

**FOUNDATION INVESTIGATION REPORT
PROPOSED ATMS CROSSINGS
GO TRANSIT WESTON SUBDIVISION
AND CNR HALTON SUBDIVISION
HIGHWAY 427 INSIDE WIDENING
FROM FASKEN DRIVE TO STEELES AVENUE
TORONTO, ONTARIO
G.W.P. 202-95-00**

Geocres Number: 30M12-293

Report to

SNC-Lavalin

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
Phone: (905) 829 8666
Fax: (905) 829 1166

March 18, 2010
File: 19-92-70

H:\19\92\70 Hwy427 Widening\Reports & Memos\ATMS
Crossings\199270 Proposed ATMS Crossings FIR FINAL
Mar18.doc

TABLE OF CONTENTS**PART 1 FACTUAL INFORMATION**

1	INTRODUCTION	1
2	PROJECT AND SITE DESCRIPTION	1
3	SITE INVESTIGATION AND FIELD TESTING.....	2
4	LABORATORY TESTING	2
5	DESCRIPTION OF SUBSURFACE CONDITIONS	3
5.1	Topsoil	3
5.2	Crushed Rock (Railway Ballast).....	3
5.3	Sand Fill.....	3
5.4	Silty Clay	3
5.5	Silty Clay Till.....	4
5.6	Water Levels	4
6	MISCELLANEOUS	5

APPENDICES

Appendix A	Record of Borehole Sheets
Appendix B	Laboratory Test Results
Appendix C	Borehole Locations and Soil Strata Drawings

**FOUNDATION INVESTIGATION REPORT
PROPOSED ATMS CROSSINGS
GO TRANSIT WESTON SUBDIVISION
AND CNR HALTON SUBDIVISION
HIGHWAY 427 INSIDE WIDENING
FROM FASKEN DRIVE TO STEELES AVENUE
TORONTO, ONTARIO
G.W.P. 202-95-00**

Geocres Number: 30M12-293

PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the location of two (2) proposed Advanced Traffic Management System (ATMS) duct crossings related to the inside widening of Highway 427 from Fasken Drive to Steeles Avenue in Toronto, Ontario. Both ATMS crossings will pass under railway tracks located east of the northbound lanes of Highway 427. One ATMS crossing is located at the GO Transit Weston Subdivision and the second ATMS crossing is located at the CNR Halton Subdivision. The GO Transit tracks pass under Highway 427 north of the interchange with Highway 409 and the CNR tracks pass under Highway 427 south of Albion Road.

The purpose of the investigation was to explore the subsurface conditions at the proposed ATMS crossing locations and, based on the data obtained, to provide borehole location plans, records of boreholes, laboratory test results, stratigraphic profiles and a written description of the subsurface conditions.

Thurber carried out the investigation as a sub-consultant to SNC-Lavalin under the Ministry of Transportation Ontario (MTO) Agreement Number 2004-E-0071.

2 PROJECT AND SITE DESCRIPTION

The proposed inside widening of Highway 427 from Fasken Drive to Steeles Avenue includes the installation of additional traffic cameras for the Greater Toronto Area Advanced Traffic Management System (ATMS). It is proposed that the ATMS cables will run along the east side of the northbound lanes of Highway 427, cross under the GO Transit tracks (north of Highway 409) and under the CNR tracks (south of Albion Road).

Highway 427 is currently a 6-lane highway, surrounded by industrial, commercial and residential properties along the route. The elevation of this section of the highway gently increases from the south to the north, and is situated within the South Slope physiographic region. The geology generally comprises a till plain consisting of clayey silt to silty clay (Halton Till) grading into a sandy

silt to silty sand till with depth. Cobbles and boulders are often encountered in the local till deposits. The underlying bedrock consists of grey shale with hard siltstone and limestone interlayers of the Georgian Bay Formation.

3 SITE INVESTIGATION AND FIELD TESTING

Site investigation and field testing for the proposed ATMS crossings consisted of drilling and sampling five (5) boreholes, designated as FO-01 to FO-05. All of the boreholes were drilled to a depth of 6.7 m below the ground surface, with the exception of FO-03 which was drilled to a depth of 9.8 m due to the higher ground surface elevation at this location. At each of the proposed ATMS crossings, boreholes were drilled near each proposed manhole location on either side of the railway tracks. At the proposed GO Transit crossing, an additional borehole was drilled between the two northernmost railway tracks. No borehole was drilled between rail tracks for the ATMS crossing at CN due to prohibitively short track time. Boreholes FO-01 to FO-03 were drilled on January 21, 2010 at the GO Transit crossing and Boreholes FO-04 and FO-05 were drilled on January 26, 2010 at the CNR crossing. Prior to commencement of drilling, the necessary work permits and utility clearances were obtained for all borehole locations. Railway flagging protection was arranged for working within and near the railway right-of-ways.

The approximate borehole locations are shown on the Borehole Locations and Soil Strata Drawings in Appendix C. The coordinates and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendix A. The borehole coordinates and elevations were surveyed using a Trimble Pathfinder ProXRT differential GPS.

Solid stem augers were used to advance the boreholes and samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with the Standard Penetration Test (SPT).

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, visually examined the recovered samples, and transported them to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. One standpipe piezometer was installed at each proposed ATMS crossing location to permit monitoring of groundwater levels. The piezometers consisted of 19 mm PVC pipes with slotted screens. The locations and completion details of the piezometers as well as the borehole completion details are summarized in Table A-1 in Appendix A.

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and soil classification. Moisture content determinations were carried out on all soil samples. More than 25% of the recovered soil samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. The results of this testing program are presented on the Record of Borehole sheets in Appendix A and on the figures presented in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

This section presents a generalized summary of the subsurface conditions encountered at the borehole locations drilled for the proposed ATMS crossings. Reference is made to the Record of Borehole sheets in Appendix A. Stratigraphic profiles for both ATMS crossing locations are also presented on the Borehole Locations and Soil Strata Drawings in Appendix C. An overall description of the stratigraphy encountered in Boreholes FO-01 to FO-05 is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It must be recognized that soil conditions may vary between and beyond the borehole locations.

In general terms, the soil stratigraphy encountered in the boreholes at the two ATMS crossing locations consists of topsoil or railway ballast and fill overlying native silty clay and/or silty clay till deposits. Descriptions of the individual stratum are presented below.

