

FOUNDATION INVESTIGATION REPORT
FOR
CONRAIL RAILWAY OVERPASS
G.W.P. 60-00-00, SITE 6-73
HIGHWAY 401
WINDSOR, ONTARIO

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September 2002

TABLE OF CONTENTS

INTRODUCTION	1
SITE DESCRIPTION	1
INVESTIGATION PROCEDURES	2
SUMMARIZED SUBSURFACE CONDITIONS	3
Fill	4
Topsoil	4
Silty Clay	4
Sandy Silty Clay Till	4
Sand	5
Silty Clay Till	5
Bedrock	6
Groundwater	6
CLOSURE	7

APPENDICES

APPENDIX A

TABLE I – ROCK CORE DESCRIPTION

FIGURE 1 – PLASTICITY CHART

FIGURES 2 AND 3 – GRAIN SIZE DISTRIBUTION CHARTS

APPENDIX B

RECORD OF BOREHOLE SHEETS

DRAWING 1

FOUNDATION INVESTIGATION REPORT

for
Conrail Railway Overpass
G.W.P. 60-00-00, Site 6-73
Highway 401
Windsor, Ontario

INTRODUCTION

This report summarizes the results of the foundation investigation carried out for the proposed overpass structure at Conrail Railway and Highway 401 in Windsor, Ontario. The investigation was conducted for the Southwestern Region Structural Section of the Ontario Ministry of Transportation.

Highway 401 will pass over Conrail Railway at approximate Station 12+950, Highway 401 chainage, in the Town of Tecumseh (South Sandwich Township).

The report pertains to the proposed overpass structure and approaches within about 20 m of the abutments.

SITE DESCRIPTION

The site is situated at the intersection of the existing Highway 401 and Conrail Railway. The proposed one-span structure will carry the Highway 401 traffic over Conrail Railway. At the location of the structure, Highway 401 runs in the southwest-northeast direction. The existing approaches comprise a fill embankment with a height of approximately 10 m to the west and an existing multi-span structure to the east.

The site is located in the south suburbs of the City of Windsor in Essex County (Southwestern Ontario). The surrounding lands are mainly level and used for a mix of residential, commercial and industrial purposes.

The area is part of the Essex Clay Plain physiographic sub-region. It is essentially a till plain smoothed by deposits of lacustrine clay which settled in the depressions while the knolls were being lowered by wave action. In general, the overburden in the sub-region consists of silty clays and/or clayey silts. The bedrock belonging to the Dundee Formation and anticipated at a depth of about 35 m is largely composed of Middle Devonian limestone, dolostone and shale.

INVESTIGATION PROCEDURES

The field work was carried out during the period of February 19 to 22, 2002 and comprised four boreholes advanced to depths of 9.6 to 35.8 m, as summarized in the following table, at the locations indicated on Drawing 1 (Appendix B).

Location	Borehole No.	Depth (m)		
		Auger	Rock Core ⁽¹⁾	Total
West Abutment, North Side	73-1	32.8	3.0	35.8
West Abutment, South Side	73-2	9.6	—	9.6
East Abutment, North Side	73-3	9.6	—	9.6
East Abutment, South Side	73-4	30.4	—	30.4

⁽¹⁾ NQ diamond rock coring equipment

In addition, three boreholes (No. 108 to 110 inclusive) drilled to 9.1 m depth for the concurrent Embankment Foundation Investigation were used to supplement the subsurface data at the approach locations.

The locations of and ground surface elevations at the boreholes were established in the field by Peto MacCallum Ltd. The following benchmark (BM) was used for vertical reference:

BM 993: Plate on north wall of house at
1965 Provincial Road, 0.2 ft from
west wall and 1.2 ft above grade.
Elevation 190.896 (geodetic)

The boreholes were advanced using continuous flight solid and hollow stem augers as well as mud rotary methods, powered by a track-mounted CME-75 Nodwell drill rig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of our engineering staff.

Representative samples of the overburden were recovered at frequent depth intervals using a conventional split spoon sampler during drilling. Standard penetration tests were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata. In situ vane shear and pocket penetrometer tests were also performed to further assess the shear strength of the cohesive soils.

The groundwater conditions in the boreholes were closely monitored during the course of the field work.

All of the recovered samples were returned to our laboratory for detailed visual examination, classification and routine moisture content determinations. Atterberg Limits tests and grain size distribution analyses were carried out on selected samples, their results being presented in Figures 1 to 3 (Appendix A) and on the Record of Borehole sheets (Appendix B).

SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Record of Borehole sheets for details of the subsurface conditions including soil classifications, inferred stratigraphy, boundary elevations, standard penetration and in situ vane shear/pocket penetrometer test results, groundwater observations, the results of laboratory grain size distribution analyses, Atterberg Limits tests and moisture content determinations. Samples submitted for laboratory testing are also shown on the borehole logs.

The borehole locations and stratigraphic profiles prepared from the borehole data are presented on Drawing 1.

The subsurface stratigraphy revealed in the boreholes drilled at the site generally comprised a surficial fill or topsoil underlain by deposits of sandy silty clay till overlying sand and silty clay till. Limestone bedrock was contacted below the predominantly clay overburden at a depth of 32.8 m (elevation 158.0). The strata encountered are summarized below.

Fill

Fill was encountered surficially in boreholes 73-3 and 73-4 drilled along the alignment of former Conrail railway tracks. It consisted of crushed limestone (ballast material) and was 1.2 m thick.

Topsoil

Surficial topsoil of 50 to 80 mm in thickness was present in boreholes 73-2 and 108.

Silty Clay

A 900 mm thick layer of cohesive silty clay was encountered directly beneath the fill in borehole 73-3. In borehole 110, the silty clay was 280 mm thick and present surficially.

Sandy Silty Clay Till

Cohesive sandy silty clay till was encountered surficially in borehole 73-1 and at depths varying between 0.1 and 2.1 m (elevation 190.0 to 190.9) in the remaining boreholes. The consistency of this stratum was typically stiff to hard. Standard penetration test 'N' values ranged from 6 to 59, generally from 10 to 20 between depths of about 5 to 25 m. One vane shear test carried out in the unit at an approximate depth of 18.5 m (elevation 173.5) gave the undisturbed and remolded shear strength values of 100 kPa and 70 kPa respectively (soil sensitivity is 1.4). The results of pocket penetrometer testing conducted within the unit at various depths indicate that the values of undrained shear strength are in a range of 25 to 110 kPa (locally 210 kPa), generally decreasing with depth.

