,5
P7	273171.8	4794858.1	Hwy. 403	10+244.5	9	LT	1
P8	273061.9	4794792.1	Hwy. 403	10+120.3	30.2	LT	1
P9	272963.2	4794696.5	Hwy. 403	35+145.7	28.5	LT	1
P10	272865.2	4794602.2	Hwy. 403	35+009.7	27.4	LT	1
P11	272777.0	4794495.9	Hwy. 403	34+872.6	10.7	LT	1
P12	272658.8	4794355.6	Hwy. 403	34+690	0	-	2
P13	272574.2	4794190.0	Hwy. 403	34+503	0	-	2
P14	272555.4	4794013.4	Hwy. 403	34+324.4	0	-	2
P15	272597.6	4793846.1	Hwy. 403	34+151	0	-	2
P16	272695.3	4793697.4	Hwy. 403	33+972.5	0	-	2
P17	272808.9	4793558.4	Hwy. 403	33+793	0	-	2
P18	272909.5	4793419.3	Hwy. 403	33+621	0	-	3
P19	272957.5	4793232.2	Hwy. 403	33+426	1	LT	4
P20	272942.1	4793038.2	Hwy. 403	33+231	0	-	2
P21	272905.3	4792846.7	Hwy. 403	33+036	0	-	2
P22	272903.5	4792652.3	Hwy. 403	32+841	0	-	2
P23	272915.2	4792457.6	Hwy. 403	32+646	0	-	2
P24	272926.2	4792263.0	Hwy. 403	32+451	0	-	4

Pole No.	Coordinates		Location	Station	Offset (m)	Side	Notes
	Easting	Northing					
P25	272921.6	4792070.1	Hwy. 403	32+258	0	-	1
P26	272907.5	4791877.6	Hwy. 403	32+065	0	-	1,6
P27	272893.4	4791085.1	Hwy. 403	31+872	0	-	1,6
P28	272879.4	4791492.7	Hwy. 403	31+679	0	-	1,6
P29	272865.5	4791298.5	Hwy. 403	31+484	0	-	1,6
P30	272826.0	4791108.0	Hwy. 403EBL	31+285.1	12.1	LT	1,6

Notes

1. Poles P1 to P11 and P25 to P30 are assumed to be at the ultimate grade elevation.
2. Poles P12 to P17 and P20 to P23 will be installed on top of new tall wall barrier in the centre median.
3. Pole P18 will be installed on top of the existing tall wall barrier between Desjardins Canal and the York Blvd. Ramp structure.
4. Poles P19 and P24 will be installed on raised footings at elevation levelled with the top of the split tall walls in the centre median.
5. Barrier protection is required at locations of poles P5 and P6.
6. Installation of poles P26 to P30 within this contract is subject to the review by the MTO Freeway Design Section and the MTO Electrical Design Section, Central Region.

APPENDIX 'B'

NSSP FOR HIGH MAST POLE CONSTRUCTION

NON STANDARD SPECIAL PROVISION

Sheet _____ of _____
Date _____

WP NO _____ Contract No _____
Location _____

District No _____ Hwy No _____
Type of Work _____

This SP in new (✓) []
This SP replaces No _____
Remarks:

Explanation of Intent: To define High Mast Pole construction

Item No	Spec No	Title or Item Description
		CONCRETE FOOTING FOR HIGH MAST POLES

CONSTRUCTION

The Contractor is advised that variable types of subsurface material may be encountered at the high mast light pole locations; for addition information regarding soil conditions the Contractor is referred to the Foundation Investigation Report.

For bidding purposes it may be assumed that:

- Ground water is at or near the surface.
- If cohesionless material is encountered, it would be susceptible to disturbance under conditions of unbalanced hydrostatic head.
- If glacial deposits are encountered, there is a probability that occasional cobbles and boulders may be encountered within the deposit.

The Contractor is responsible for constructing the high mast pole foundations without disturbing the material at the sides or bases of the foundations. The Contractor shall submit eight copies of the proposed construction method to the Engineer for review a minimum of 15 working days prior to the commencement of construction of these foundation elements.

