



**TECHNICAL MEMORANDUM**

**for**

**RETAINING WALLS**

**HIGHWAY 401 / HENRY STREET UNDERPASS**

**SITE 22-152, W.O. 09-20009**

**WHITBY, ONTARIO**

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**1. INTRODUCTION**

This Technical Memorandum includes updates to the Foundation recommendations provided in the Foundation Investigation and Design report (FIDR) dated September 5, 2014 (GEOCREC No. 30M15-199) for the Highway 401/ Henry Street Underpass, Site No. 22-152, W.O. 09-20009 in Whitby, Ontario.

The previous 2014 recommendations remain unchanged except for those related to the updating of the Canadian Highway Bridge Design Code (CHBDC) from the 2006 edition to the current 2014 edition. The revised CHBDC 2014 references affected the seismic design site classification and included the CHBDC 2014 clauses. These new references are contained in this Technical Memorandum and supersede those in the September 5, 2014 FIDR.

It is also noted that the delivery of this project was changed from a Design Build in 2014 to the current Design Bid Build model.

**1.1 General**

This report provides foundation engineering recommendations regarding design and comments for construction of the proposed retaining walls associated with the replacement of an underpass carrying Henry Street traffic over Highway 401 in Whitby, Ontario. The project is administered as a Design Bid Build. This Foundation Design Report is solely for the use of AECOM Canada Ltd. (AECOM) for the detail design of this specific project on behalf of the Ministry of Transportation of Ontario (MTO) and shall not be used for any other purposes or by any other parties including the construction contractor. Refer to the associated contract drawings for design requirements.



Where comments are made on construction, they are provided solely to identify aspects that could affect the design of the project. Construction contractors should make their own assessment of the factual information provided in the Foundation Investigation portion of this report for their decisions related to construction including, but not limited to, equipment selection, proposed construction methods and scheduling.

The underpass is at approximate Station 13+415, Highway 401 chainage, in Whitby. The replacement underpass is proposed to be a 2-span structure with a total length of 81.0 m and width of 15.3 m (ref. General Arrangement Drawing 1 'Highway 401 / Henry Street Underpass' prepared by AECOM in October 2015). Refer to "Foundation Investigation and Design Report for Highway 401 / Henry Street Underpass, Site 22-152, W.O. 09-20009, Whitby, Ontario" prepared by Peto MacCallum Ltd. and dated September 5, 2014, (GEOCREC NO. 30M15-199).

The project involves construction of four retaining walls – one at each quadrant of the underpass – behind the structure abutments. The retaining walls will be 8.5 to 9.5 m long and up to 6.0 m high and are envisaged to be retained soil system (RSS) wing walls for the new underpass.

The proposed retaining walls have been given the following identification numbers:

**Table 1.1 – Retaining Wall Locations**

<b>WALL NO.</b>	<b>RETAINING WALLS</b>	<b>STATIONS (HENRY STREET CHAINAGE)</b>	<b>LENGTH (m)</b>
RW1	Northeast RSS Wall	Sta. 9+950.5 to 9+960.0	9.5
RW2	Northwest RSS Wall	Sta. 9+944.5 to 9+954.0	9.5
RW3	Southeast RSS Wall	Sta. 10+041.0 to 10+049.5	8.5
RW4	Southwest RSS Wall	Sta. 10+035.0 to 10+043.5	8.5

All elevations in this report are expressed in metres.



## **1.2 RSS Walls at the Underpass**

At the locations of the four RSS walls extending to the north and south of the underpass on both sides of Henry Street, boreholes H-2, H-3, H-6 and H-7 in the Foundation Investigation and Design Report identified in Section 1.1 are considered to be representative of the subsurface conditions.

In summary, the subsurface stratigraphy at the founding levels of the RSS walls generally comprised cohesive fill, firm to hard clayey silt till or compact to very dense sand / silt till. Cobbles were encountered in the glacial till in boreholes H-2, H-3 and H-6. The piezometric water level measured in boreholes H-3 and H-6 was at depths of 3.1 and 3.8 m (elevation 88.4 and 86.6) on June 18, 2014 and at depths of 3.4 and 4.6 m (elevation 88.1 and 85.8) on July 9, 2014, respectively.

