

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M3-201

DIST. 4 REGION                     

W.P. No. 11-68-20

CONT. No.                     

W. O. No.                     

STR. SITE No.                     

HWY. No. 406

LOCATION FROM PORT ROBINSON RD  
SOUTHERLY to WOODLAWN RD EXT.

No. of PAGES -                     

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     

REMARKS:



Ministry of  
Transportation and  
Communications

FILE No. \_\_\_\_\_ DATE \_\_\_\_\_

REMARKS \_\_\_\_\_

Access to Merit Island From Public Works key at office.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# memorandum



To: V. Boehnke  
Head, Structural Section  
4th Floor, Atrium Tower

Attn: J. Lam

From: Foundation Design Section  
Room 315, Central Bldg.

Re: Foundation Recommendations  
Proposed Concrete Box Culvert  
W.P. 11-68-20  
District 4, Toronto

Date: 1991 12 17

It is proposed to construct a 2.00 m X 1.25 m concrete box culvert at this location. The invert level at the inlet end is set at El. 173.7 and at the outlet end at El. 173.22. The final height of the fill above the culvert varies between El. 178.7 and El. 179.4. Based on the available borehole information in the approximate vicinity of the proposed culvert (BH #201, W.P. 171-90-01) and on the size and type of the culvert, we have concluded that no field investigation is required. The subsoil consists of a deep (20 m $\pm$ ) deposit of stiff to very stiff silty clay to clayey silt with occasional silt seams and trace of sand.

For the purposes of the O.H.B.D.C., the following design parameters are recommended:

Factored Capacity at U.L.S.	180 kPa
Capacity at S.L.S. Type II	125 kPa

Earth pressures should be computed as per subsection 6.6.1.2.1 of the code. Yielding foundation conditions should be considered to apply.

The following parameters are recommended for the granular backfill.

	<u>Gran. "A"</u>	<u>Gran. "B"</u>
Angle of Internal Friction	$\phi = 35^{\circ}$	$\phi = 30^{\circ}$
Unit Weight (kN/m $^3$ )	$\gamma = 22.8$	$\gamma = 21.2$

The proposed culvert should be designed and constructed according to current OPSD Standards.

The concrete for the culvert should be formed "in the dry". Should softened material be encountered at the base of the excavation, it should be removed to the full extent and replaced with mass concrete.

The culvert ends and channel in the vicinity of the embankment should be protected against erosion.

.../2

The effective height of the fill is about 6.4 m. No stability problems are anticipated for embankments of this height and constructed with slopes not steeper than 2:1.

Please contact our office if further information is required.

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

for

M. Devata, P. Eng.  
Chief Foundation Engineer

MD/PP/jb

MINISTRY OF TRANSPORTATION  
**meeting memorandum**

structural section

central region

October 28, 1991

**PRESENT:**

P. Payer                      Foundation Design Section  
J. Lam                        Structural Section, Central Region

**HELD ON:**      October 28, 1991

**HELD AT:**      Foundation Design Section  
                 1201 Wilson Avenue, Downsview, Ontario

**PURPOSE:**     **FOUNDATION RECOMMENDATION - NEW CULVERT**  
                 2.00m x 1.25m Concrete Culvert - Closed Box  
                 Highway 406 - Station 15 + 643.50  
                 W.P. 11-68-20  
                 Highway 406, District 4, Burlington



**SUMMARY**

**ACTION BY**

P. MacLeod of Giffels has recently initiated the detailed design of the new concrete culvert at station 15 + 643.50 along Highway 406 of the above captioned project.

Following the meeting dated October 28, 1991 with P. Payer, attached are the following:

- \* General Site Plan of the Proposed Culvert;
- \* Detailed Plan and Elevation of the Proposed Culvert;
- \* Design data for the Proposed Culvert.

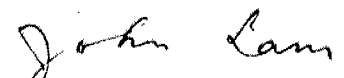
As discussed with P. Payer, Foundation Design Section will review existing soil and borehole information available to determine whether field investigation will or will not be required.