The moisture content of the clay till ranged from 11 to 26%, typically 13 to 18%. The results of the Atterberg Limits tests are presented in Figure 1 (Appendix A). The clay till plots as a clay of low plasticity, with liquid and plastic limits of 28 to 30 and 13 to 16, respectively. The results of particle size distribution analyses conducted on the clay till are presented in Figure 2 (Appendix A).

The clay till had a confirmed thickness of 25.9 and 24.7 m in boreholes 73-1 and 73-4. This stratum was not penetrated upon termination of boreholes 73-2, 73-3, 108 and 110 at depths of 9.1 to 9.6 m (elevation 181.4 to 182.5).

Sand

A deposit of fine sand was revealed at an approximate depth of 25.9 m (elevation 164.9 to 166.2). It was contacted within the clay till in borehole 73-1 and had a thickness of 2.6 m. In borehole 73-4, this unit was not penetrated upon termination of drilling at 30.4 m depth (elevation 161.8) and was at least 4.5 m thick. The sand was very dense and had a moisture content of 12 to 18%.

Silty Clay Till

A 4.3 m thick layer of cohesive silty clay till was encountered at 28.5 m depth (elevation 162.3) in borehole 73-1. The silty clay till was very stiff in consistency and had a moisture content of 25%.

The result of one Atterberg Limits test is presented in Figure 1 (Appendix A). The silt and clay till plots as a clay of medium plasticity (liquid limit of 37, plastic limit of 19). The results of a particle size distribution analysis conducted on the silty clay till are presented in Figure 3 (Appendix A).

Bedrock

Limestone bedrock was contacted in borehole 73-1 below the predominantly clay till overburden at the following depth/elevation confirmed by rock coring:

Location	Depth to Rock (m)	Bedrock Elevation
West Abutment, North Side	32.8	158.0

Rock core description is provided in Table I (Appendix A). The measured core recovery was 95%. The RQD determined from the rock cores was 85%, indicating a good quality rock. No loss of drill water circulation was experienced during the coring operation.

The unconfined compressive strength of the rock determined on two representative samples from borehole 73-1 corresponding to depths of 33.1 and 34.1 m (elevation 157.7 and 156.7) was 61 and 86 MPa respectively.

Groundwater

Water was not observed in any of the boreholes during the course of the field work. The water level measured in a piezometer installed in an adjacent borehole for the concurrent High Fill embankment study was 0.5 m below grade (elevation 190.3), 34 days after completion of drilling. (Borehole 109 drilled at 4 678 697 N, 266 854 E). Based on visual examination of the samples retrieved and the groundwater level measured in the adjacent piezometer, the groundwater level is expected to be about 500 mm below grade, near elevation 190.3).

CLOSURE

The field work was carried out under the supervision of Mr. M. Rapsey and direction of Mr. M.R. Anderson, M.Eng., P.Eng., Senior Foundation Engineer. The equipment was supplied by All-Terrain Drilling Limited.

The report was prepared by Mr. G.O. Degil, Ph.D., Senior Project Supervisor, and Mr. M.R. Anderson, M.Eng., P.Eng. It was reviewed by Mr. D.W. Kerr, M.Eng., P.Eng., Chief Foundation Engineer. Mr. B.R. Gray, M.Eng., P.Eng., President, carried out an independent review of the report.



Yours very truly

Peto MacCallum Ltd.

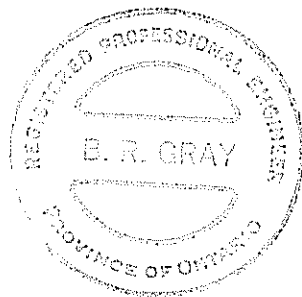
A handwritten signature of Murray R. Anderson, consisting of stylized initials and a surname, written over a horizontal line.

Murray R. Anderson, M.Eng., P.Eng.
Senior Foundation Engineer



A handwritten signature of Dennis W. Kerr, featuring a large, flowing initial 'D' followed by the surname 'Kerr'.

Dennis W. Kerr, M.Eng., P.Eng.
Chief Foundation Engineer



A handwritten signature of Brian R. Gray, with a large, stylized initial 'B' and the surname 'Gray'.