5.1 Topsoil

A layer of topsoil was encountered at the ground surface in Boreholes FO-04 and FO-05 located on each side of the right-of-way of the CNR crossing. The topsoil thickness was measured at 180 mm at both locations. It should be noted that the thickness of the topsoil may vary between and beyond these borehole locations. Topsoil was not encountered at the locations of Boreholes FO-01 to FO-03 at the GO crossing, where ballast and fill were present at the surface.

5.2 Crushed Rock (Railway Ballast)

Crushed rock (railway ballast) was encountered in Boreholes FO-01 and FO-02 which were located near the GO railway tracks. The layer of crushed rock at both borehole locations was found to be 500 mm thick.

5.3 Sand Fill

Sand fill was encountered below the ballast at the GO crossing in Boreholes FO-01 and FO-02 and at ground surface in Borehole FO-03. The sand fill encountered below the ballast contained trace silt and was 0.3 to 0.6 m thick. The sand fill encountered at ground surface in Borehole FO-03 contained some gravel and was 0.6 m thick. The base of this fill ranged between Elevations 162.5 and 165.6 m. Sand fill was not encountered at the CNR crossing in Boreholes FO-04 or FO-05.

5.4 Silty Clay

Silty clay containing trace sand and trace gravel was encountered below the topsoil in Boreholes FO-04 and FO-05 at the CNR crossing. Trace roots, rootlets and wood fragments were noted in the clay. The silty clay deposit extended from an approximate depth of 0.2 m to depths of 1.4 to 2.6 m in Boreholes FO-04 and FO-05, respectively. The base of this deposit was encountered at approximate Elevations 169.1 and 168.7 m.

Based on SPT N-values ranging from 5 to 8 blows for 0.3 m of penetration, the silty clay material is described as firm to stiff.

The natural moisture contents of silty clay samples ranged from 11% to 36%.

5.5 Silty Clay Till

Native brown to grey silty clay till with sand, trace gravel was encountered below the sand fill in Boreholes FO-01, FO-02, and FO-03, and below the silty clay in Boreholes FO-04 and FO-05. The till deposits were encountered at depths ranging from 0.6 m to 2.6 m and extended to the full depth of the boreholes at 6.7 to 9.8 m below ground surface, or Elevations 156.4 to 164.6 m.

In Boreholes FO-01 to FO-03, SPT N-values typically ranging from 8 to 28 blows for 0.3 m of penetration indicate a stiff to very stiff consistency, except in Borehole FO-03 where 'N' values of 30 and 41 were encountered indicating a hard zone. In Boreholes FO-04 and FO-05, SPT N-values ranging from 19 to 32 blows for 0.3 m of penetration indicate a very stiff to hard consistency. Sand layers and seams were encountered within the till below 3 m depth in Borehole FO-03.

The natural moisture contents of the glacial till samples ranged from 7% to 27%.

Grain size distribution curves for selected samples of the till are presented on the Record of Borehole sheets and on Figures B1 and B2 of Appendix B. Atterberg Limit test results are presented on Figures B3 and B4 of Appendix B.

The results of laboratory gradation and Atterberg Limits tests from SPT samples (< 35 mm diameter) are summarized as follows:

Soil Particles	(%)
Gravel	0 to 4
Sand	2 to 41
Silt	19 to 66
Clay	21 to 38

Index Property	(%)
Liquid Limit	20 to 32
Plasticity Index	7 to 13

The above results show that the silty clay till is low plastic with a group symbol of CL.

Although cobbles were not recovered in the SPT samples, local experience indicates that the till inherently contain cobbles and boulders.

5.6 Water Levels

The groundwater level was observed in the boreholes during and upon completion of drilling. In Borehole FO-01, the groundwater level was observed at approximately 0.2 m below

ground surface, at Elevation 163.1 m, upon completion of drilling. One standpipe piezometer was installed at each proposed ATMS crossing location to monitor water levels after completion of drilling. The measured water levels are summarized in Table 5.1.

Table 5.1 – Measured Groundwater Levels

Location	Borehole	Tip Elevation and Material	Date	Water Level (m)	
				Depth Below Surface	Elevation
GO Crossing	FO-01	Open borehole	Jan. 21, 2010	0.2	163.1 (seepage in fill)
	FO-03	Piezometer tip at 156.4 (silty clay till)	Feb. 5, 2010	6.9	159.3
			Mar. 17, 2010	3.1	163.1
CNR Crossing	FO-05	Piezometer tip at 164.6 (silty clay till)	Feb. 5, 2010	0.7	170.6
			Mar. 17, 2010	0.8	170.5

The shallow groundwater level observed in Borehole FO-01 during drilling indicates the presence of a perched water table within the fill.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

After a second set of water level readings were collected, both piezometers were decommissioned according to O.Reg. 903.

6 MISCELLANEOUS

The drilling and sampling equipment was supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The field work was supervised on a full time basis by Mr. Stephane Loranger of Thurber Engineering Ltd. Laboratory testing was carried out at Thurber's Laboratory in Oakville, Ontario.

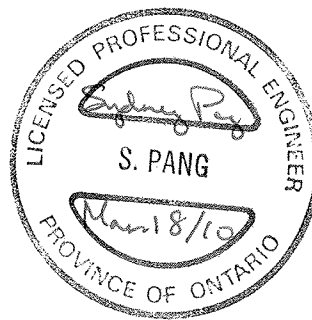
Supervision of the field program was conducted by Mrs. Lindsey Blaine, E.I.T. Interpretation of the field data and preparation of the investigation report was conducted by Mrs. Lindsey Blaine, E.I.T.

The report was reviewed by Messrs. Sydney Pang, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

THURBER ENGINEERING LTD.

L. Blaine
Mar. 18/10

Lindsey Blaine, E.I.T.
Engineer-in-Training



Sydney Pang, P.Eng.
Associate, Senior Project Engineer



P.K. Chatterji, P.Eng.
Review Principal

Appendix A

Record of Borehole Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer


4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample		TP Thin Wall Piston Sample
	PH Sampler Advanced by Hydraulic Pressure		PM Sampler Advanced by Manual Pressure
	WH Sampler Advanced by Self Static Weight		RC Rock Core
			SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. $(W_L < 30\%)$.
		CI	Inorganic clays of medium plasticity, silty clays. $(30\% < W_L < 50\%)$.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

Table A-1 – Borehole Completion Details

Location	Details	
	Piezometer Tip Depth / Elevation (m)	Completion Details
FO-01	None Installed	Backfilled with bentonite holeplug to 1.7 m and cuttings to ground surface.
FO-02	None Installed	Backfilled with bentonite holeplug to 2.1 m and cuttings to ground surface.
FO-03	9.8 / 156.4	Piezometer with 1.5 m slotted screen installed with sand filter to 6.1 m, bentonite seal from 6.1 m to 2.0 m, and cuttings to ground surface.
FO-04	None Installed	Backfilled with bentonite holeplug to 1.7 m and cuttings to ground surface.
FO-05	6.7 / 164.6	Piezometer with 1.5 m slotted screen installed with sand filter to 3.8 m, bentonite seal from 3.8 m to 2.4 m, and cuttings to surface.