Foundation  
Design

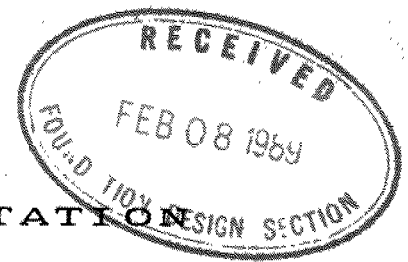
If adequate existing data is available, P. Payer will provide foundation recommendation to Structural Section as soon as possible. Otherwise, detailed foundation investigation will probably took four month. Foundation Design Section to advise.

Foundation  
Design

\*\*\*\* Please contact the undersigned at 416-235-5509 if there are any errors and omissions. \*\*\*\*

  
John K. Lam  
Senior Structural Engineer  
for:  
V.F. Boehnke  
Head, Structural Section

cc:    Those present  
      P. Chackeris, Planning and Design  
      P. MacLeod, Giffels



MINISTRY OF TRANSPORTATION

M E M O R A N D U M

TO: N. Sen  
Planning & Design  
Central Region

DATE: 1989-02-03

FROM: Structural Section  
Central Region

RE: Culvert in Causeway at Station 15 - 215.0  
Old Welland Canal  
Highway 406 - Woodlawn Road to Port Robinson Road  
W.P. 11-68-13/20, District 4

This memo will confirm the design approach to the above noted culvert:

- For cost effectiveness and ease of construction purposes, a series of CSP pipes will be installed to replace the 1.80 dia. pipe proposed in the E.A.A.R.
- The smaller diameter pipes will have a total drainage area larger than the single 1.8 m culvert.
- To further mitigate any potential water quality problems, these pipes will be located as close to Merritt Island as possible.
- Hydrology Section will examine the size and number of CSP pipes to replace the single culvert.
- Geotechnical Section will detail bedding and surrounding materials around each pipe to ensure uniform radial pressure is applied to each pipe.
- With information from appropriate sections, Environmental Unit will address the revision to the E.A.A.R. regarding the culvert to applicable agencies and authorities for their information.
- The Road consultant, upon receiving design information (by February 9, 1989) will detail the C.S.P. culvert drawings and prepare document accordingly.

If you have any further questions regarding this matter, please contact me at 224-7425.

*John Lam*

John K. Lam  
Senior Structural Engineer  
for:  
G.C.E. Burkhardt  
Head, Structural Section

JKL:rb

cc: P. Billings  
A. Wittenberg - P & D  
H.A. McNeely - Environmental  
D. Zander - District 4  
G. Cautillo - Geotechnical  
A. Bradbury - Geotechnical  
P. Payer - Foundation  
J. Carter - Hydrology  
W. Lachmaniuk - Giffels

## memorandum

235-3731



To: Mr. G. Cautillo  
Acting Head  
Geotechnical Section  
Central Region, Toronto

Date: 1988 05 25

Attn: Mr. K. Ganesh

From: Foundation Design Section  
Room 315, Central Building

RE: FOUNDATION INVESTIGATION FOR  
W.P. 11-68-20  
CITY OF THOROLD  
DISTRICT 4, BURLINGTON

The following is a summary of the results of our foundation investigation at the above mentioned site. We are providing recommendations for stability of the cut and have included copies of the Record of Borehole Sheets with lab results and field test results included on the sheets.

Should any additional information be required please contact our office.

Subsurface Conditions

The fieldwork consisted of 9 sampled boreholes and nine dynamic cone penetration tests. The borings were advanced using hollow stem augers. Sampling was performed to a maximum depth of 21 m (elevation 164.1 m) and the cone tests to a maximum depth of 17.4 m (elevation 167.4 m) from ground surface. The fieldwork was performed during the period from 88 02 01 to 88 02 16.