Brian R. Gray, M.Eng., P.Eng.
President

GD:lad

APPENDIX A

TABLE I	-	ROCK CORE DESCRIPTION
FIGURE 1	-	PLASTICITY CHART
FIGURES 2 and 3	-	PARTICLE SIZE DISTRIBUTION CHARTS

TABLE I

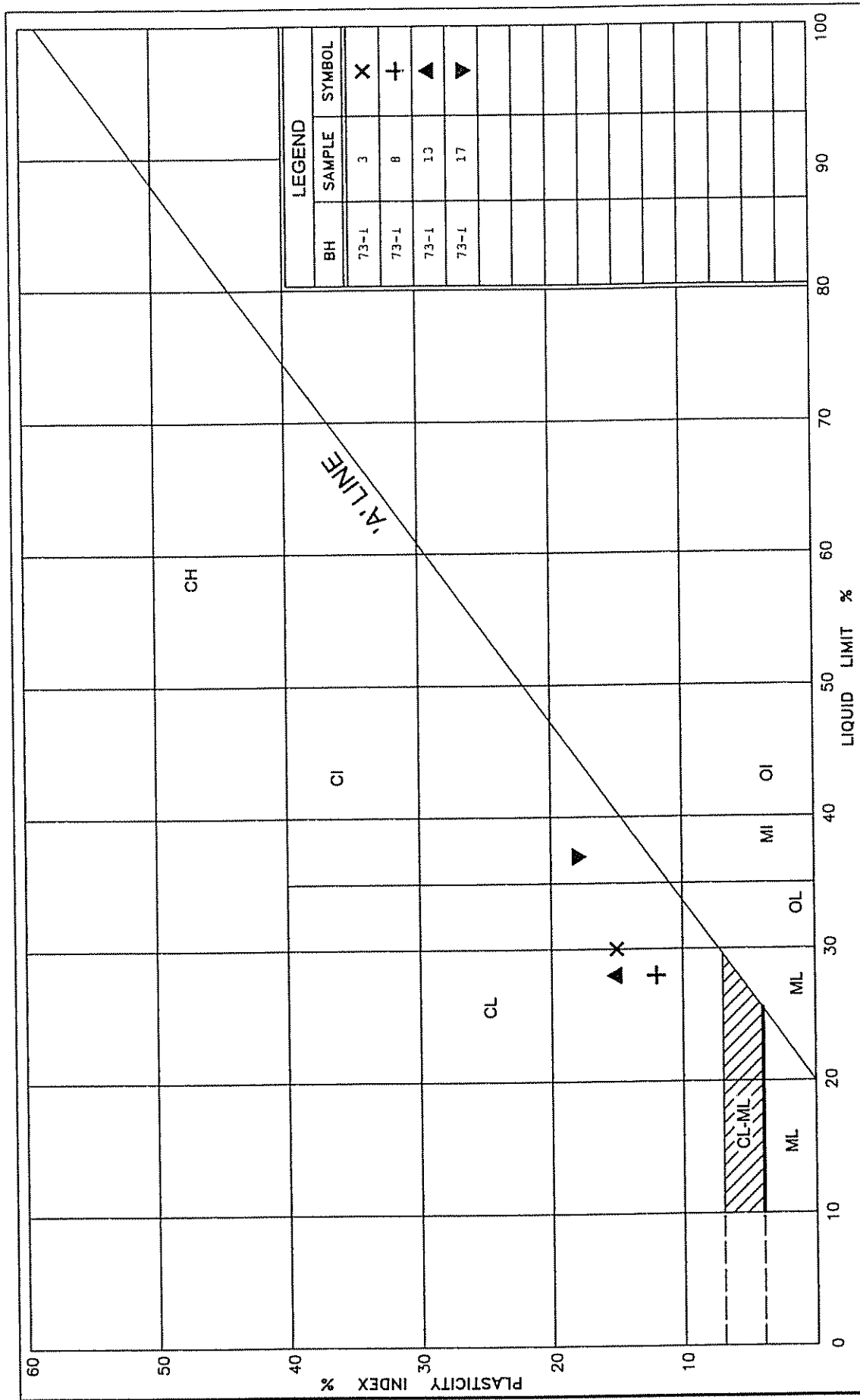
ROCK CORE DESCRIPTION
CONRAIL RAILWAY OVERPASS
G.W.P. 60-00-00, SITE 6-73
HIGHWAY 401
WINDSOR, ONTARIO

CORE RECOVERY					CORE DESCRIPTION	
HOLE NO.	RUN NO.	DEPTH (m)	RECOVERY %	RQD %	DEPTH (m)	DESCRIPTION
73-1	18	32.75 – 35.80	95	85	32.75 – 35.80	LIMESTONE: light grey, aphanitic, occ. white mottling, occ. stylitic partings; medium to high strength; unweathered; closely to moderately spaced discontinuities; fracture index 5; good quality

Logged by J.F. Wright using the Provincial Highways "A Guide to the Description of Rock for Engineering Purposes"
Dated October, 1982.

RQD = Rock Quality Designation

Originated: JFW
Compiled: GD
Checked: MRA



Ministry of
Transportation
Ontario

PLASTICITY CHART

SANDY SILTY CLAY TILL (CL) and SILTY CLAY TILL (CI)

