

## FINAL REPORT

**Foundation Investigation Report  
Algoma Central Rail CR Overhead (Site No. 38C-006)  
Hwy 17, Wawa Area  
WO 5009-E-0060  
MTO GEOCRES No. 41N-18**

Prepared for:  
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**Trow Associates Inc.**

March 31, 2011  
Amended May 10, 2011

ADM-00011658-A0

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# 1. Part I: FOUNDATION INVESTIGATION

## 1.1 Introduction

This report presents the results of a geotechnical investigation completed by Trow Associates Inc. (Trow) for the Algoma Central Rail Overhead Rehabilitation (Site No. 38C-006), Lendrum Township, Wawa Area. The existing structure consists of a single span bridge with free span of 12 m and an overall length of 13.4 m.

The work was undertaken under Agreement # 5006-E-0060. The terms of reference were as presented in MTO letter dated January 24, 2011.

The purpose of the investigation is to examine the existing soil conditions within the area of the existing bridge and foundation supports. The site specific geotechnical investigation consisted of test borings, borehole logging, and field and laboratory testing. This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing.

## 1.2 Site Description and Geological Setting

### 1.2.1 Site Description

The site is located on Hwy 17, approximately 3.3 km north of Hwy 101 in the Township of Lendrum, approximately 3.3 km north of Wawa, in the District of Algoma. There is an existing bridge at the site that crosses the historic railway line. The bridge consists of a single span concrete structure set on concrete abutments. The roadway is paved and guiderail is present of the roadway edge on each side. Rock outcrops are visible just north of the bridge structure and the vegetation in the immediate area consists of small to medium sized coniferous and deciduous trees with small shrubs.

The site plan is as shown on the drawings in Appendix B.

### 1.2.2 Geological Setting

According to the Ontario Ministry of Natural Resources (MNR), Map 5010, the regional surficial geology in the area consists of sand and gravel glaciofluvial outwash plain (valley train), with a moderate local relief (terraced) and dry surface conditions

According to Bedrock Geology of Ontario Map 2543 (Ministry of Northern Development and Mines, Ontario), the bedrock underlying the site is from the Archean Age and Neo-to Mesoarchean geologic era (approximately 2.5 to 3.4 billion years old) and typically consists of felsic to intermediate metavolcanic rock.

## 1.3 Investigation Procedures

### 1.3.1 General

The field work for this investigation was performed between March 15 and March 20, 2011 and consisted of drilling four (4) sampled boreholes (BH-1, BH-2, BH-3, and BH-4). The four (4) boreholes were strategically located adjacent to the existing abutments to permit geotechnical investigation of the foundations. BH-1 was advanced from the road surface and was located on the south-east side of the bridge. BH-2 was advanced from the old CP rail bed surface and was located on the northeast side of the bridge. BH-3 and BH-4 were also advanced from the old CP rail bed surface and were located on the southwest and northwest side, respectively, of the bridge. Site photographs of the borehole locations are provided in Appendix A. Drawing No. 1 in Appendix B shows the locations of the four (4) boreholes.

All boreholes were advanced using a Morooka track mounted CME 55 drill rig, equipped with continuous flight hollow stem augers. All borehole drilling/sampling were operated by a specialist drilling contractor, Abraflex Drilling, also an MOE Licensed Well Drilling Contractor.

During the drilling, soil samples were obtained using a 51 outside diameter (O.D.) split-spoon sampler with automatic trip hammer, in accordance with Standard Penetration Test (SPT) procedures (ASTM D 1586), at intervals shown on the attached borehole logs (Appendix C). The SPT “N” values were recorded and used to provide an assessment of in-situ consistency or compactness of the non-cohesive soils.

After completion, boreholes were backfilled by the drilling contractor, Abraflex, with the native soils removed by the augers. This is an acceptable procedure if groundwater is not encountered (as was the case here), in accordance with O.Reg. 903.

The fieldwork was supervised by a member of Trow’s engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO Soils Classification System for foundation reports, and retrieved soil samples for subsequent laboratory testing and identification. All of the recovered soil samples were placed in moisture-proof bags and returned to Trow’s Thunder Bay laboratory for additional visual, textual and olfactory examination.

Details of the soil strata encountered in the boreholes are included in attached borehole log sheets in Appendix C, and plotted on the profiles in Appendix B.

The borehole locations were surveyed by Trow personnel, with reference to the benchmark located adjacent to the site (GBM 0011969U303), with an elevation of 290.329 m.

### 1.3.2 Laboratory Testing

All samples returned to the laboratory were subjected to visual examination and classification. The laboratory testing program included natural water content (LS-701) and grain size distribution tests (LS703/704) on approximately 25% of the collected soil samples. Hydrometer analyses and Atterberg limit testing was not performed since the soils were entirely non-plastic.

The laboratory test results are provided on the attached borehole log sheets in Appendix C. The results of the grain size analyses are presented geographically in Appendix D.

## 1.4 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the borehole log sheets in Appendix C. Laboratory test results are provided in Appendix D. The “Explanation of Terms Used in Report” preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and cross section soil profiles are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole log and cross section soil profiles are inferred from non-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Further, subsurface conditions may vary between and beyond the borehole locations.

In general, the stratigraphic sequence at the site typically consists of sand and gravel fill material that is underlain by sand to sand and silt.

A summary of the soil and groundwater conditions encountered in the boreholes is provided below.

### 1.4.1 Asphalt

Asphaltic concrete was encountered at ground surface in BH-1. The thickness of the asphaltic concrete layer was 0.1 m, and the top elevation of this layer is about 290.3 m.

### 1.4.2 Sand and Gravel (Fill)

Sand and gravel fill was encountered in all boreholes completed during the site investigation. At BH-1 the sand and gravel was encountered underlying the asphalt and in BH-2, BH-3 and BH-4, that were completed from the historic rail bed surface, the sand and gravel was encountered at the ground surface. The thickness of the sand and gravel fill was

approximately 11.3 m in BH-1 and extended from elevation 290.2 m to 278.9 m. The sand and gravel fill encountered in BH-2, BH-3 and BH-4, advanced from the historic rail bed surface, ranged in thickness from 0.2 m to 1.7 m and extends from elevation of about 281.1 m to 279.4 m.