RECORD OF BOREHOLE No FO-01

1 OF 1

METRIC

G.W.P. 202-95-00 LOCATION N 4 840 601.5 E 295 795.0 ORIGINATED BY SLL
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.01.21 - 2010.01.21 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
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		
163.3														
0.0	BALLAST (500mm) (FILL)													Ground Water Seepage
162.8														
0.5	SAND, trace silt Brown													
162.5														
0.8	(FILL)													
	Silty CLAY, with sand, trace gravel Stiff to Very Stiff Brown to Grey (TILL)(CL)													
			1	SS	23									
			2	SS	18									3 36 33 28
			3	SS	10									
			4	SS	14									
			5	SS	17									4 34 28 34
			6	SS	15									
156.6														
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN AND WATER LEVEL AT 0.2m BELOW SURFACE UPON COMPLETION (PERCHED WATER IN FILL). BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.7m, THEN CUTTINGS TO SURFACE.													

ONTMT4S 9270.GPJ 3/18/10

+ 3 . X 3 Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No FO-02

1 OF 1

METRIC

G.W.P. 202-95-00 LOCATION N 4 840 615.9 E 295 790.2 ORIGINATED BY SLL
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.01.21 - 2010.01.21 CHECKED BY LRB

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
163.6													
0.0	BALLAST (500mm) (FILL)												
163.1													
0.5	SAND, trace silt Brown Moist (FILL)												
162.5													
1.1	Silty CLAY, with sand, trace gravel Stiff to Very Stiff Brown to Grey (TILL)(CL)												
			1	SS	18								
			2	SS	12								
			3	SS	10								2 29 31 38
			4	SS	8								
			5	SS	8								4 36 28 32
			6	SS	16								
156.9													
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 2.1m. THEN CUTTINGS TO SURFACE.												

ONTMT4S 9270.GPJ 3/18/10

+ 3. X 3. Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No FO-03

1 OF 2

METRIC

G.W.P. 202-95-00 LOCATION N 4 840 635.0 E 295 780.8 ORIGINATED BY SLL
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.01.21 - 2010.01.21 CHECKED BY LRB

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE							w _p w w _L		
							● QUICK TRIAXIAL x LAB VANE										
166.2								20	40	60	80	100	20	40	60		
0.0	SAND, some gravel Brown Moist (FILL)						166										
165.6																	
0.6	Silty CLAY, some sand, trace gravel, trace organics Stiff to Very Stiff Brown to Grey (TILL)(CL)		1	SS	13		165										
			2	SS	28												
			3	SS	24		164										
	Hard from 3.1m to 4.4m		4	SS	41		163										0 17 55 28
	Sand layers or seams		5	SS	30		162										
			6	SS	13												
							161										
			7	SS	12		160										
							159										
	with sand		8	SS	17		158										3 41 19 37
							157										
			9	SS	27												
156.4																	
9.8	END OF BOREHOLE AT 9.8m.																

Continued Next Page

+ 3 X 3

Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No FO-03

2 OF 2

METRIC

G.W.P. 202-95-00 LOCATION N 4 840.635.0 E 295 780.8 ORIGINATED BY SLL
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.01.21 - 2010.01.21 CHECKED BY LRB

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					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page															
	BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.															
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV (m) 2010.02.05 6.9 159.3 2010.03.17 3.1 163.1															

ONTMT4S 9270.GPJ 3/18/10

RECORD OF BOREHOLE No FO-04

1 OF 1

METRIC

G.W.P. 202-95-00 LOCATION N 4 845 107.7 E 294 409.9 ORIGINATED BY SLL
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.01.26 - 2010.01.26 CHECKED BY LRB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
170.5														
0.0	TOPSOIL, with roots and rootlets Brown Moist (180mm)		1	SS	5		170							
0.2	Silty CLAY, trace gravel, trace sand, trace roots and rootlets, with wood fragments Firm to Stiff Brown		2	SS	8									
169.1														
1.4	Silty CLAY, with sand, trace gravel Very Stiff Brown to Grey (TILL)(CL)		3	SS	23		169							
			4	SS	23		168							
			5	SS	26		167							2 25 52 21
			6	SS	25		166							
	trace sand		7	SS	23		165							0 2 66 32
							164							
163.8			8	SS	24									
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.7m, THEN CUTTINGS TO SURFACE.													

+³ ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No FO-05

1 OF 1

METRIC

G.W.P. 202-95-00 LOCATION N 4 845 151.1 E 294 404.6 ORIGINATED BY SLL
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.01.26 - 2010.01.26 CHECKED BY LRB

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								WATER CONTENT (%)
171.3								20 40 60 80 100								
0.0	TOPSOIL, with roots and rootlets Brown Moist (180mm)		1	SS	6		171									
0.2	Silty CLAY, with roots and rootlets Firm Brown		2	SS	8		170									
			3	SS	8											
168.7			4	SS	19		169								1 23 39 37	
2.6	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown to Grey (TILL)(CL)		5	SS	30		168									
			6	SS	21		167								3 14 60 23	
			7	SS	32											
			8	SS	24		165									
164.6																
6.7	END OF BOREHOLE AT 6.7m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2010.02.05 0.7 170.6 2010.03.17 0.8 170.5															