Refer to Appendix TM-A for the conceptual RSS layout drawing prepared by AECOM in September 2015. The concrete levelling pads for the retaining walls are proposed to be founded at elevation 88.1 to 91.5 for the northeast wall (RW1), at elevation 88.1 to 91.8 for the northwest wall (RW2), at elevation 88.8 to 92.6 for the southeast wall (RW3) and at elevation 88.8 to 92.5 for the southwest wall (RW4).

The AECOM drawing indicates that the founding subgrade of the levelling pads will consist of granular engineered fill and/or compact to very dense / firm to hard native soils at approximate elevation 87 to 91 at the north abutment and elevation 88 to 92 at the south abutment. However, if these walls are to be specified as RSS walls from MTO's DSM list, the ultimate design must be provided by the RSS company in which case the compacted granular pad detail is not mandatory if the native soils provide adequate support at this site.

It is considered that construction of the four RSS walls is feasible at the site. The retaining walls should be founded on the native soils or on compacted granular materials in compliance with the requirements of the RSS design.

The retaining walls should be designed and analysed for bearing capacity, sliding, overturning and overall stability in accordance with the methods outlined in the Canadian Highway Bridge Design Code (CHBDC) 2014 Edition.



## **2. FOUNDATIONS**

### **2.1 General**

A retaining scheme by means of an RSS wall is considered to be the preferred option for the four retaining walls at the underpass.

The reference Peak Ground Acceleration ( $PGA_{ref}$ ) is 0.075 for the Town of Whitby, Ontario (National Building Code of Canada, 2015). Based on the subsurface conditions, the site classification for seismic design purposes is Type C in accordance with clause 4.4.3.2 of the CHBDC, 2014.

The thickness of levelling pads is designed by the proprietary RSS system and only partial frost protection is generally provided. If there is compelling site-specific evidence that frost action will distress the RSS wall, the structural designer may specify that levelling pads be placed to the frost penetration depth. The foundation frost penetration depth at this site is 1.2 m according to OPSD 3090.101.

### **2.2 RSS Walls**

A retained soil system (RSS) can be employed for the four retaining walls at the location of the underpass. It is envisaged that the RSS walls will be constructed utilising a series of steps in founding level to meet site grading and construction requirements. Refer to the Retained Soil System Layout drawing in Appendix TM-A for details.

A high performance, high appearance rated RSS wall will be required. The design, supply and construction of the RSS wall should conform to SP 599S22 and SP 599S23.

The founding material of the RSS walls is expected to comprise the native sandy/silty soil and/or granular engineered fill in the stepped areas of the walls where levelling pads would be located above the native soils.



The recommended geotechnical bearing resistance at ultimate limit states (ULS) and serviceability limit states (SLS) for a RSS wall constructed on the native sand / silt is as follows:

**Table 2.2.1 – Geotechnical Bearing Resistance for RSS Walls**

WALL NO.	REFERENCE FOUNDING ELEVATION (m)	REFERENCE BOREHOLES	FOUNDING CONDITIONS	FACTORED GEOTECHNICAL RESISTANCE AT ULS (kPa)	FACTORED GEOTECHNICAL RESISTANCE AT SLS (kPa)
RW1	88.1 – 91.5	H-2, H-3	Firm to stiff silty clay fill / Firm to hard clayey silt till / Compact to very dense sand and silt till	300	200
RW2	88.1 – 91.8	H-2	Firm silty clay / Stiff to hard sandy clayey silt till / Very dense silty sand till	375	250
RW3	88.8 – 92.6	H-7	Firm to stiff silty clay fill / Compact to dense sandy silt till	300	200
RW4	88.8 – 92.5	H-6	Soft to firm clayey silt fill / Stiff silty clay till / Compact to very dense sandy silt till	225	150

The geotechnical parameters employed to design the RSS will be dependent upon the type of backfill required for internal stability of the proprietary system as well as the soil contiguous to the RSS system that will govern global stability, overturning and/or sliding of the base. The design parameters for granular fill and the native sandy/silty soils are as follows:

**Table 2.2.2 – Geotechnical Parameters for RSS walls**

PARAMETERS	GRANULAR A / GRANULAR B TYPE II	SAND / SILT
Friction Angle, degrees	35	30
Cohesion, kPa	0	0
Unit Weight, kN/m <sup>3</sup>	22.8	20.0

The horizontal force at the base of the RSS will be resisted by the friction along the interface between the granular backfill and the founding soil. An unfactored friction coefficient of 0.6 is considered to be appropriate.