The composition of this layer is sand and gravel to gravel and sand, trace to some silt, with occasional cobbles. The sand and gravel fill is brown to grey in colour, and frozen to damp and contained some to trace of organics. Uncorrected STP “N” value ranges from 21 to 100 blows per 300 mm in BH-1, completed from the road surface, classifying the material as compact to very dense in compactness condition. The sand and gravel layer encountered at the surface of the historic rail bed was frozen resulting in collection of one (1) uncorrected SPT “N” value during the site investigation. The resultant SPT “N” value was eight (8) that classifies the sand and gravel fill in this area as loose.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 4% to 9%

Grain Size Distribution:

- 39% to 52% gravel;
- 40% to 51% sand; and
- 8% to 11% silt and clay size

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheet in Appendix C. The results of the grain size distribution tests are also provided on Figure 1 in Appendix D.

### 1.4.3 Sand to Silt

Sand was encountered in all boreholes advanced during the site investigation. Layers of finer material, consisting of varying degrees of silt content, were also encountered within the sand layer.

The sand was encountered underlying the sand and gravel fill and had a thickness ranging from about 12.1 m to 15.7 m. It extends to depths between 14.5 m and 23.5 m from the ground surface, with approximate elevations ranging from 265.1 m to 266.8 m. Advancement was terminated at depth of 23.5 m in BH-1 and at 15.9 m in BH-2 and BH-3. Advancement in BH-4 was terminated at 14.7 m depth due to refusal to the augers.

Layers or zones of sand with increased silt content were encountered in BH-1 at 11.4 m depth to 12.7 m depth and also at 13.7 m depth to 15.3 m depth. Sand with increased silt

content was also encountered in BH-2 at depths of 3.1 m to 4.6 m, in BH-3 at 4.6 m to 9.2 m and in BH-4 at depths of 1.7 m to 9.2 m.

The sand deposit consists of sand, some silt to sand and silt, trace gravel and was fine to medium grained. A 120 mm layer of wet sand and silt was encountered in BH-3 at approximately 6.1 m deep and a 100 mm layer of wet sand and silt was encountered in BH-4 at approximately 3.0 m deep. Interbedded wet sand and silt layers were also encountered in BH-4 at approximately 3.8 m deep. The sand is brown in color, and was frozen to moist to damp. Uncorrected SPT “N” values range from 5 to 37 blows per 300 mm, classifying the sand as loose to dense in compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 3% to 17%

Grain Size Distribution:

- 0% gravel;
- 51% to 89% sand; and
- 11% to 49% silt and clay size

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheet in Appendix C. The results of the grain size distribution tests are also provided on Figure 2 in Appendix D.

As mentioned above, the sand layer contained layers or zones with higher silt contents. These layers consisted of silt, some sand to silt and sand. Occasional clay seams, 5 mm to 10 mm thick, with trace organics and trace oxidation were noted in BH-1 at approximately 11.4 m deep. The silt and sand was brown in color, moist and was fine grained. Uncorrected SPT “N” values range from 8 to 15 blows per 300 mm, classifying the silt and sand layers as loose to compact in compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 10% to 31%

Grain Size Distribution:

- 0% gravel;
- 14% to 47% sand; and

- 53% to 87% silt and clay size

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheet in Appendix C. The results of the grain size distribution tests are also provided on Figure 3 in Appendix D.

## 1.5 Groundwater Conditions

Groundwater or standing water was not encountered in the boreholes advanced during the site investigation. Increased moisture contents were observed in finer grained soils sampled during the site investigation. It should be noted that the groundwater levels are subject to seasonal fluctuations and could become established within the soil subsurface after extended periods of precipitation or potentially after the spring melt and freshet has occurred.

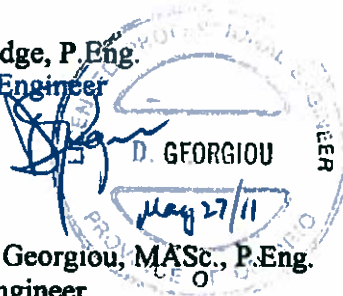
### Signature

This Foundation Investigation Report has been prepared by Ben Plumridge, P.Eng. and Demetri N. Georgiou, P.Eng., and reviewed by S.E. Gonsalves, P.Eng., Designated MTO Foundations Contact.

Yours truly,

**Trow Associates Inc.**

Ben Plumridge, P.Eng.  
Sr. Project Engineer



Demetri N. Georgiou, M.A.Sc., P.Eng.  
Principal Engineer  
Thunder Bay Branch Manager

A large, stylized handwritten signature of S.E. Gonsalves.

S.E. Gonsalves, M.Eng., P.Eng.  
Principal Engineer  
Designated MTO Foundations Contact



Encl.



## **APPENDIX A: PHOTOGRAPHS**



Photo No. 1: Set-up at BH-1 located on south-east side of bridge. Borehole advanced from Hwy 17 shoulder. View looking north.



Photo No. 2: Auger cuttings from BH-1 consisting of sand and gravel fill with cobbles, that is underlain asphalt.