The boundaries of the different strata, together with the field and laboratory test results appear on the Record of Borehole Sheets which were forwarded to you on 88 04 18.

The subsoil consists of a fill which was placed on the original ground surface apparently during dredging of the Old Welland Canal. There was no clear demarcation between the original ground surface and the fill.

.../2



The fill consists of soft to hard clayey silt to silty clay and pockets of organic silt and silt all mixed with varying proportions of sand and gravel. The fill constituents vary randomly between boreholes. Borehole 4 has a 4.5 m thick layer of compact sand and gravel with boulders and cobbles underlying 4.1 m of firm to stiff clayey silt to silt clay. The sand and gravel is angular and could have been crushed. There are numerous pieces of concrete on the surface indicating a concrete mixing operation may have been operated in the vicinity of BH #4.

The soil underlying the fill consists of firm to hard clayey silt to silty clay with layers or pockets of loose to very dense silt and soft organic silt.

The groundwater level varied from 0.3 m to 4.0 m below ground level. The groundwater probably consists of isolated perched water tables formed in silt pockets and trapped by the surrounding clay.

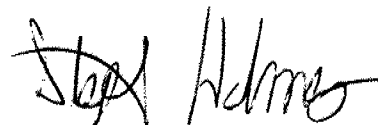
Vane test results were occasionally affected by stones interfering with the vane and causing the clay to shear at a high strength. Field vane test results ranged from 26 kPa to greater than 120 kPa.

#### Recommendations

It is proposed to excavate a cut between Sta. 15+400 and Sta. 15+600 to provide for both the Northbound and Southbound lanes of the future Hwy. #406. At this location, the existing groundlevel (along centreline) varies from El. 186 to El. 186.5 and the level of the proposed profile grade from El. 178.9 to El. 178.2. The maximum distance between the existing groundlevel and profile grade is 7.9 m.

In view of the encountered soil conditions it is recommended that the slopes of the cuts should not be steeper than 2:1. The cut slopes should be protected against erosion as per current MTO practices and/or standards.

Due to the variable nature of the fill zones or pockets of silt could be encountered in the sides of the cut. The silt will slough into the cut but should dry out quickly as the watertables are probably perched and will drain into the cut. This must be dealt with during construction.



S. Holmes, P.Eng.  
Foundation Engineer

# RECORD OF BOREHOLE No 1

METRIC

W.P. 11-68-20 LOCATION STA 15+412.5 22m L.L. of HWY 406 ORIGINATED BY SMH  
 DIST 4 HWY 406 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS COMPILED BY SMH  
 DATUM GEODETIC DATE 88-02-01-88-02-02 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W <sub>p</sub>	W					
185.6 0.0	GROUND SURFACE														
5	clayey silt to silty clay trace sand trace gravel trace organics firm to stiff (fill)		1	SS	12		184.0							3 7 47.4	
			2	SS	10										
182.7 2.9	clayey silt to silty clay with sand trace gravel trace organics firm (fill)		3	SS	7									5 42 36 17 1 15 (84)	
			4	SS	4		182.0								
			5	SS	5										
			6	SS	4										
180.1 5.5	clayey silt to silty clay trace sand  (fill)		7	TW	PH		180.0							21.0 0 4 70 26 1 6 (93)	
			8	SS	11										
			9	SS	48		178.0								
	firm to hard		10	SS	30		176.0								
174 11.6	silt to clayey silt compact / stiff		11	SS	25		174.0								
172.5 13.1	clayey silt trace sand trace gravel  stiff to very stiff		12	SS	14		172.0							0 4 (96)	
							170.0								
							168.0								
							166.0								
164.9 20.7	END OF BOREHOLE													0 2 (98)	