The global stability should be assessed using the geotechnical parameters noted in Table 2.2.2.

The RSS supplier should be responsible for specifying the type of backfill material employed, taking into consideration the engineering properties of the proprietary product, the design life of the structure, the pull-out resistance required, drainage requirements and the estimated settlements.

The supplier of the RSS should also be responsible for the detail design of the structure (backfill, reinforcement, stability) and provide drawings to show pertinent information such as location, length, height, elevations, performance level, appearance, etc.

The global stability of the conceptually designed RSS retaining walls has been analysed for feasibility. Refer to Section 2.4 for details. The final RSS wall design for construction should be carried out by the RSS supplier.

### **2.3 Structural Fill Pad**

Since the requirements for the levelling pad should conform to the accepted proprietary design of the RSS, the following recommendations apply only if the structural designer determines that structural fill pads are necessary such as where the foundations for stepped walls are above the natural ground level.

The structural fill pad should comprise Granular A material placed in maximum 200 mm thick lifts compacted to 100% of the ASTM D698 (standard Proctor) maximum dry density. The following geotechnical bearing resistance should be used for the design depending on the thickness of a structural fill pad:

**Table 2.3.1 – Geotechnical Bearing Resistance for RSS Walls founded on Structural Fill**

<b>STRUCTURAL FILL PAD THICKNESS (m)</b>	<b>FACTORED GEOTECHNICAL RESISTANCE AT ULS (kPa)</b>	<b>FACTORED GEOTECHNICAL RESISTANCE AT SLS (kPa)</b>
Minimum 2.0	400	250
Minimum 3.0	900	350





The granular fill should extend horizontally a minimum 1.0 m from the edge of the structure to be supported. The granular fill pad should be widening with depth at an inclination of 1 horizontal to 1 vertical (1H:1V). The depth of a granular pad underneath the levelling pad varies according to the subsurface conditions at each retaining wall.

The following parameters should be used for sliding resistance of retaining wall foundations on a structural fill pad:

**Table 2.3.2 – Geotechnical Parameters for Structural Fill Pad**

PARAMETER	GRANULAR A / GRANULAR B TYPE II	GRANULAR B TYPE I
Friction Angle, degrees	35	32
Cohesion, kPa	0	0
Unit Weight, kN/m <sup>3</sup>	22.8	21.2

The structural designer should apply appropriate factors to the values of friction angle and cohesion for the sliding resistance check.

The fill should be placed and compacted in accordance with OPSS.PROV 501.

## **2.4 Stability Analyses**

The stability of the RSS retaining walls was analysed using the limit equilibrium methods and the SLOPE/W software developed by Geo-Slope International Ltd. The software analyses numerous potential failure surfaces and establishes the critical one with a minimum factor of safety.

The soil parameters used in the analyses were based on the results of both field and laboratory testing and adjusted by applying engineering judgement in case of layered soil deposits. A summary of the engineering parameters and their values assumed in the calculations is as follows:



SOIL TYPE	UNIT WEIGHT (kN/m <sup>3</sup> )	SHEAR STRENGTH (kPa)	INTERNAL FRICTION (Degrees)
Granular B Type I	21.2	0	32
Embankment Fill	20.0	0	30
Silty Clay / Clayey Silt Fill	20.0	30 – 50	0
Silty Clay	20.0	50	0
Clayey Silt Till	21.0	80 – 100	0
Sand / Silt Till	21.0	0	32 – 34

The results of the short-term (during construction) stability analyses are listed below:

WALL NO.	RETAINING WALLS	WALL HEIGHT (m)	MINIMUM FACTOR OF SAFETY	FIGURE NO.
RW1	Northeast RSS Wall	6.0	1.4	1
RW2	Northwest RSS Wall	6.0	1.4	2
RW3	Southeast RSS Wall	5.5	1.9	3
RW4	Southwest RSS Wall	5.5	1.4	4

These results indicate that the RSS walls up to 6 m high at the underpass would be stable. The minimum safety factor obtained was in excess of the minimum 1.3 considered adequate for retaining walls to be stable during construction.