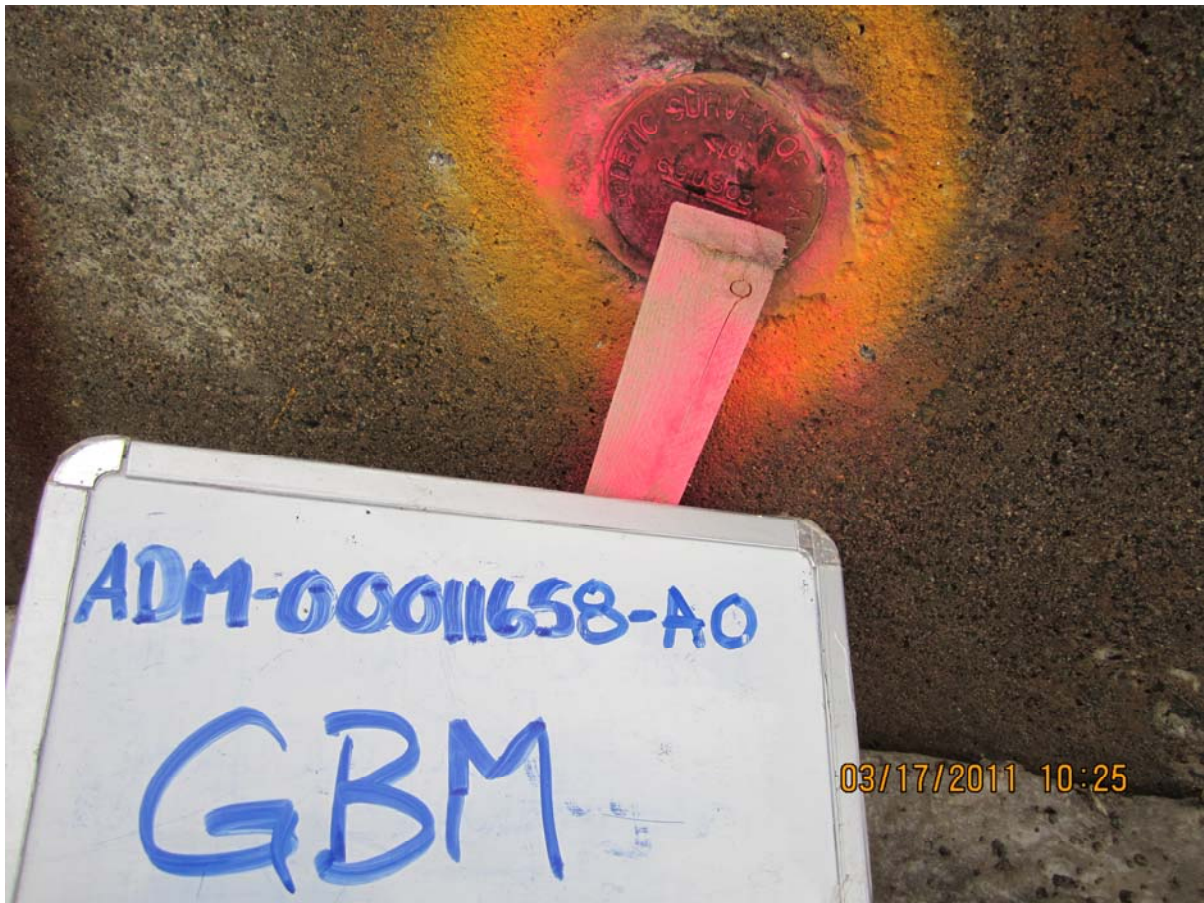


Photo No. 3: Local GBM at the site used for survey elevations of boreholes.



Photo No. 4: Set-up at BH-2 located on north-east side of bridge. Borehole advanced from historic railway surface. View looking north-east.



Photo No. 5: Set-up at BH-3 located on south-west side of bridge. Borehole advanced from historic railway surface. View looking south-west.





Photo No. 6: Set-up at BH-4 located on north-west side of bridge. Borehole advanced from historic railway surface. View looking north-west.

## **APPENDIX B: DRAWINGS**





1485m

Image © 2011 GeoEye  
© 2011 Cnes/Spot Image

Imagery Date: Oct. 8, 2006      47°59'01.95" N      84°47'13.66" W      elev. 260 m      Ey



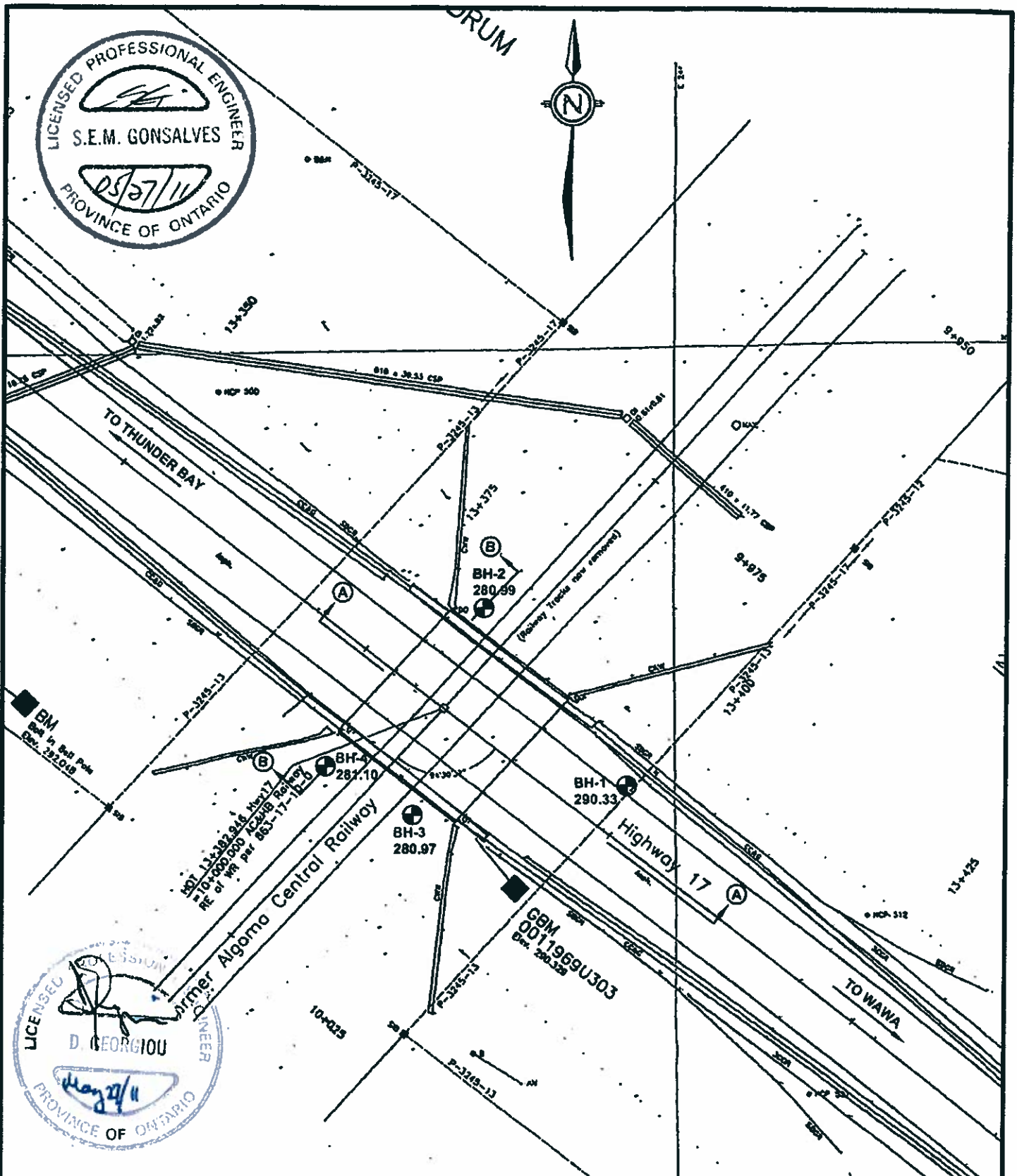
**Trow Associates Inc.**  
Thunder Bay, Ontario