+ 3 x 3 Numbers refer to
Sensitivity

20
15 10
5 (%) STRAIN AT FAILURE

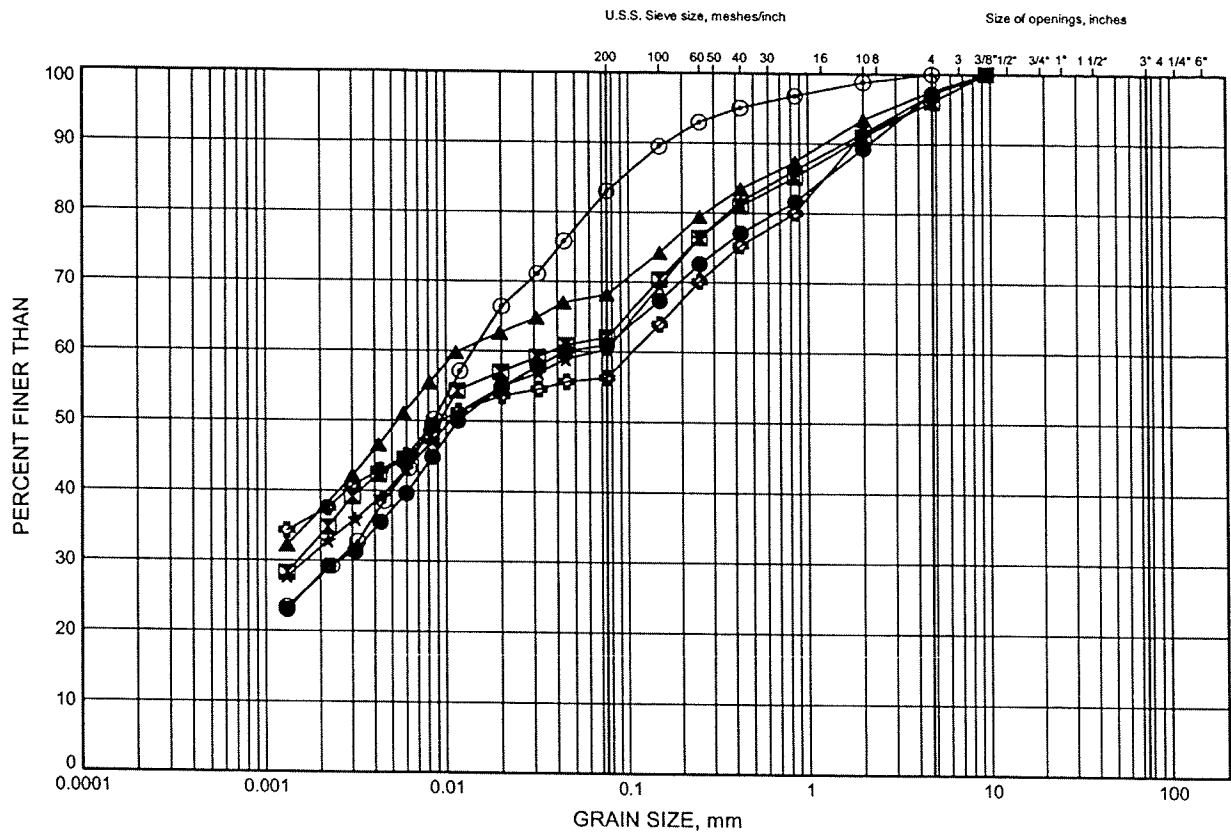
Appendix B

Laboratory Test Results

Hwy 427 Northbound and Southbound GRAIN SIZE DISTRIBUTION

FIGURE B1

SILTY CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	FO-01	2.59	160.71
⊠	FO-01	4.88	158.42
▲	FO-02	3.35	160.25
★	FO-02	4.88	158.72
⊙	FO-03	2.59	163.61
⊛	FO-03	7.92	158.28

GRAIN SIZE DISTRIBUTION - THURBER 9270.GPJ 2/11/10

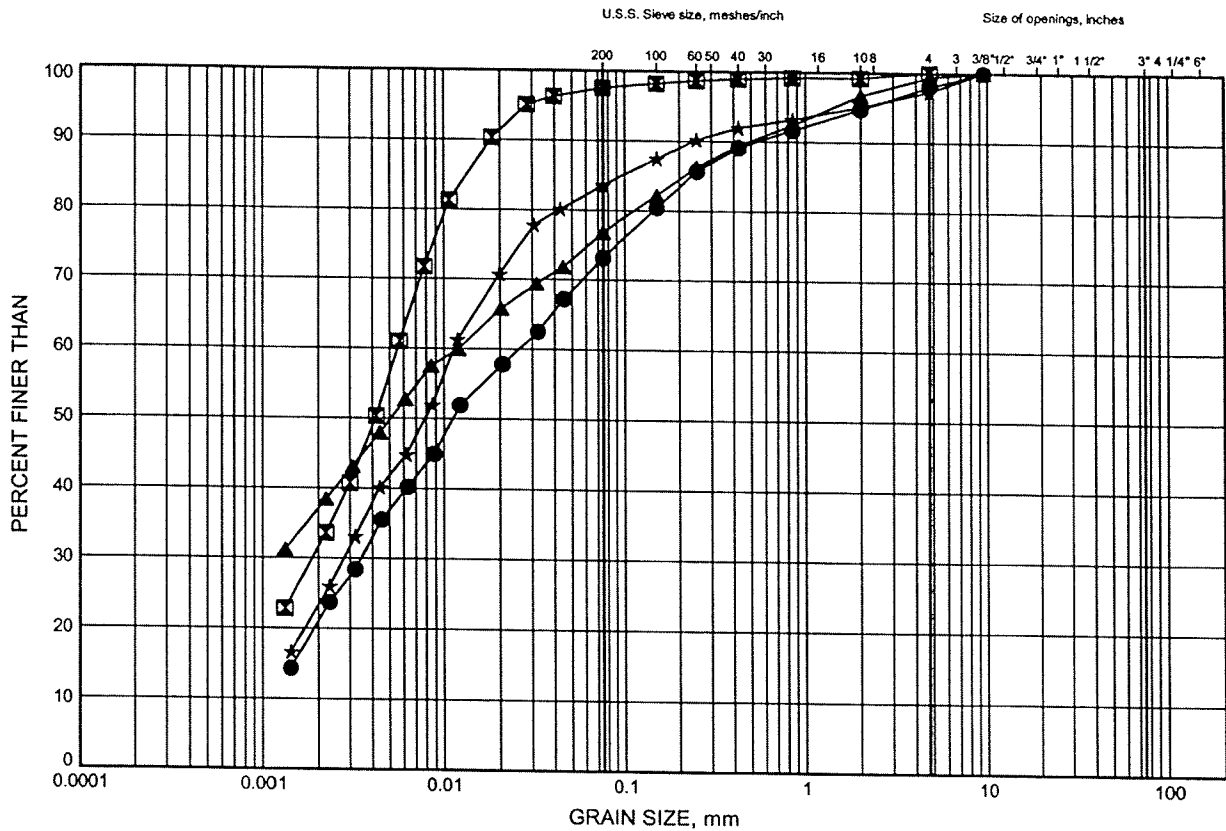
W.P.# 202-95-00.....
Prepared By AN.....
Checked By LRB.....