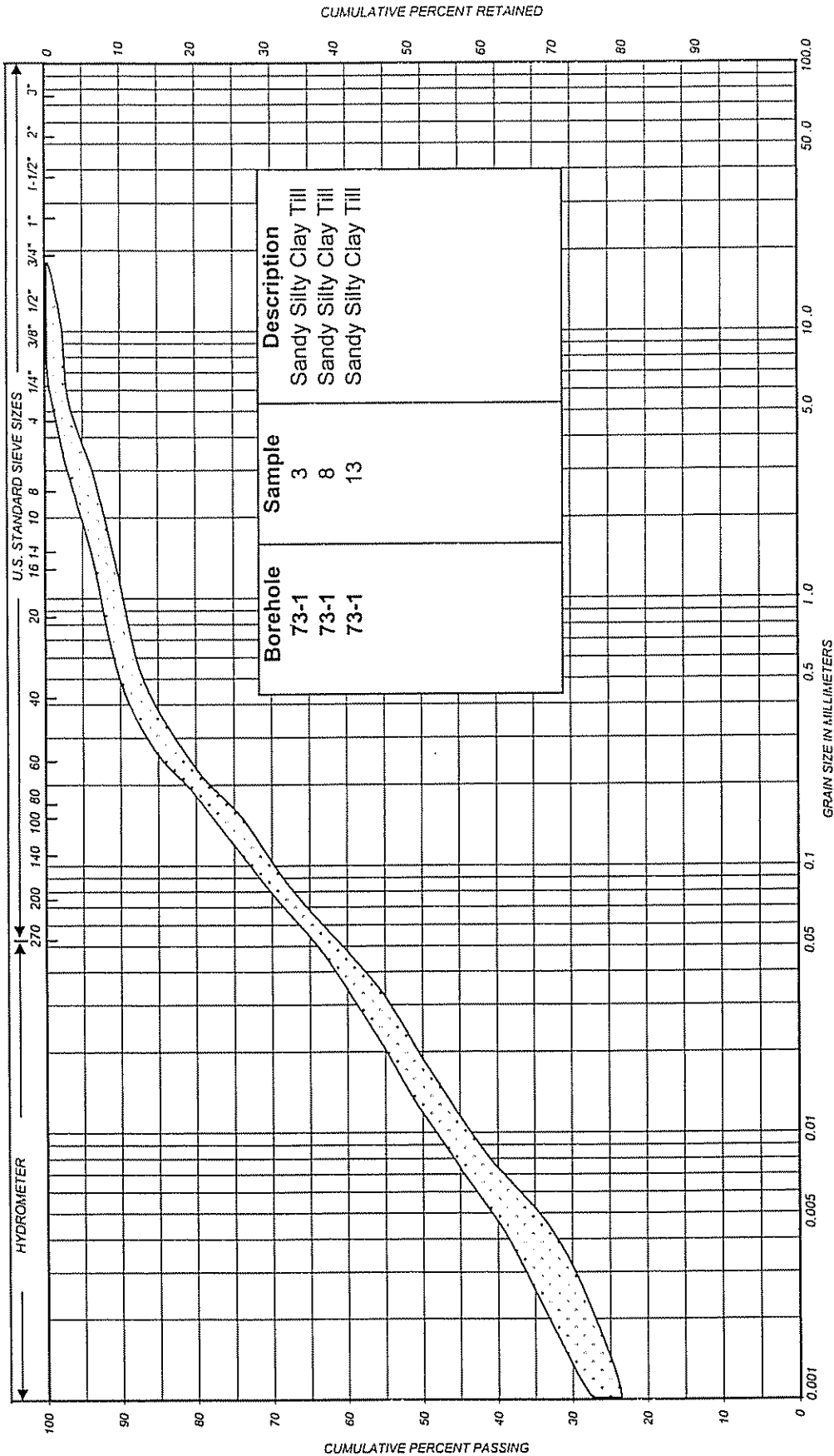
FIG No 1

HIGHWAY 401

G.W.P. 60-00-00, Site 6-73

PML REF. 01TF072C
G.W.P. 60-00-00
FIGURE 2

PARTICLE SIZE DISTRIBUTION CHART

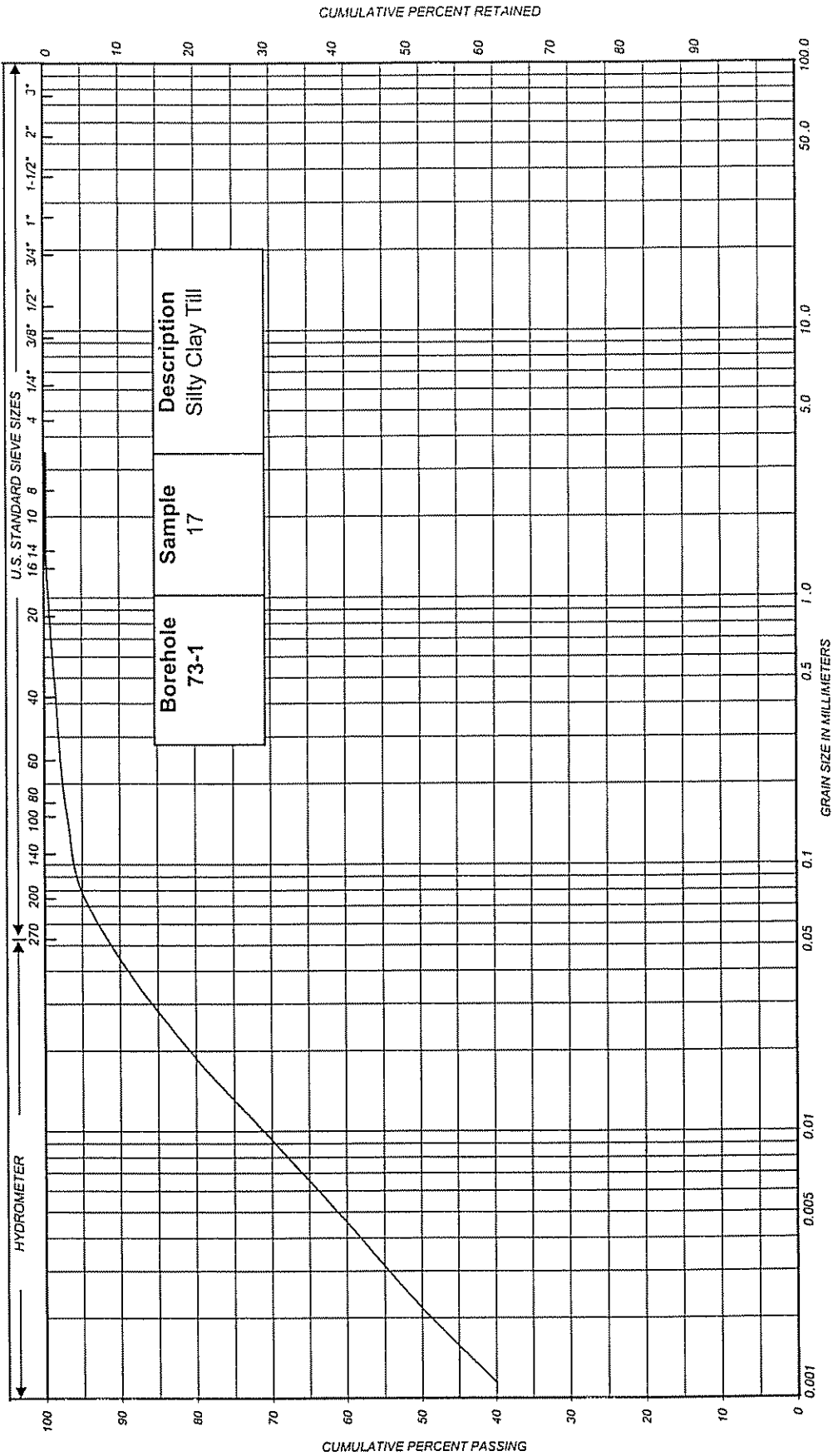


SILT & CLAY										GRAVEL	COBBLES	UNIFIED
CLAY		FINE	MEDIUM	COARSE	SAND			COARSE				
		SILT									M.I.T.	U.S. BUREAU
		FINE	MEDIUM	COARSE	FINE	MEDIUM	SAND	COARSE	GRAVEL			
					VERY FINE	FINE	MEDIUM	COARSE	GRAVEL			
					SAND							

REMARKS SANDY SILTY CLAY TILL

PML REF 01TF072C
G.W.P. 60-00-00
FIGURE 3

PARTICLE SIZE DISTRIBUTION CHART



SILT & CLAY							GRAVEL		COBLES	UNIFIED
CLAY	SILT			SAND			GRAVEL		COBLES	M.I.T.
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL			
CLAY	SILT			SAND			GRAVEL		COBLES	U.S. BUREAU
	VERY FINE	FINE	MEDIUM	COARSE	GRAVEL					