**FIGURE**  
**1**

**SITE LOCATION PLAN**  
Foundation Investigation & Design  
Algoma Central Rail-CR Overhead  
(Site No. 38C-006)  
GeoCres No. 41N-18  
Wawa, ON

PROJECT NO.:	ADM-00011658-A0
SCALE:	1:25000
DRAWN BY:	DT
CHECKED BY:	BP
DATE:	MARCH 31, 2011





**NOTES:**

1) REFERENCE: BASE PLAN PROVIDED BY CLIENT

**LEGEND:**

● BH1 BOREHOLE LOCATION  
290.33 ELEVATION IN METRES



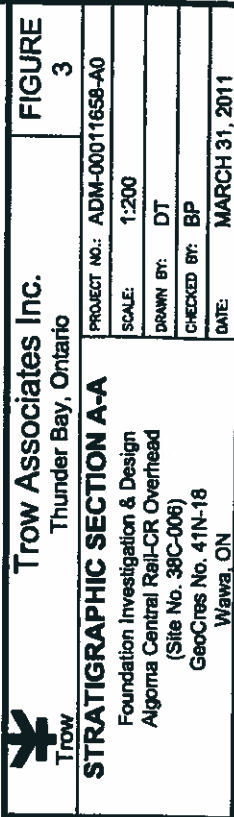
**Trow Associates Inc.**  
Thunder Bay, Ontario

**FIGURE**  
2

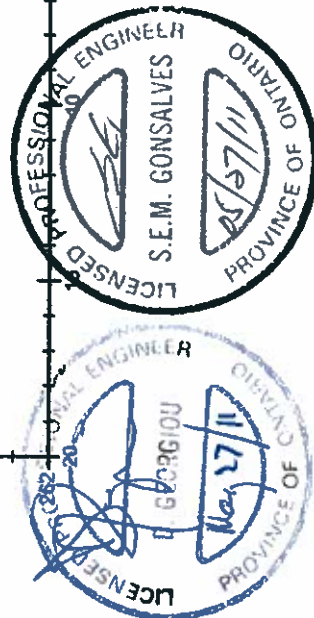
**BOREHOLE LOCATION PLAN**

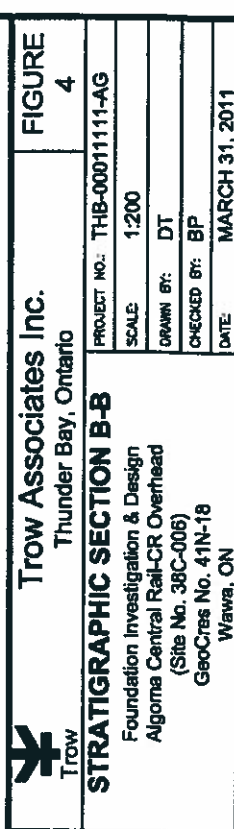
Foundation Investigation & Design  
Algoma Central Rail-CR Overhead  
(Site No. 38C-008)  
GeoCres No. 41N-18  
Wawa, ON

PROJECT NO.: ADM-00011858-A0  
SCALE: 1:400  
DRAWN BY: DT  
CHECKED BY: BP  
DATE: MARCH 31, 2011

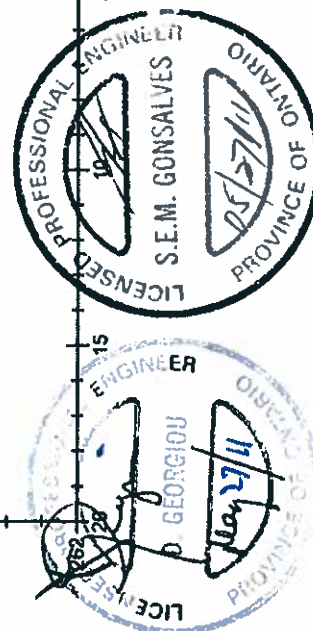


**SECTION A-A**  
**§ HWY 17**





**SECTION B-B**  
**NORTH ABUTMENT**



## **APPENDIX C: BOREHOLE LOGS**

## 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 475J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

$C_u$ (kPa)	0 – 12	12 – 25	25 – 50	50 – 100	100 – 200	>200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