Hwy 427 Northbound and Southbound GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	FO-04	3.35	167.15
⊠	FO-04	4.88	165.62
▲	FO-05	2.59	168.71
★	FO-05	4.11	167.19

GRAIN SIZE DISTRIBUTION - THURBER 9270.GPJ 2/19/10

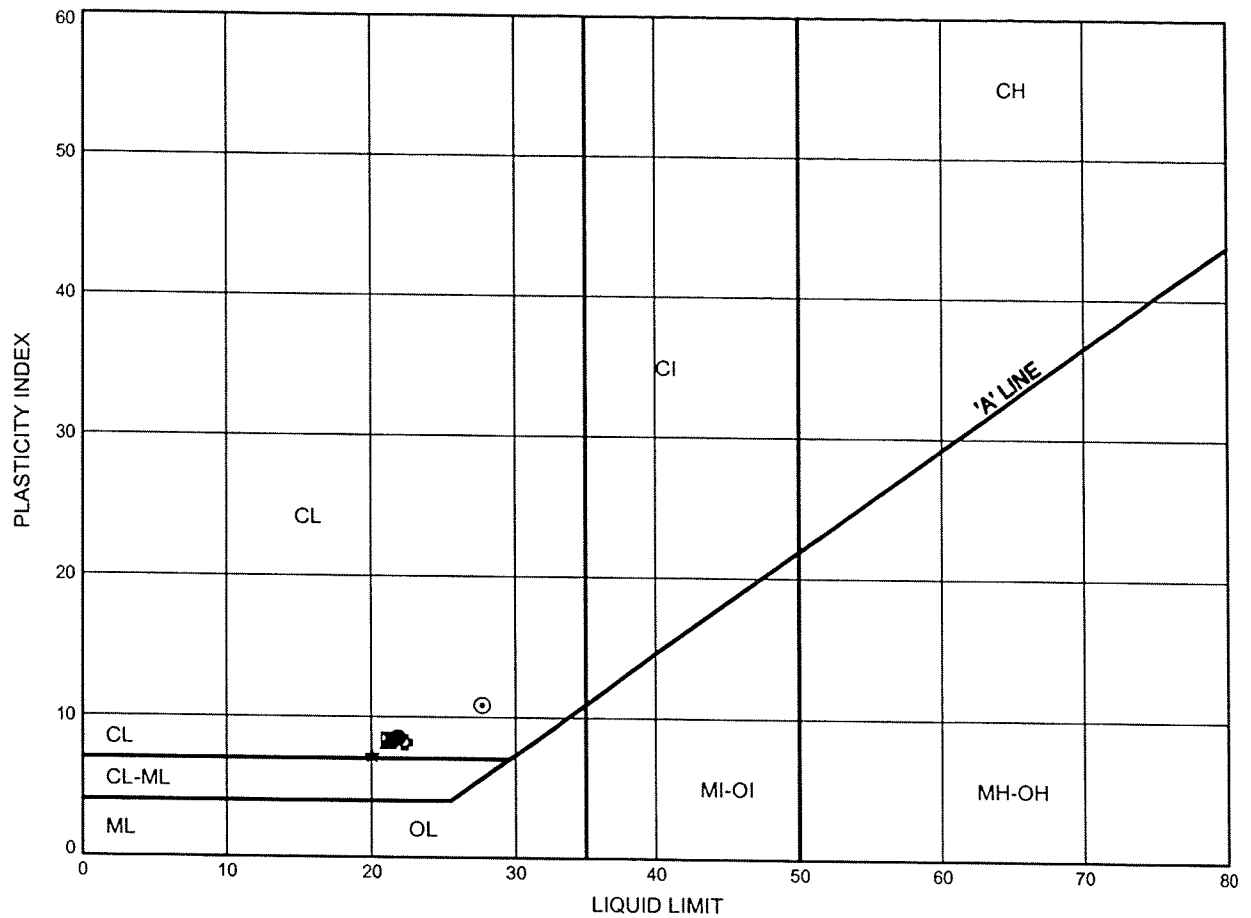
W.P.# 202-95-00.....
Prepared By AN.....
Checked By LRB.....



Hwy 427 Northbound and Southbound
ATTERBERG LIMITS TEST RESULTS

FIGURE B3

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	FO-01	2.59	160.71
⊠	FO-01	4.88	158.42
▲	FO-02	3.35	160.25
★	FO-02	4.88	158.72
⊙	FO-03	2.59	163.61
⊛	FO-03	7.92	158.28