REMARKS SILTY CLAY TILL

APPENDIX B

RECORD OF BOREHOLE SHEETS

DRAWING 1

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 0.3 m INTO THE SUBSOIL. DRIVEN BY MEANS OF A 63.5 kg HAMMER FALLING FREELY A DISTANCE OF 0.76 m

DYNAMIC PENETRATION RESISTANCE: - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 51 mm. 60 DEGREE CONE. FITTED TO THE END OF DRILL RODS 0.3 m INTO THE SUBSOIL. THE DRIVING ENERGY BEING 475 J PER BLOW

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:

<u>CONSISTENCY</u>	<u>'N' BLOWS/0.3 m</u>	<u>c kPa</u>	<u>DENSENESS</u>	<u>'N' BLOWS/0.3 m</u>
VERY SOFT	0 – 2	0 – 12	VERY LOOSE	0 – 4
SOFT	2 – 4	12 – 25	LOOSE	4 – 10
FIRM	4 – 8	25 – 50	COMPACT	10 – 30
STIFF	8 – 15	50 – 100	DENSE	30 – 50
VERY STIFF	15 – 30	100 – 200	VERY DENSE	> 50
HARD	> 30	> 200		
W T P L. WETTER THAN PLASTIC LIMIT			D T P L. DRIER THAN PLASTIC LIMIT	
A P L. ABOUT PLASTIC LIMIT				

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Q_u	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q_{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q_d	DRAINED TRIAXIAL		

▲, ▲ - UNDISTURBED AND REMOULDED SHEAR STRENGTH DETERMINED FROM IN SITU VANE TEST

■ - UNDRAINED SHEAR STRENGTH DETERMINED FROM POCKET PENETROMETER TEST

RECORD OF BOREHOLE No 73-1

1 of 3

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+937, o/s 15.0m Lt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE C.F.H.S.A., Mud Rotary and NQ Rock Coring COMPILED BY MRA
DATUM Geodetic DATE February 20, 2002 CHECKED BY DWK

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE								
190.76 0.00	Ground Level							20	40	60	80	100	20	40	60		GR SA SI CL		
	Sandy silty clay, trace of gravel, with bluish grey fissures and oxidized stains																		
	Stiff to Very Stiff		1	SS	11		190						○						
	Brown (Till)		2	SS	19		189						○						
	Hard		3	SS	52		188						○	—			3 30 40 27		
	with inclusions of rusty brown silt		4	SS	59		187						○						
	Very Stiff to Stiff		5	SS	29		186						○						
	Grey		6	SS	20		185						○						
			7	SS	17		184						○						
			8	SS	12		183						○	—			3 29 35 33		
			9	SS	13		182						○						
			10	SS	11		181						○						
			11	TW	PH		180						○						
							179						○						
							178												
							177												
							176												
	Cont'd																		

Cont'd

RECORD OF BOREHOLE No 73-1

2 of 3

METRIC

W.P.	<u>64-00-04</u>	LOCATION	<u>Hwy 401 Sta. 12+937, o/s 15.0m Lt. of CL median</u>	ORIGINATED BY	<u>MR</u>
DIST	<u>31</u>	HWY	<u>401</u>	BOREHOLE TYPE	<u>C.F.H.S.A., Mud Rotary and NO Rock Coring</u>
				COMPILED BY	<u>MRA</u>
DATUM	<u>Geodetic</u>	DATE	<u>February 20, 2002</u>	CHECKED BY	<u>DWK</u>

SOIL PROFILE			SAMPLES		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
175.8	(Till)	[Strat Plot]	12	SS	15
			13	SS	13
			14	SS	14
			15	SS	10
164.86	Fine sand, some silt	[Strat Plot]			
25.90	Very Dense Grey Saturated	[Strat Plot]	16	SS	73
162.26	Silty clay, trace of sand	[Strat Plot]			
28.50	Very Stiff Grey (Till)	[Strat Plot]			
	Cont'd	[Strat Plot]			

RECORD OF BOREHOLE No 108

1 of 1

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+914, o/s 21.6m Lt. of CL median ORIGINATED BY MR
 DIST 31 HWY 401 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY GD
 DATUM Geodetic DATE February 22, 2002 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
190.76	Ground Level							20	40	60	80	100					
0.89	Topsoil																
	Sandy silty clay, trace of gravel																
	Stiff to Hard		1	SS	12		190										
	Brown																
	(Till)		2	SS	26		189										
							188										
			3	SS	46		187										
	Very Stiff						186										
	Grey		4	SS	28		185										
							184										
			5	SS	21		183										
							182										
181.61			6	SS	15												
9.15	End of Borehole																
	Borehole dry on completion of drilling																
	■ Penetrometer Test																

RECORD OF BOREHOLE No 110

1 of 1

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+972, o/s 31.6m Lt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY GD
DATUM Geodetic DATE February 15, 2002 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w _p	w	w _L					
190.71	Ground Level							20	40	60	80	100								
0.00	Silty clay, trace of sand Dark Brown																			
0.28	Sandy silty clay, trace of gravel																			
	Stiff Brown (Till)		1	SS	12		190													
	Very Stiff		2	SS	23		189													
	Hard						188													
			3	SS	53		187													
	Very Stiff Grey		4	SS	17		186													
						185														
						184														
	Stiff		5	SS	15		183													
						182														
181.56			6	SS	13															
9.15	End of Borehole																			
	Borehole dry on completion of drilling																			
	■ Penetrometer Test																			

RECORD OF BOREHOLE No 73-1

3 of 3

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+937, o/s 15.0m Lt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE C.F.H.S.A., Mud Rotary and NQ Rock Coring COMPILED BY MRA
DATUM Geodetic DATE February 20, 2002 CHECKED BY DWK

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
160.76			17	SS	25												0 5 46 49
158.01							160										
158.75	Bedrock Unweathered, strong limestone Light Grey		18	RC	REC 95%		159										
	100% drill water return						158										
							157										RQD = 85%
							156										
154.96							155										
35.80	End of Borehole																
	Borehole dry on completion of drilling																
	■ Penetrometer Test																

RECORD OF BOREHOLE No 73-2

1 of 1

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+959, o/s 18.0m Rt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY MRA
DATUM Geodetic DATE February 22, 2002 CHECKED BY DWK