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

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

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

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

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

**JOINT 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

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

### STRESS AND STRAIN

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

### MECHANICAL PROPERTIES OF SOIL

$m_v$	$\text{kPa}^{-1}$	COEFFICIENT OF VOLUME CHANGE
$c_c$	1	COMPRESSION INDEX
$c_s$	1	SWELLING INDEX
$c_a$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	$\text{m}^2/\text{s}$	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_i$	1	SENSITIVITY = $c_u / \tau_r$

## PHYSICAL PROPERTIES OF SOIL

$P_s$	$\text{kg}/\text{m}^3$	DENSITY OF SOLID PARTICLES	$e$	1, %	VOID RATIO	$e_{\text{min}}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SOLID PARTICLES	$n$	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{\text{max}} - e}{e_{\text{max}} - e_{\text{min}}}$
$P_w$	$\text{kg}/\text{m}^3$	DENSITY OF WATER	$w$	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF WATER	$s_r$	%	DEGREE OF SATURATION	$D_n$	mm	N PERCENT – DIAMETER
$P$	$\text{kg}/\text{m}^3$	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma'$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$P_d$	$\text{kg}/\text{m}^3$	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	$\text{m}^3/\text{s}$	RATE OF DISCHARGE
$\gamma_d$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $(w_L - w_p)$	v	$\text{m}/\text{s}$	DISCHARGE VELOCITY
$P_{\text{sat}}$	$\text{kg}/\text{m}^3$	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $(w - w_p) / I_p$	i	1	HYDRAULIC GRADIENT
$\gamma_{\text{sat}}$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $(w_L - w) / I_p$	k	$\text{m}/\text{s}$	HYDRAULIC CONDUCTIVITY
$P'$	$\text{kg}/\text{m}^3$	DENSITY OF SUBMERGED SOIL	$e_{\text{max}}$	1, %	VOID RATIO IN LOOSEST STATE	j	$\text{kN}/\text{m}^2$	SEEPAGE FORCE
$\gamma'$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SUBMERGED SOIL						

# RECORD OF BOREHOLE No BH-1

1 OF 1

METRIC

W.P. **5142-06-01** LOCATION **Algoma Central Rail CR Overhead (Site No. 38C-006)** ORIGINATED BY **EF**  
 DIST **Algoma** HWY **17** BOREHOLE TYPE **CME 55 Trackout / HSA** COMPILED BY **AM**  
 DATUM **Geodetic** DATE **3.15.11 - 3.17.11** CHECKED BY **BP**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	"N" VALUE		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>		
290.3	Asphalt						290							
290.3	ASPHALT - about 100 mm		S1	AUGER			290							
	SAND AND GRAVEL (FILL) -		S2	AUGER										
	frozen, brown to grey, trace to some		S3	AUGER										
	silt		S4	SS	100									
	- becoming brown, no SPT													
	penetration due to frost at about 0.8													
	m depth													
	- very dense, brown, damp at about		S5	SS	66		288							
	1.5 m depth													
	- occasional cobbles at about 1.6 m		S6	SS	37									
	depth													
	- becoming dense at about 3.0 m		S7	SS	22		286							
	depth													
	- becoming compact, moist at about		S8	SS	47									
	3.8 m depth													
	- becoming dense to very dense at		S9	SS	43									
	about at 4.8 m depth													
			S10	SS	60		284							
	- becoming compact to dense, moist		S11	SS	21									
	at about 6.9 m depth, trace roots at													
	about 6.9 m to 7.6 m depth		S12	SS	30									
	- becoming damp, occasional													
	cobbles at about 7.6 m depth		S13	SS	32		282							
			S14	SS	35									
			S15	SS	32		280							
			S16	SS	24									
278.9														
11.4	SILT AND SAND - compact to loose,		S17	SS	13		278							
	brown, moist to wet, occasional 5 to													
	10 mm clay seam, trace organics,		S18A	SS	8									
	some oxidation													
277.7			S18B	SS	7									
12.7	SAND - loose to compact, brown,													
	moist to wet, trace gravel, fine													
	grained													
276.6														
13.7	SILT - loose, brown, moist, some		S19	SS	9		276							
	sand													
275.1														
15.3	SAND - compact, light brown, moist,		S20	SS	25		274							
	trace to some silt, very fine grained													
			S21	SS	11									
			S22	SS	14		272							
			S23	SS	26		270							
			S24	SS	37									
							268							
			S25	SS	25									
266.8														
23.5	End of Borehole													
	- No groundwater encountered during													
	drilling													
	- Borehole dry upon completion													

ONTARIO MOT F-11111 ALGOMA CENTRAL RAIL CP OVERHEAD SITE - WAWA - BRAMPTON GPJ ONTARIO MOT.GDT 4/20/11

# RECORD OF BOREHOLE No BH-2

1 OF 1

METRIC

W.P. 5142-06-01 LOCATION Algoma Central Rail CR Overhead (Site No. 38C-006) ORIGINATED BY EF  
 DIST Algoma HWY 17 BOREHOLE TYPE CME 55 Trackmout / HSA COMPILED BY AM  
 DATUM Geodetic DATE 3.19.11 - 3.19.11 CHECKED BY BP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	"N" VALUE		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		
281.0	Sand and Gravel		S1	AUGER			280							
280.9	SAND AND GRAVEL (FILL) - frozen, brown, trace silt, some organics		S2	AUGER										
	SAND - frozen, dark brown, trace gravel in upper 0.8 m, trace silt, trace organics in upper 0.8 m, fine grained - becoming loose, light brown, damp at about 0.8 m depth		S3	SS	7									
			S4	SS	5									
			S5	SS	5									
277.9			S6	SS	8		278							
3.1	SILT AND SAND - loose to compact, light brown, moist, very fine grained		S7	SS	16									
276.4			S8	SS	17		276							
4.6	SAND - compact, light brown, moist, some silt to silty, very fine grained		S9	SS	18									
			S10	SS	20									
			S11	SS	19		274							
	- becoming fine grained at about 7.6 m depth		S12	SS	17									
			S13	SS	20		272							
			S14	SS	15									
			S15	SS	15									
			S16	SS	15		270							
			S17	SS	24									
			S18	SS	25									
			S19	SS	23		268							
			S20	SS	28									
			S21	SS	14		266							
			S22	SS	30									
265.1	End of Borehole													
15.9	- No groundwater encountered during drilling - Borehole dry upon completion													