Date February 2010

Project 202-95-00



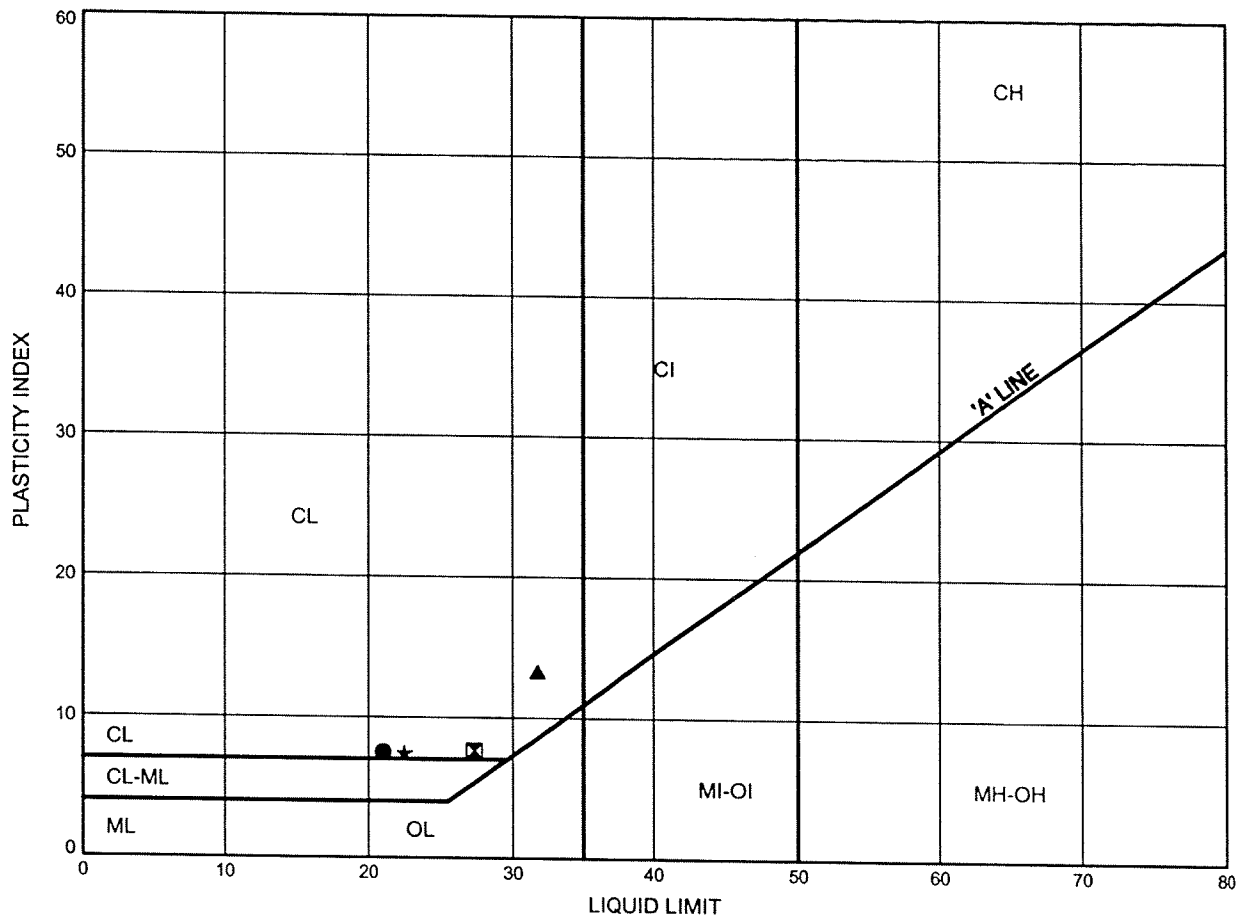
Prep'd AN

Chkd. LRB

Hwy 427 Northbound and Southbound
ATTERBERG LIMITS TEST RESULTS

FIGURE B4

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	FO-04	3.35	167.15
⊠	FO-04	4.88	165.62
▲	FO-05	2.59	168.71
★	FO-05	4.11	167.19