2, 2.5: Numbers refer to  
Sensitivity

10-20: % STRAIN AT FAILURE

# RECORD OF BOREHOLE No

METRIC

W P ' 11-68-20 LOCATION Sta. 15+434 35m Left of E. Med. Hwy 406  
 DIST 4 HWY 406 BOREHOLE TYPE Continuous Flight H.S. Auger ORIGINATED BY SMH  
 DATUM GEODETIC DATE 88-02-02-03 COMPILED BY SMH  
 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  K <sub>N</sub> /M <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%) 20 40 60					
186.7 0.0	Ground Surface													
5	silty clay trace sand trace organics some gravel (fill) very stiff		1	SS	20		186.0							4 5 (91)
184.6 2.1	clayey silt trace of sand trace of gravel firm to stiff (fill)		2	SS	17									
10			3	SS	8		184.0							
15			4	SS	4									
182.1 4.6	silt to clayey silt trace to with sand (fill) very soft to firm		5	SS	6		182.0							0 21 (79)
20			6	SS	0									0 2 80 18
180.7 6.0	clayey silt with pockets of silty clay trace of sand firm (fill)		7	SS	6		180.0							0 1 (99)
25			8	SS	0									0 14 (86)
30			9	TW	PH		178.0							20.8 3 5 (92)
177.5 9.2	silt to organic silt trace organics trace sand soft.		10	SS	8									0 32 (68)
35							176.0							0 1 (99)
176.3 10.4	silt to clayey silt		11	SS	41									
40	trace of sand trace of gravel very stiff to hard		12	SS	2.8		174.0							0 2 (98)
45			13	SS	2.5									
50			14	SS	2.0		172.0							
55			15	SS	2.7		170.0							0 3 (97)
60			16	SS	1.8		168.0							
65			17	SS	1.7									0 3 (97)
166.0 20.7	END OF BOREHOLE													

+3, x<sup>5</sup>: Numbers refer to  
 Sensitivity

20  
 15-0-5 (%) STRAIN AT FAILURE  
 10

# RECORD OF BOREHOLE No 3

METRIC

W P 11-68-20 LOCATION Sta 15+434 38.8m R ORIGINATED BY SMH  
 DIST 4 HWY 406 BOREHOLE TYPE Continuous Flight Hollow Stem Auger COMPILED BY GB  
 DATUM GEODETIC DATE 88-02-03-04 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W <sub>p</sub>	W	W <sub>L</sub>		
185.5	Ground Surface													
0.0	clayey silt to silty clay trace organics trace sand some gravel stiff (fill)		1	SS	13		189.0	0 (FROZEN GROUND)						2.4 (94)
5			2	SS	5									
10	silt to clayey silt trace organics trace to some sand trace to some gravel very loose to compact (fill)		3	SS	5		182.0							40.25 (35)
15			4	SS	18									1.6 (93)
20			5	SS	0		180.0							
25			6	SS	3									0.29 (71)
30	clayey silt pockets of silt and organic silt trace sand (fill)		7	TW	PH		178.0						20.1	
35	trace gravel stiff to hard		8	SS	29		176.0							0.1 (99)
40			9	SS	35		174.0							0.1 (99)
45			10	SS	21		172.0							
50			11	SS	17		170.0							2.22 (76)
55			12	SS	12		168.0							
60			13	SS	16		166.0							
65			14	SS	27									
68.2			15	SS	23									0.3 (97)
70.3	END OF BOREHOLE													

+3, x5: Numbers refer to Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No. 11

METRIC

W.P. 11-68-20

LOCATION Sta. 15+559, E. of Med. Hwy. 406

ORIGINATED BY S.M.H.

DIST. 4 HWY. 406

BOREHOLE TYPE Continuous Flight Hollow Stem Augers

COMPILED BY G.E.