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					
190.96 0.08	Ground Level Topsoil						20	40	60	80	100						
	Sandy silty clay, trace of gravel, with bluish grey fissures and oxidized stains		1	SS	15												
	Stiff Brown (Till)		2	SS	11												
	Hard		3	SS	23												
			4	SS	48												
	Very Stiff Grey		5	SS	30												
			6	SS	26												
			7	SS	19												
			8	SS	22												
181.36 9.60	End of Borehole		9	SS	17												
	Borehole dry on completion of drilling																
	■ Penetrometer Test																

RECORD OF BOREHOLE No 73-3

1 of 1

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+950, o/s 8.4m Lt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY MRA
DATUM Geodetic DATE February 19, 2002 CHECKED BY DWK



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					
192.06 0.00	Ground Level						192	20	40	60	80	100	20	40	60		
190.86 1.20 189.96 2.10	Limestone, railway ballast (Fill)						191										* No recovery
	Silty clay, some sand						190										
	Firm Black to Brown		1	SS	7*		189										
	Sandy silty clay, trace of gravel, with bluish grey fissures and oxidized stains		2	SS	11		188										
	Stiff to Very Stiff		3	SS	25		187										
	Brown (Till)						186										
	Hard		4	SS	52		185										
			5	SS	45		184										
	Very Stiff to Stiff						183										
	Grey		6	SS	22												

RECORD OF BOREHOLE No 73-4

1 of 3

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+978, o/s 19.0m Rt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE C.F.H.S.A. and Mud Rotary COMPILED BY MRA
DATUM Geodetic DATE February 19, 2002 CHECKED BY DWK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID 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			SHEAR STRENGTH kPa					w _p	w	w _L					
192.12	Ground Level						20	40	60	80	100									
0.00	Crushed limestone (Fill)																			
190.92																				
1.20	Sandy silty clay, trace of gravel, with bluish grey fissures		1	SS	6															
	Firm to Stiff																			
	Olive Brown to Brown		2	SS	7															
	(Till)																			
			3	SS	11															
	Hard																			
			4	SS	35															
			5	SS	38															
	Very Stiff to Stiff																			
			6	SS	18															
			7	SS	15															
			8	SS	13															
			9	SS	16*															
			10	SS	13															
															</					

* No
recovery

RECORD OF BOREHOLE No 73-4

2 of 3

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+978, o/s 19.0m Rt. of CL median ORIGINATED BY MR
DIST 31 HWY 401 BOREHOLE TYPE C.F.H.S.A. and Mud Rotary COMPILED BY MRA
DATUM Geodetic DATE February 19, 2002 CHECKED BY DWK

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 (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE		
177.1 15.00	Sandy silty clay, trace of gravel, with bluish grey fissures (Till)		11	SS	11*									* No recovery				
			12	SS	8		174											
				FV														
							173											
							172											
			13	SS	11		171											
							170											
							169											
			14	SS	13		168											
							167											
166.22 25.90	Fine sand, some silt, trace of gravel Very Dense Grey Saturated		15	SS	09/23cm**		165								** 50 blows for last 75mm			
							164											
							163											
	Cont'd																	

RECORD OF BOREHOLE No 73-4

3 of 3

METRIC

W.P. 64-00-04 LOCATION Hwy 401 Sta. 12+978, o/s 19.0m Rt. of CL median ORIGINATED BY MR
 DIST 31 HWY 401 BOREHOLE TYPE C.F.H.S.A. and Mud Rotary COMPILED BY MRA
 DATUM Geodetic DATE February 19, 2002 CHECKED BY DWK

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 (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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METRIC