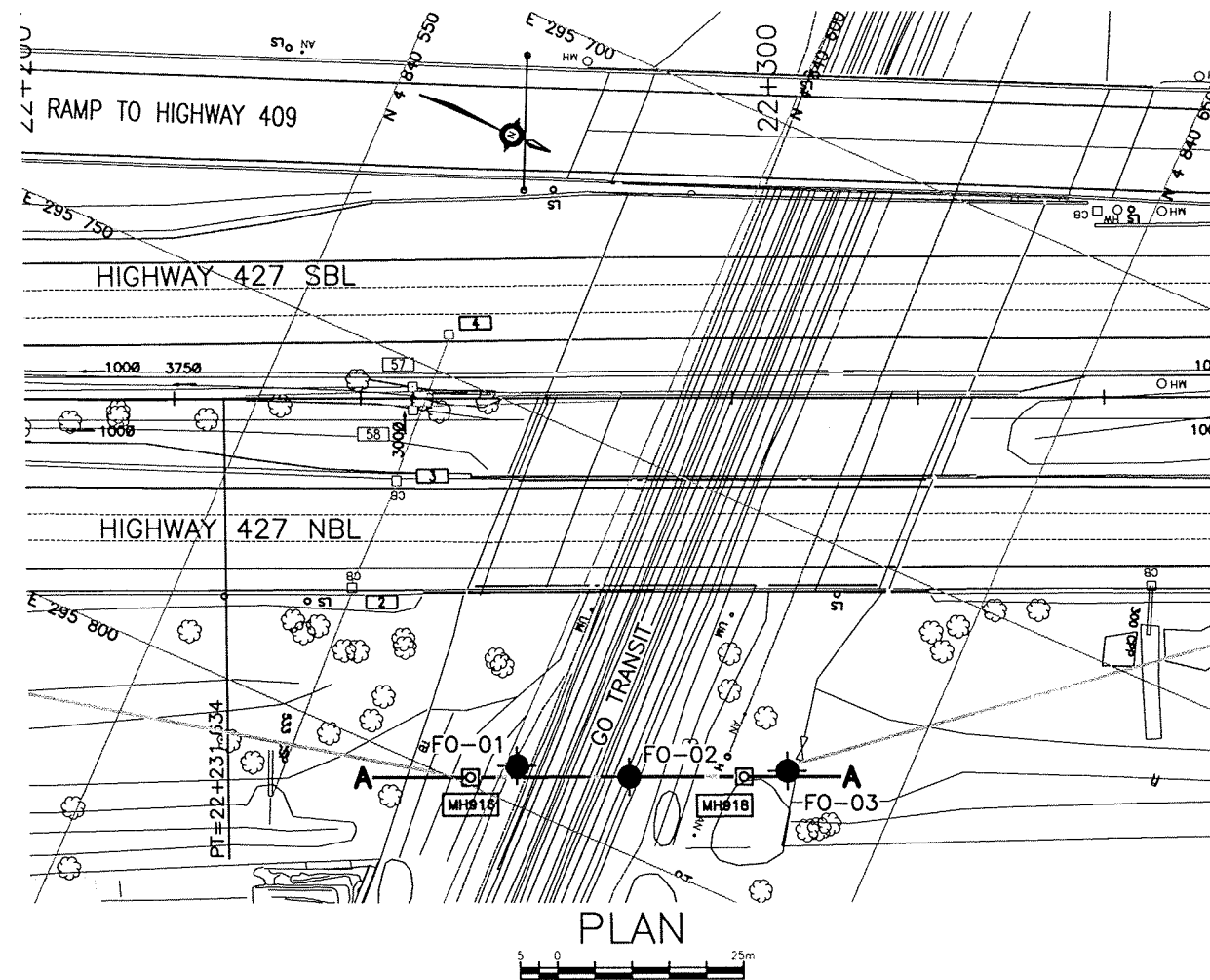
Date February 2010
 Project 202-95-00



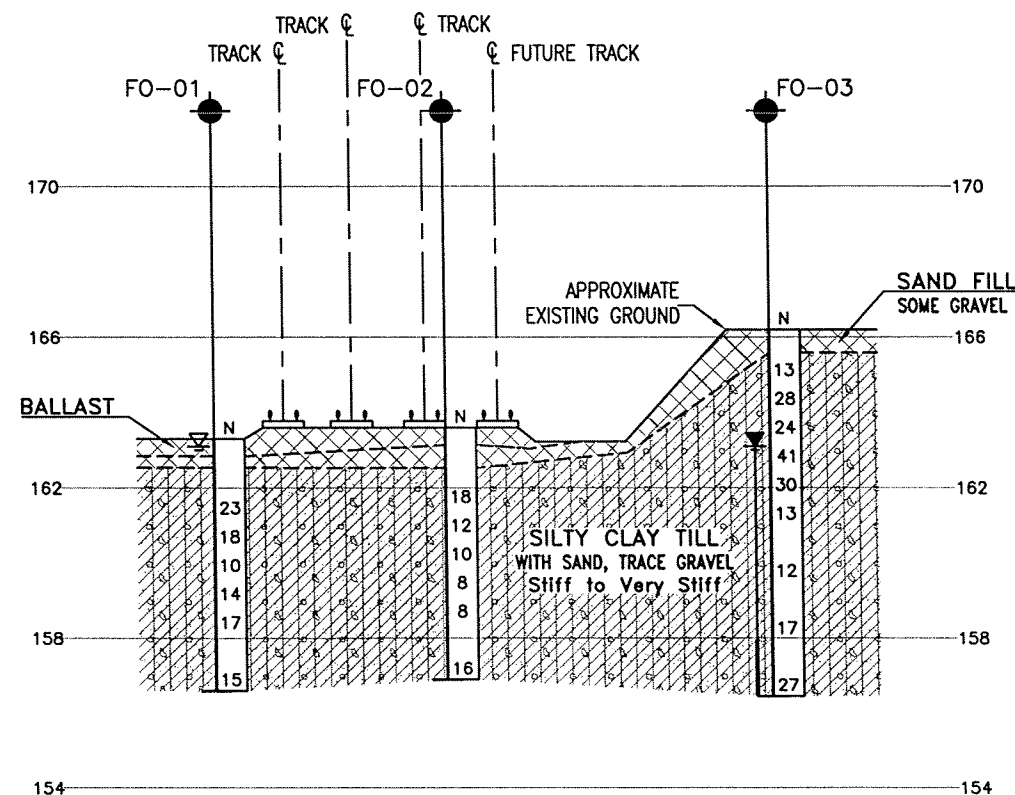
Prep'd AN
 Chkd. LRB

Appendix C

Borehole Locations and Soil Strata Drawings



PLAN



SECTION A-A

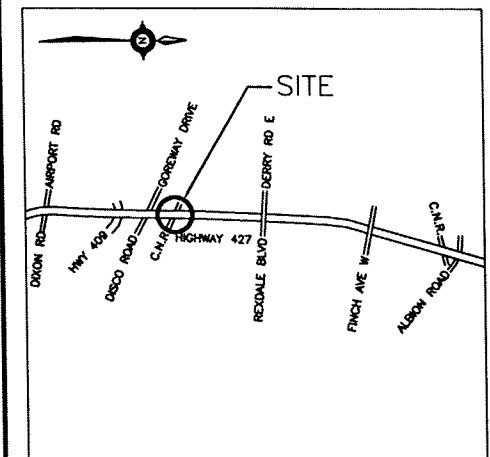
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 202-95-00

HIGHWAY 427 INSIDE WIDENING
GO TRANSIT WESTON SUB.
PROPOSED ATMS CROSSING
BOREHOLE LOCATIONS AND SOIL STRATA








SHEET



KEYPLAN

LEGEND

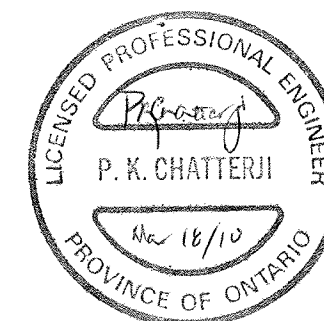
	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