ONTARIO MOT F-11111 ALGOMA CENTRAL RAIL CP OVERHEAD SITE - WAWA - BRAMPTON GP J. ONTARIO MOT GDT 4/20/11



# RECORD OF BOREHOLE No BH-3

1 OF 1

METRIC

W.P. **5142-06-01** LOCATION **Algoma Central Rail CR Overhead (Site No. 38C-009)** ORIGINATED BY **EF**  
 DIST **Algoma** HWY **17** BOREHOLE TYPE **CME 55 Trackmout / HSA** COMPILED BY **AM**  
 DATUM **Geodetic** DATE **3.19.11 - 3.19.11** CHECKED BY **BP**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	"N" VALUE			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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100			
281.0	Sand and Gravel														
0.0	<b>SAND AND GRAVEL (FILL)</b> - frozen, dark brown, trace organics		S1	AUGER											
280.2															
0.8	<b>SAND</b> - loose to compact, brown to red, damp, trace gravel in upper 2.3 m, trace silt, fine grained - becoming brown to light brown at about 1.5 m depth - becoming moist, silty, very fine grained at about 2.3 m depth		S2	SS	10		280								
			S3	SS	10										
			S4	SS	5		278								
			S5	SS	5										
			S6	SS	12										
276.4															
4.6	<b>SILT</b> - compact, light brown, moist, some sand		S7	SS	12		276								0 72 28
275.6															
5.4	<b>SILT TO SAND</b> - compact, light brown, moist, very fine grained - 120 mm layer of wet sand at about 6.1 m depth		S8	SS	18										
			S9	SS	17										
			S10	SS	14		274								0 14 86
			S11	SS	16										
			S12	SS	19										
271.8							272								
9.2	<b>SAND</b> - compact, light brown, damp to moist, trace to some silt, very fine grained		S13	SS	25										
			S14	SS	22										
			S15	SS	17		270								
			S16	SS	22										
			S17	SS	19										
			S18	SS	20		268								
			S19	SS	22										
			S20	SS	23		266								
265.1			S21	SS	17										
15.9	<b>End of Borehole</b> - No groundwater encountered during drilling - Borehole dry upon completion														