BASIS OF PAYMENT

Payment at the contract price for the above tender item shall be full compensation for all labour, equipment and materials required to do the work.

Initiated by _____

Detailed by _____

Approved by _____

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/0.3 m)	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 (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	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

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

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	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 = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

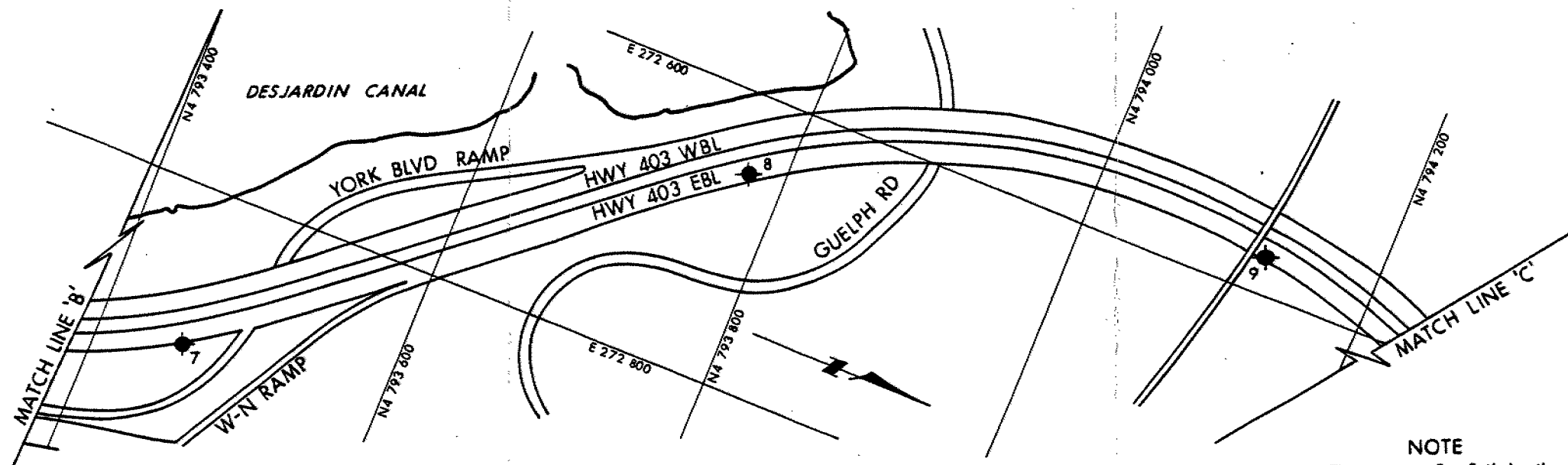
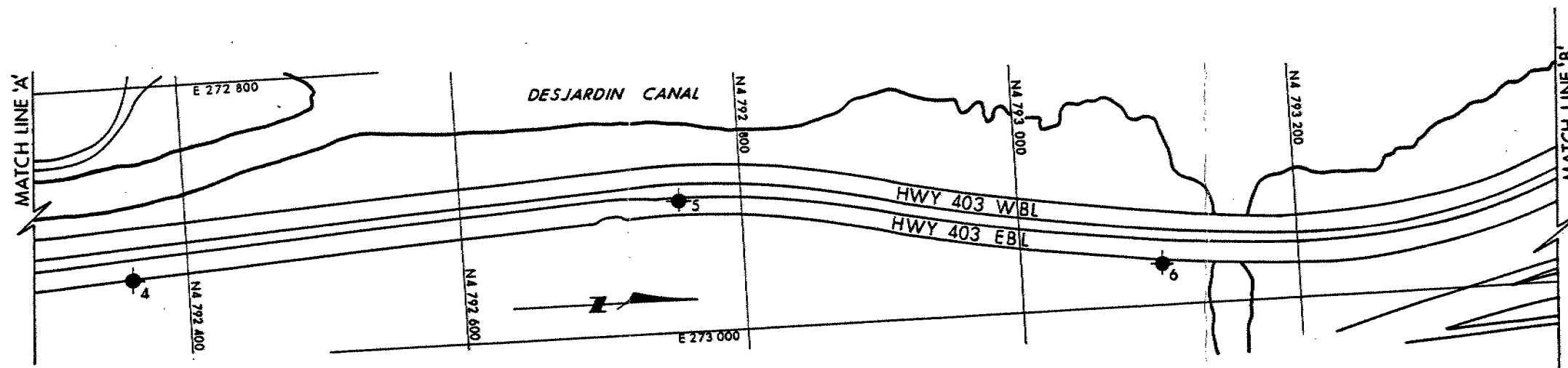
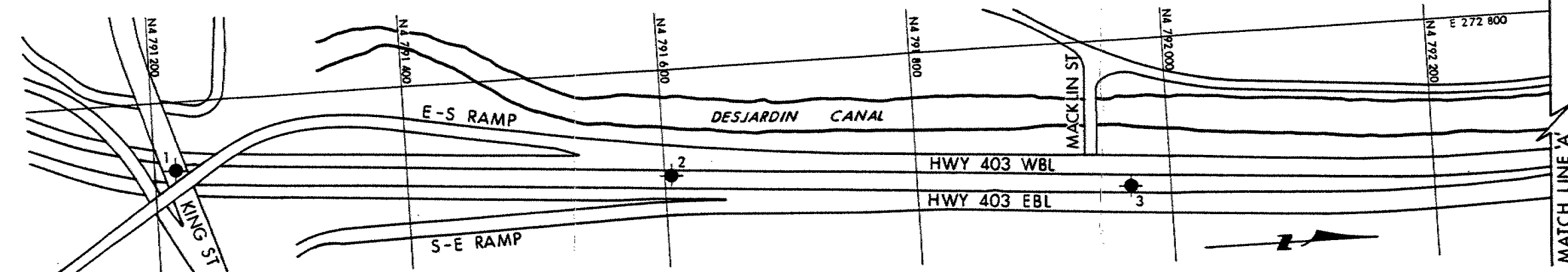
ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kn/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kn/m ³	UNIT 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 = $\frac{w_L - w_p}{w - w_p}$	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 ³	SEEPAGE FORCE
γ'	kn/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