DATUM Geodetic

DATE 88 02 05-08

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
184.8	Ground Surface																
184.0	clayey silt to silty clay, some sand and gravel trace organics Firm to stiff (Fill)		1	SS	14		184.0										1 4 (95)
			2	SS	13												5 3 (92)
			3	SS	6		182.0										54 32 (14)
			4	SS	10												
180.7			5	SS	10/19												
180.0	silty sand & gravel some cobbles probable boulders		6	SS	17		180.0										
			7	SS	24												
			8	SS	11		178.0										
	compact (Fill)		10	SS	31												
176.2			11A	SS	3		176.0										0 14 (86)
175.4	sandy silt, some gravel very loose		11B	SS	3												0 1 (99)
174.0			12	SS	22		174.0										
			13	SS	19		172.0										0 1 65 34
	clayey silt seams of sand trace of gravel Firm to very stiff		14	SS	9												
			15	SS	17		170.0										
			16	SS	11		168.0										0 2 (98)
			17	SS	6		166.0										
			18	SS	18												
164.1	End of Borehole																

+3, x<sup>S</sup>: Numbers refer to Sensitivity

20  
15 → 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No. 5

METRIC

W.P. 11-68-20

LOCATION Sta. 15+522, 335 m. Right of E. Road, 100 ft. S. of

ORIGINATED BY S.M.H.

DIST 4 HWY 406

BOREHOLE TYPE Continuous Flight Hollow Stem Augers

COMPILED BY G.E.

DATUM Geodetic

DATE 88 02 09

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			25	40	60	80	100					
185.8	Ground Surface																
0.2			1	SS	22/8												
5	clayey silt to silty clay		2	SS	13		184.0										35 35 (30)
	trace sand		3	SS	8												0 5 (95)
10	trace gravel		4	SS	20												0 8 (92)
	Firm to very stiff		5	SS	10		182.0										
15			6	SS	13												0 3 (97)
20			7	T.W. PH			180.0									19.3	0 8 (92)
			8	SS	8												
25			9	SS	11		178.0										0 3 (97)
30			10	SS	29		176.0										
35			11	SS	24		174.0										0 1 (99)
40	silt to silty clay		12	SS	25		172.0										0 2 88
	trace sand		13	SS	17												
45	trace gravel		14	SS	17		170.0										
	Very stiff		15	SS	20		168.0										1 2 (97)
50	clayey silt to silty clay		16	SS	14		166.0										
	trace sand		17	SS	19												
55	trace gravel																
60	stiff to very stiff																
65																	
70	End of Borehole																
75																	
80																	
85																	
90																	
95																	
99																	

+2, +5: Numbers refer to Sensitivity

20  
15-45 (%) STRAIN AT FAILURE  
12

# RECORD OF BOREHOLE No 6

METRIC

W.P. 11-68-20

LOCATION Sta. 15+471.5 20m right of M-1 Hwy, 4/45

ORIGINATED BY S.M.H.

DIST 4 HWY 406

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY G.E.

DATUM Foss. 1016

DATE 88 02 10

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100								
								SHEAR STRENGTH KPa								
								○ UNCONFINED + FIELD VANE								
								● QUICK TRIAXIAL x LAB VANE								
						20 40 60 80 100				WATER CONTENT (%)			γ	GR SA SI CL		
										20 40 60						
186.9	Ground Surface															
0.0	Clayey silt		1	SS	37		186.0								5	12 53 25
	trace to some gravel		2	SS	16											
	some sand		3	SS	2											
	occasional trace organic		4	SS	12		84.0								11	20 48 21
	Firm to stiff		5	SS	3											
	(Fill)		6	SS	5										23	23 35 19
181.6			7	SS	4		82.0									
5.2	silt		8	SS	0										0	16 75 9
	trace to some sand		9	SS	8										0	0 94 6
	Loose		10	SS	2		180.0								0	6 (94)
179.2			11	TW	PH											
7.2	silt and organic silt		12	SS	12		178.0								19.8	0 5 (95)
	to silty clay		13	SS	23										0	12 (33)
	Some sand		14	SS	57		176.0									
	Soft to Very		15	SS	28		174.0									
	stiff		16	SS	11		172.0									
175.2			17	SS	19		170.0									
11.6	silt		18	SS	22		168.0									
	trace gravel		19	SS	9											
	Compact to															
	very dense															
172.1																
14.7	clayey silt															
	trace gravel															
	trace sand															
	stiff to v. stiff															
165.9																
26.4	End of Borehole															

3. x<sup>2</sup> Numbers refer to Sensitivity

20  
15 → 1% STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 7

METRIC

W.P. 11-68-20

LOCATION Sta. 15+478, 20m Left of E. Rd. Hwy 406

ORIGINATED BY S.P.H.G.C.