ONTARIO MOT F-11111 ALGOMA CENTRAL RAIL CP OVERHEAD SITE - WAWA - BRAMPTON GPJ ONTARIO MOT.GDT 4/20/11

# RECORD OF BOREHOLE No BH-4

1 OF 1

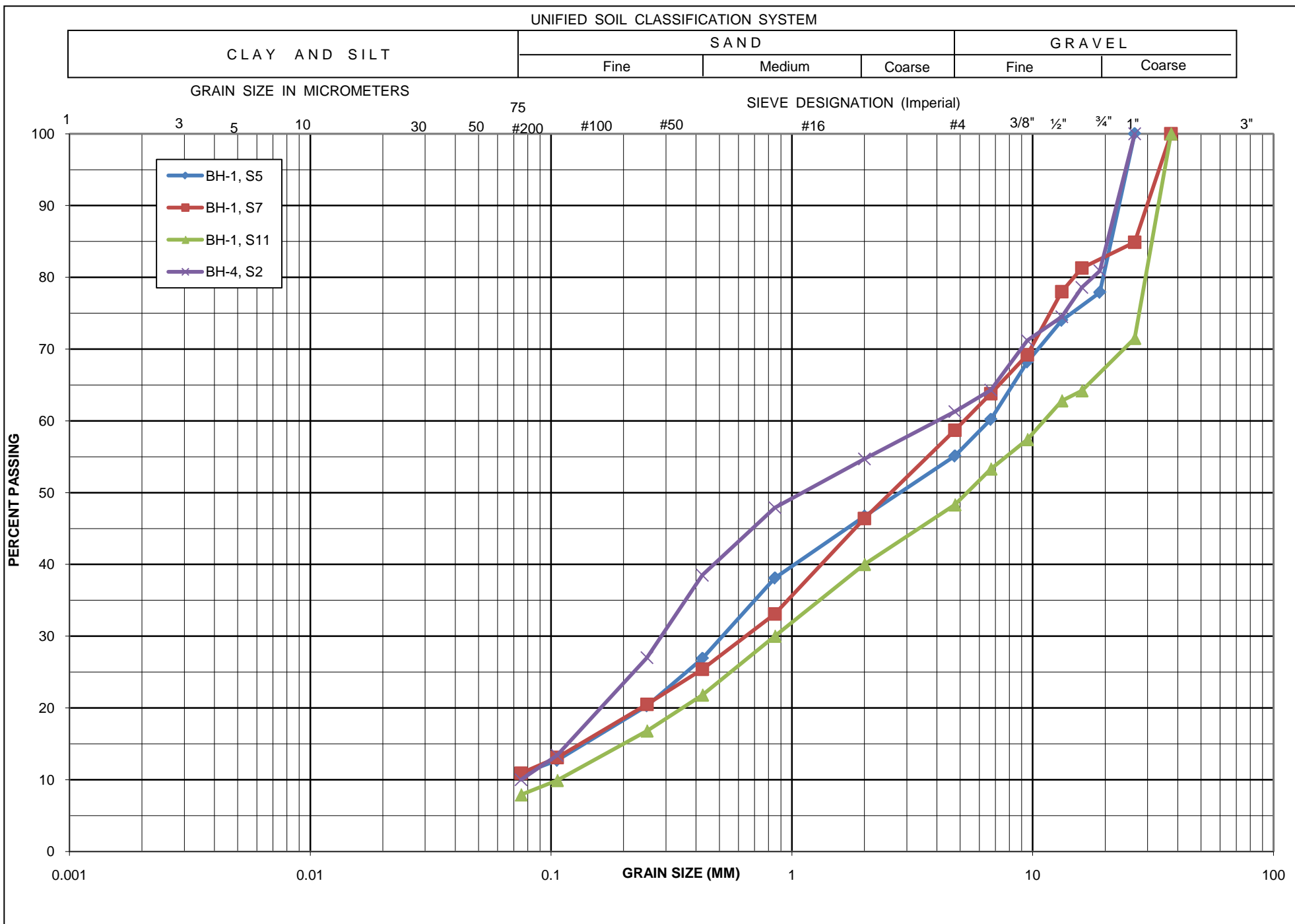
METRIC

W.P. 5142-08-01 LOCATION Algoma Central Rail CR Overhead (Site No. 38C-006) ORIGINATED BY EF  
 DIST Algoma HWY 17 BOREHOLE TYPE CME 65 Trackmout / HSA COMPILED BY AM  
 DATUM Geodetic DATE 3.20.11 - 3.20.11 CHECKED BY BP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	"N" VALUE		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			20	40					
281.1	Sand and Gravel						20	40	60	80	100		
0.0	<b>SAND AND GRAVEL (FILL)</b> - frozen, dark brown, trace silt, some organics - becoming loose, brown, damp at about 0.8 m depth		S1	AUGER									
279.4	- becoming very loose, trace peat at about 1.5 m depth		S2	SS									39 51 10
1.7	<b>SILT TO SAND</b> - loose, light brown, damp to moist, fine grained		S3A	SS									0 0 0
	- becoming very fine grained, 100 mm layer of wet sand and silt at about 3.0 m depth		S3B	SS									0 76 24
	- becoming compact, moist, interbedded wet sand and silt layers at about 3.8 m depth		S4	SS									0 0 0
	- becoming very fine grained, 100 mm layer of wet sand and silt at about 3.0 m depth		S5	SS									0 0 0
	- becoming compact, moist, interbedded wet sand and silt layers at about 3.8 m depth		S6	SS									0 51 49
	- wet layers at about 6.1 m depth		S7	SS									0 13 87
	- some silt to silty, fine grained at about 7.6 m depth		S8	SS									0 61 39
			S9	SS									0 0 0
			S10	SS									0 0 0
			S11	SS									0 0 0
			S12	SS									0 86 14
272.0	<b>SAND</b> - compact, brown, damp to moist, trace to some silt, fine grained		S13	SS									0 89 11
9.2			S14	SS									0 0 0
			S15	SS									0 0 0
			S16	SS									0 0 0
			S17	SS									0 0 0
			S18	SS									0 0 0
			S19	SS									0 0 0
266.6	<b>End of Borehole</b> - refusal to auger and SPT - No groundwater encountered during drilling - Borehole dry upon completion												
14.5													

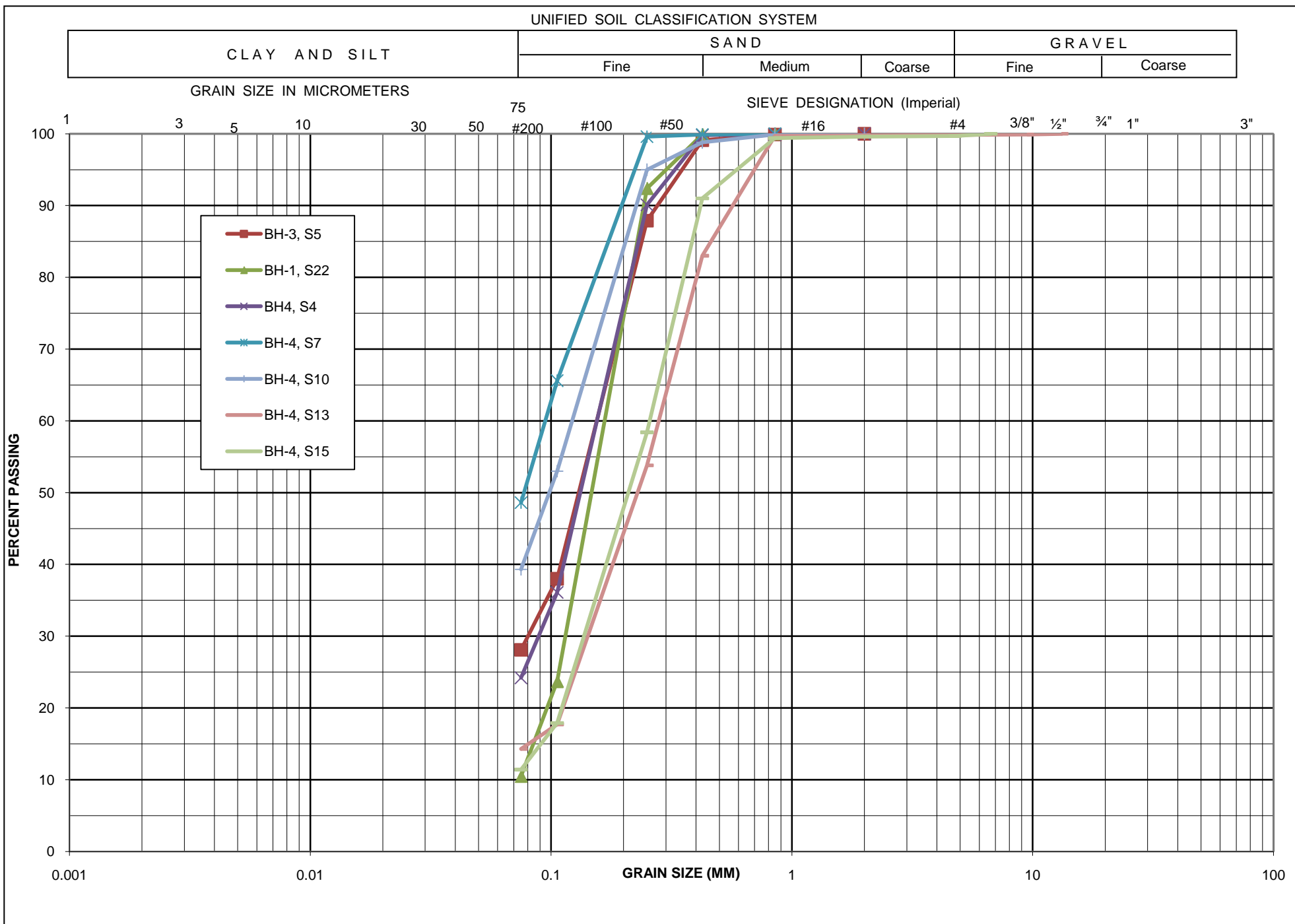
ONTARIO MOT F-11111 ALGOMA CENTRAL RAIL CP OVERHEAD SITE - WAWA - BRAMPTON.GPJ ONTARIO MOT GDT 4/20/11