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

CONT No
WP No 229-77-01

HIGH MAST LIGHTING
HWY 403, BETWEEN SNAKE RD & MAIN ST
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PLANS
SCALE
0 40m



NOTE
For Soil details refer to
Record of Borehole Sheets

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 1994 12

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	81.6	4 791 215	272 855
2	80.1	4 791 605	272 885
3	82.4	4 791 970	272 915
4	78.8	4 792 360	272 940
5	83.1	4 792 755	272 905
6	85.5	4 793 102	272 970
7	90.0	4 793 460	272 907
8	82.4	4 793 775	272 655
9	91.5	4 794 125	272 575

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 GC 2.01 of OPS Gen Cond.

DATE	BY	DESCRIPTION
Geocres No 30M5-195		
HWY No 403		DIST 4
SUBARD KA	CHECKED <input checked="" type="checkbox"/>	DATE 1995 04 04 SITE
DRAWN DT	CHECKED <input checked="" type="checkbox"/>	APPROVED DWG 2297701-A

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

CONT No
WP No 229-77-01



HIGH MAST LIGHTING
HWY 403, BETWEEN SNAKE RD & MAIN ST
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

SEE DWG No 2297701-A

KEY PLAN
SCALE

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 1994 12

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
10	100.5	4 794 410	272 740
11	104.6	4 794 610	272 955
12	104.0	4 794 820	273 115
13	105.5	4 794 935	273 420
14	101.4	4 794 690	272 885
15	116.9	4 794 910	272 740

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 GC 2.01 of OPS Gen Cond

REV	DATE	BY	DESCRIPTION
1			
Geocres No 30M5-195			
HWY No	403	DIST	4
SUBMD	KA	CHECKED	DATE 1995 04 04
DRAWN	DT	CHECKED	DATE 1995 04 04
			DWG 2297701-B

NOTE

For Soil details refer to
Record of Borehole Sheets



REF Plan from PARKER CONSULTANTS Plate No's 403-12 to 403-17

PLAN
SCALE
40m 0 40m