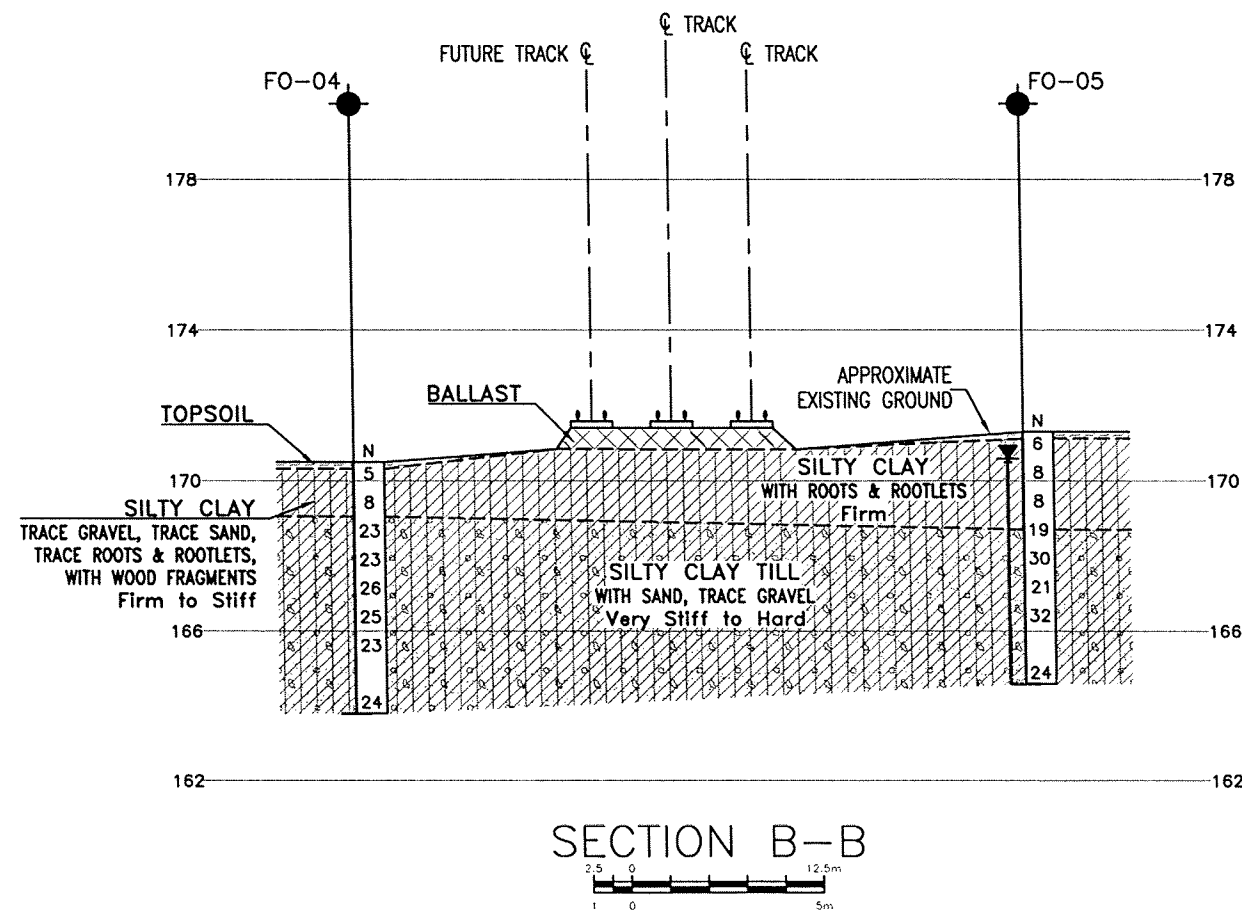
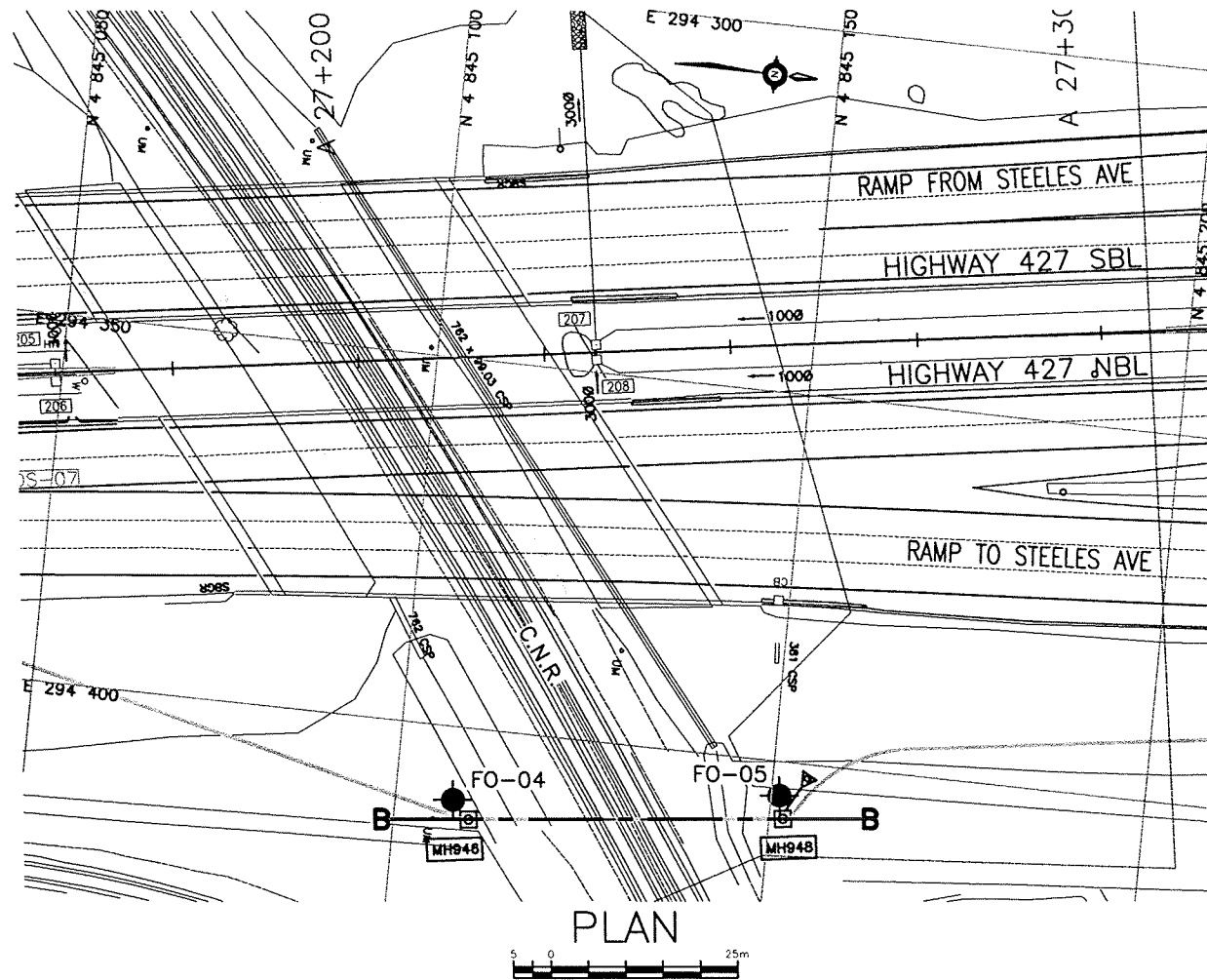
NO	ELEVATION	NORTHING	EASTING
FO-01	163.3	4 840 601.5	295 795.0
FO-02	163.6	4 840 615.9	295 790.2
FO-03	166.2	4 840 635.0	295 780.8

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

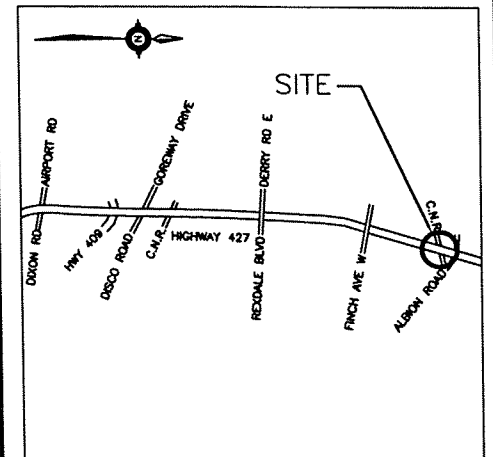
GEOCRES No. 30M12-293

[illegible]



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 202-95-00
HIGHWAY 427 INSIDE WIDENING
CNR HALTON SUB.
PROPOSED ATMS CROSSING
BOREHOLE LOCATIONS AND SOIL STRATA



KEYPLAN
LEGEND

	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
FO-04	170.5	4 845 107.7	294 409.9
FO-05	171.3	4 845 151.1	294 404.6

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 30M12-293



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MEF	CHK SKP	CODE
DRAWN	MFA	CHK PKC	SITE
		STRUCT	OWG 2