DIST 4 HWY 406

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER

COMPILED BY G.S.

DATUM Geodetic

DATE 88 02 11-12

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
185.5	Ground Surface															
184.0	clayey silt to silty clay some gravel		1	SS	14											5 10 (85)
			2	SS	8											
			3	SS	5											
			4	SS	3											
			5	TW	PH											28 13 42 (7)
			6	SS	4											11 18 (71)
			7	SS	4											
			8	SS	4											
			9	SS	6											1 3 (96)
	(Fill)		10	SS	8											
			11	SS	9											0 5 (95)
175.1																
174.4																
172.4	silt to clayey silt		12	SS	31											
171.0	compact to dense		13	SS	28											0 1 (99)
172.0			14	SS	14											
170.0	clayey silt to silty clay		15	SS	12											
	trace sand		16	SS	16											
	trace gravel		17	SS	13											1 2 (97)
			18	SS	12											
164.6	stiff to very stiff															
20.9	End of Borehole															

+3, x5: Numbers refer to Sensitivity

20

15-5-5 (%) STRAIN AT FAILURE

10



# RECORD OF BOREHOLE No 8

METRIC

W P - 11-68-20 LOCATION Sta 15+525 33.5 Left E Med Hwy 406 ORIGINATED BY GB  
 DIST 4 HWY 406 BOREHOLE TYPE Continuous Flight Hollow Stem Auger COMPILED BY GB  
 DATUM GEODETIC DATE 88.02.15 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	Wp					
185.5 0.0	Ground surface													
5	clayey silt trace organics (wood) trace gravel firm to stiff (fill)		1	SS	51		184.0							9 13 (79)
10	sandy organic silt trace gravel very loose (fill)		2	SS	10		182.0							1 50 (49)
15	clayey silt to clay trace sand trace gravel (F.11)		3	SS	5		180.0							1 3 (96)
20			4	SS	4		178.0							1 11 (88)
25			5	SS	0		176.0							1 3 (96)
30	firm to very stiff		6	SS	30.6m 31.5m		174.0							0 2 (98)
35	silt to clayey silt trace sand		7	SS	7		172.0							0 1 (99)
40			8	SS	11		170.0							1 3 (96)
45	firm to hard		9	SS	22		168.0							
50			10	SS	34									
55			11	SS	4									
60			12	SS	13									
65			13	SS	9									
70			14	SS	9									
75														
80														
85														
90														
95														
99														
100	END OF BOREHOLE													

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 → 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 9

METRIC

W.P. 11-68-20

LOCATION Sta. 15+494.5, 18m Right of Hwy 406

ORIGINATED BY G.B.

DIST 4 HWY 406

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER

COMPILED BY G.B.

DATUM Geodetic

DATE 88 02 15-16

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40						60
185.9	Ground Surface		1	SS	10										
184.9	clayey silt trace sand trace gravel trace organics firm to stiff (F.H.)		2	SS	11										
184.0			3	SS	9									8 13 (7%)	
182.0	silt to clayey silt seams of sand and gravel firm (F.H.)		4	SS	16										
180.0			5	SS	4										
178.0			6	SS	1										
176.0	silt to clayey silt trace sand trace organics firm to hard (F.H.)		7	SS	5										
			8	SS	11										
			9	SS	4										
			10	SS	17										
			11	SS	15										
			12	SS	40										
174.8			13	SS	32										
11.1	End of Borehole														

+3, x5: Numbers refer to Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10