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

CONT No 2007-3043

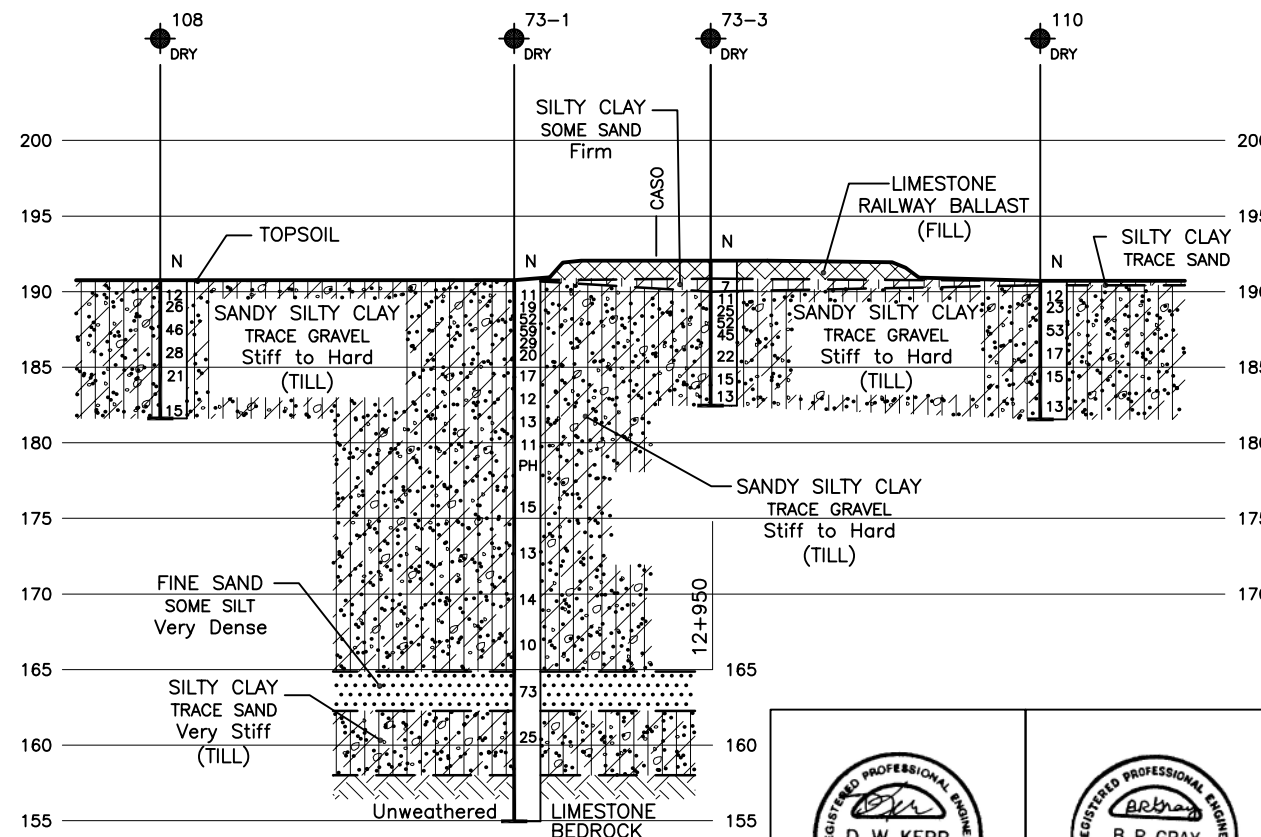
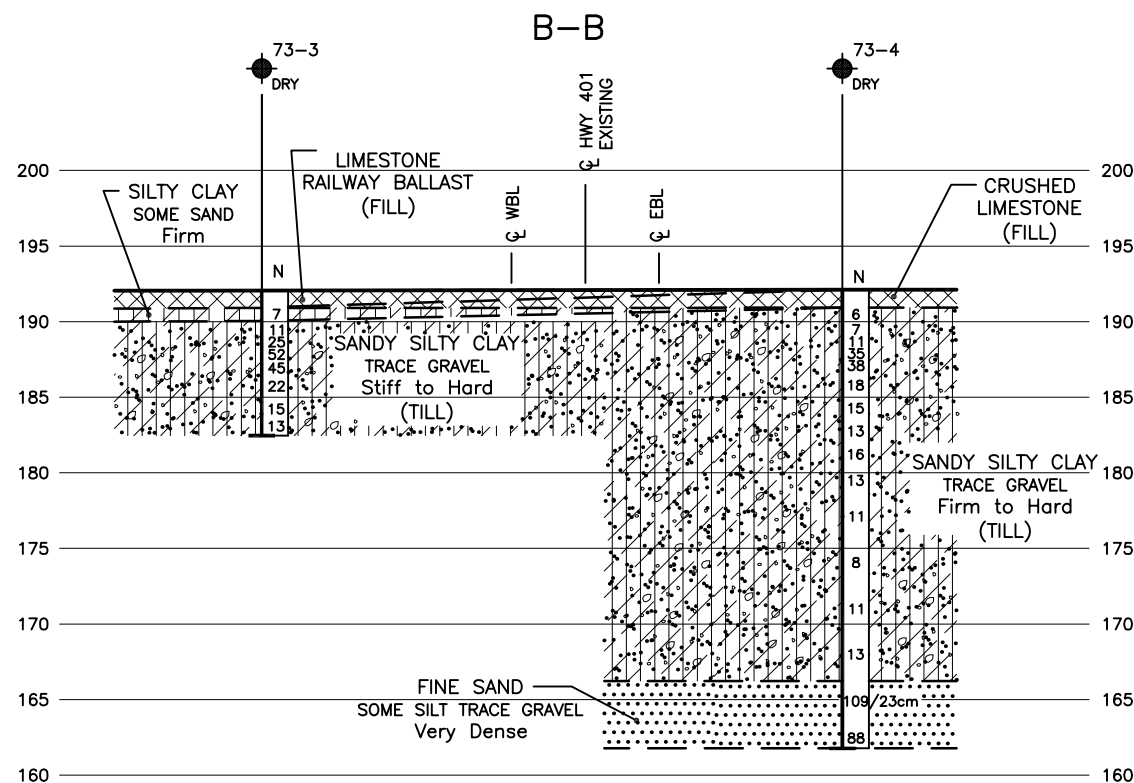
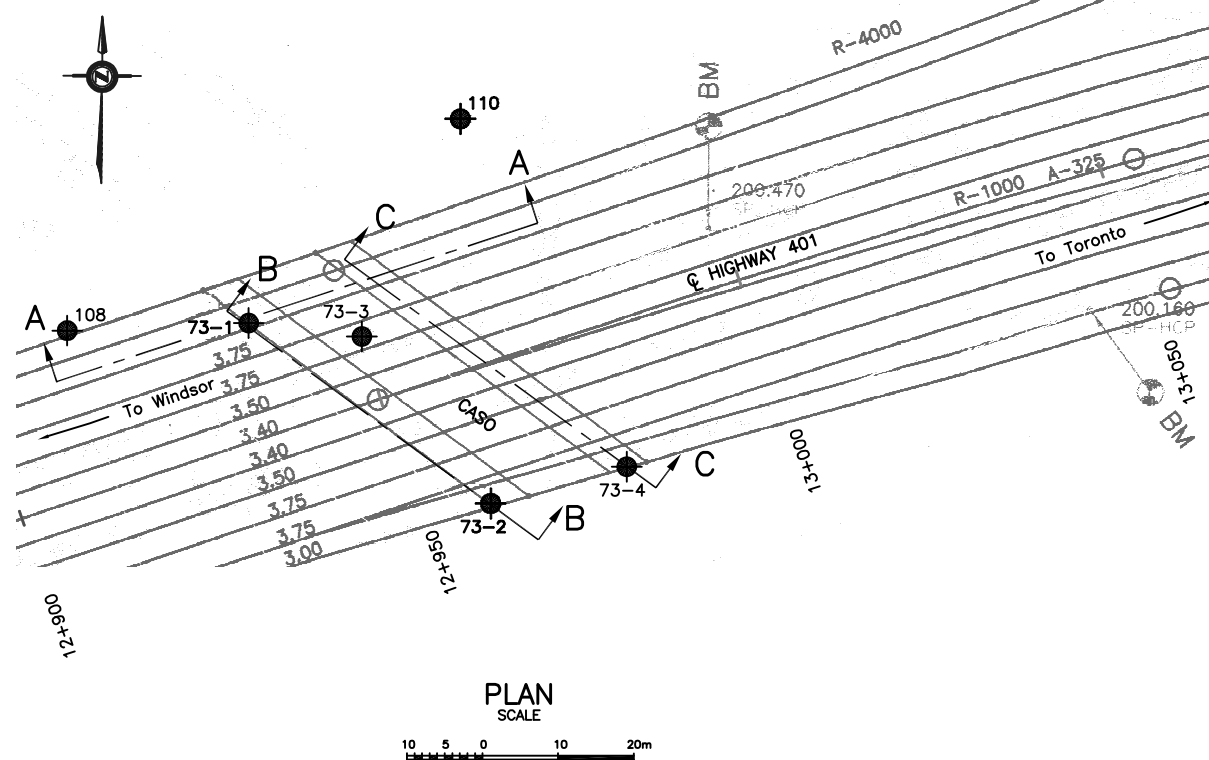
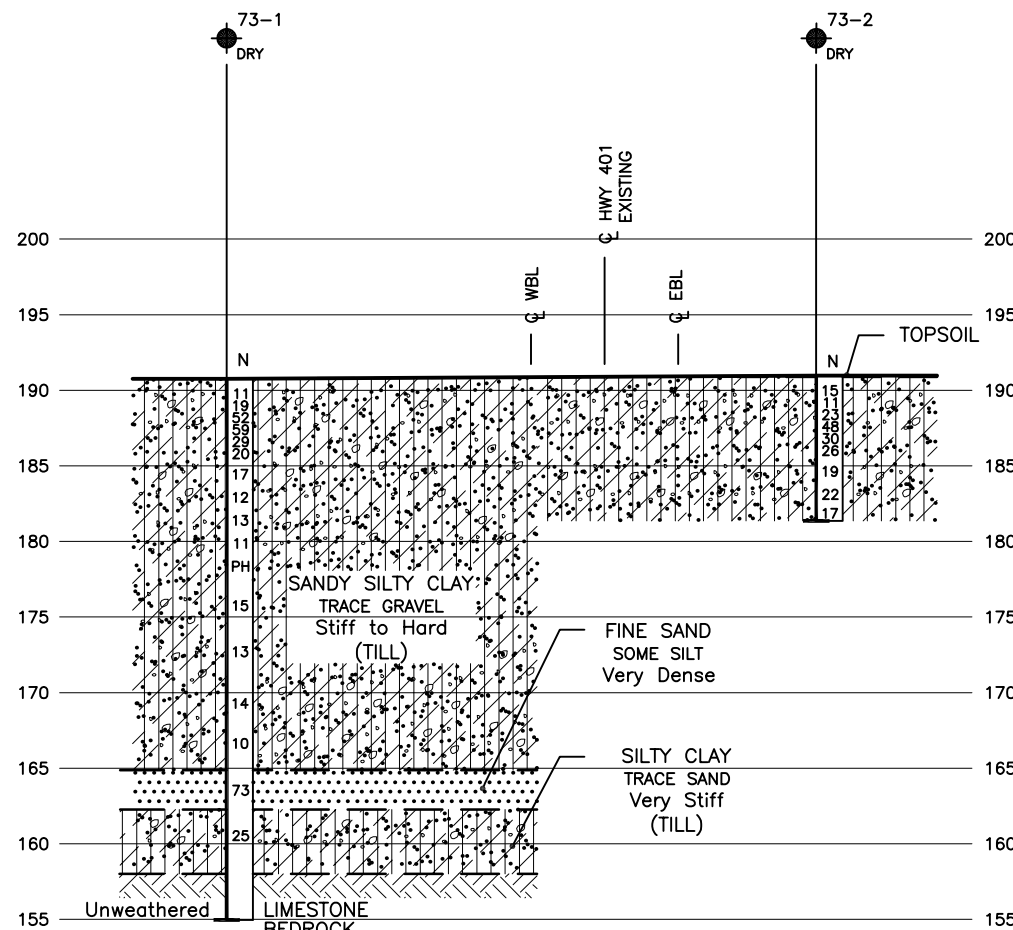
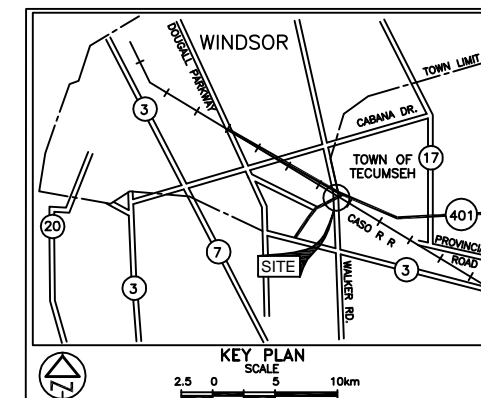
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HIGHWAY 401
CASO OVERHEAD
BOREHOLE LOCATIONS & SOIL STRATA