## **APPENDIX D: LABORATORY DATA**



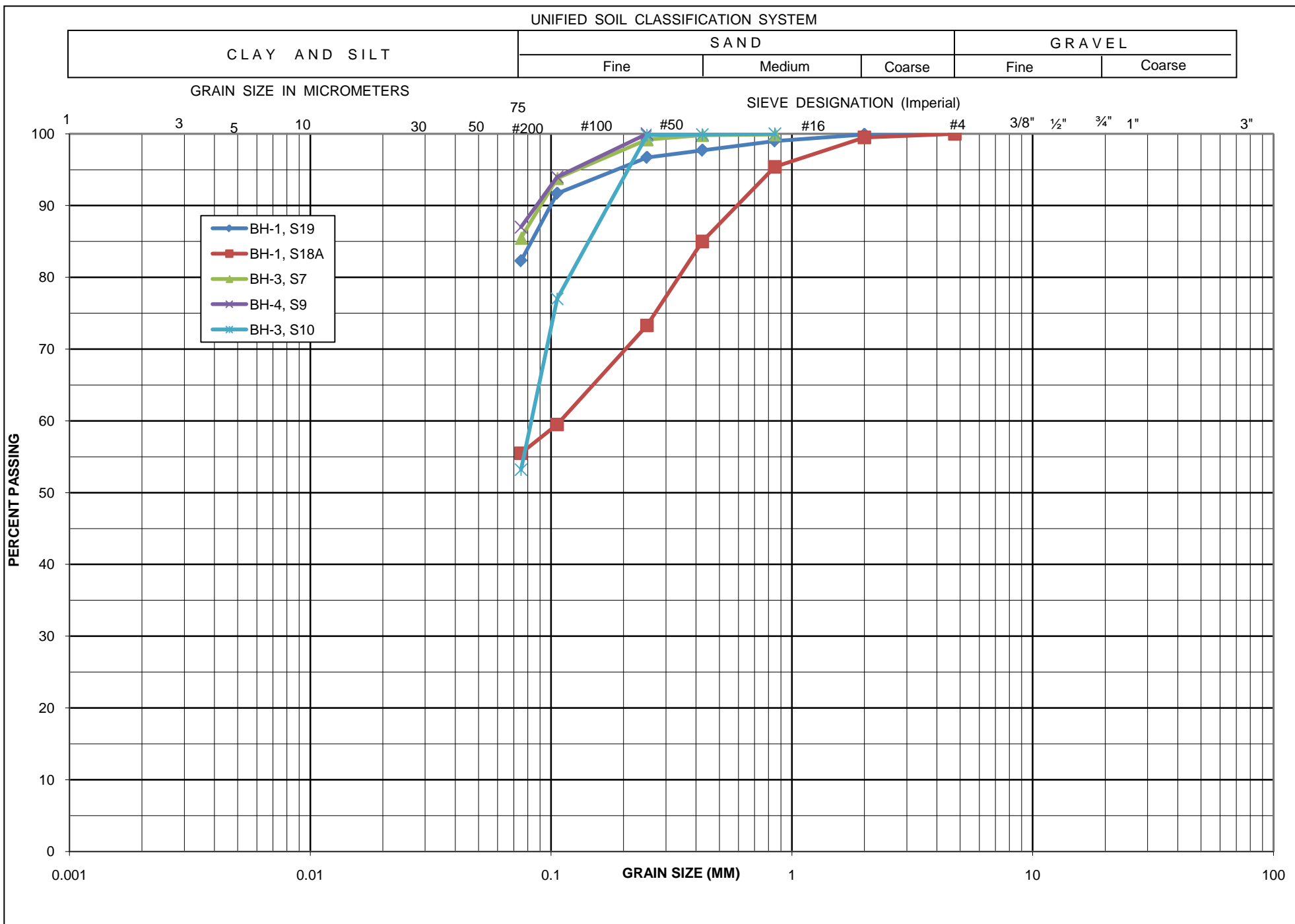
**GRAIN SIZE DISTRIBUTION - Sand and Gravel (Fill)**  
 Foundation Investigation and Design Algoma Central Rail CP Overhead (Site  
 No. 386-006) - Geocres No. 41N-18, Wawa, Ontario

FIGURE No. 1  
 Ref. No. ADM-00011658-AO  
 DATE March 30, 2011



**GRAIN SIZE DISTRIBUTION - Sand**  
 Foundation Investigation and Design Algoma Central Rail CP Overhead (Site  
 No. 386-006) - Geocres No. 41N-18, Wawa, Ontario

FIGURE No. 2  
 Ref. No. ADM-00011658-AO  
 DATE: March 30, 2011



**GRAIN SIZE DISTRIBUTION - Silt and Sand**  
 Foundation Investigation and Design Algoma Central Rail CP Overhead (Site  
 No. 386-006) - Geocres No. 41N-18, Wawa, Ontario

FIGURE No. 3

Ref. No. ADM-00011658-AO

DATE: March 30, 2011