SHEET
491

PMI Peto MacCallum Ltd.
CONSULTING ENGINEER



LEGEND

- Borehole
- Dynamic Cone Penetration Test (Cone)
- Borehole & 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 Feb 2002
- Head
- ARTESIAN WATER
- Encountered

BH No	ELEVATION	HWY 401 STA.	o/s CL MED
73-1	190.76	12+937	15.0m Lt.
73-2	190.96	12+959	18.0m Rt.
73-3	192.06	12+950	8.4m Lt.
73-4	192.12	12+978	19.0m Rt.
108	190.76	12+914	21.6m Lt.
110	190.71	12+972	31.6m Lt.

NOTE -
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

NOTE:

SECTIONS ARE PROVIDED SOLELY FOR ILLUSTRATIVE PURPOSES. REFER TO RECORD OF BOREHOLES FOR DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS, IN-SITU TEST DATA AND LABORATORY TEST RESULTS.

SECTIONS
SCALE



REF No Survey Plan 2001 Site # 6-73, entitled Proposed Bridge Site at Conrail Railway and Highway 401, Prepared by Planning and Design Section, MTO.



REVISIONS	DATE	BY	DESCRIPTION
1	MAY22/07	CN	CHANGED FOR CONTRACT DOCUMENTS AS PER EMAIL DATED APRIL 27, 2007, FROM DILLON CONSULTING LIMITED
2	FEB.15/07	CN	ADJUSTED BOREHOLE LOCATION 73-3 AS PER MTO REQUEST

Geocres No. 40J2-47

HWY No 401	CHECKED MRA	DATE SEP 18, 2002	DIST 31
SUBM'D GD	APPROVED BRG	SITE 6-73	DWG 2