### 3. LATERAL EARTH PRESSURE

The RSS retaining walls considered as wing walls for the underpass should be designed to resist the unbalanced lateral earth pressure imposed by the backfill adjacent to the wall. It is considered that the granular fill behind the retaining wall will be adequately drained by weeping tiles, and consequently hydrostatic pressures will not need to be incorporated in the design. The lateral earth pressure,  $p$  (kPa) may be computed using the following equation:



$$p = K (\gamma h + q) + C_p + C_s$$

where  $K$  = coefficient of lateral earth pressure (dimensionless)

$\gamma$  = unit weight of free-draining granular material,  $\text{kN/m}^3$

$h$  = depth below final grade, m

$q$  = surcharge load, kPa, if present

$C_p$  = compaction pressure, kPa (refer to clause 6.12.3 of CHBDC)

$C_s$  = earth pressure induced by seismic events, kPa (refer to clause 4.6.5 of CHBDC)

where  $\phi$  = angle of internal friction of retained soil

$\delta$  = angle of friction between the soil and wall

The coefficient of earth pressure at-rest should be used for design of rigid and unyielding walls, the active earth pressure coefficient for unrestrained structures. Material above the top of the wall should be treated as a surcharge load ( $q$  in the preceding equation).

The magnitude of the passive resistance is dependent on the actual lateral movement of the structure toward the retained soil. We refer to Figure C6.16 of the CHBDC for this computation.

#### **4. CONSTRUCTION CONSIDERATIONS**

##### **4.1 Excavation**

Excavation for construction of the retaining walls is expected to extend through the fill and native soils to depths of up to 6 m below existing grade.

All work should be carried out in accordance with the Occupational Health and Safety Act (Ontario Regulation 213/91) and with local/MTO regulations.

The fill and typically firm to stiff cohesive soils or compact sand / silt are classified as Type 3 soils according to Occupational Health and Safety Act (Ontario Regulation 213/91) criteria. Temporary cut slopes in earth over the full depth of excavation should therefore be inclined at an angle of  $45^\circ$  to the horizontal. If unstable soft/wet materials or concentrated seepage zones are encountered during construction, affected side slopes should be flattened until stable.



#### **4.2 Groundwater and Drainage Control**

In the process of augering, water was detected at 7.6 m depth (elevation 83.9) in borehole H-3 and a depth of 3.1 m (elevation 87.3) in borehole H-6. The groundwater was at depths of 7.0 and 7.9 m (elevation 84.5 and 82.5) upon completion of drilling. The piezometric water level measured in boreholes H-3 and H-6 was at depths of 3.1 and 3.8 m (elevation 88.4 and 86.6) on June 18, 2014 and at depths of 3.4 and 4.6 m (elevation 88.1 and 85.8) on July 9, 2014, respectively.

It is considered that seepage from soil fissures or surface water run-off that enters excavations can be handled by conventional sump pumping techniques. The groundwater level should be lowered a minimum of 0.5 m below the base of excavation. The groundwater levels at the site are subject to seasonal fluctuations and precipitation patterns.

The drainage behind the RSS walls should be designed by the RSS supplier. The drainage pipes should be installed on a positive grade.

#### **5. BACKFILL AND EROSION CONTROL**

The backfill behind the retaining walls should be in conformance with the accepted proprietary design of the RSS.

Backfilling adjacent to the retaining walls at the site should be carried out with conformance to OPSS.PROV 501. Operation of compaction equipment at the retaining structures should be restricted to limit the compaction pressure noted in clause 6.12.3 of the CHBDC. Refer to OPSS.PROV 501 for additional information in this regard.

The earth fill slopes should be protected against surface erosion by sodding and suitable vegetation. Refer to OPSS 803 and OPSS 804 for time constraints and the type of seed and mulch required.



## 6. CLOSURE

This report was prepared by Mr. G.O. Degil, PhD, P.Eng., Senior Foundation Engineer, and reviewed by Mr. C.M.P. Nascimento, P.Eng., MTO Designated Principal Contact.

Yours very truly,

Peto MacCallum Ltd.



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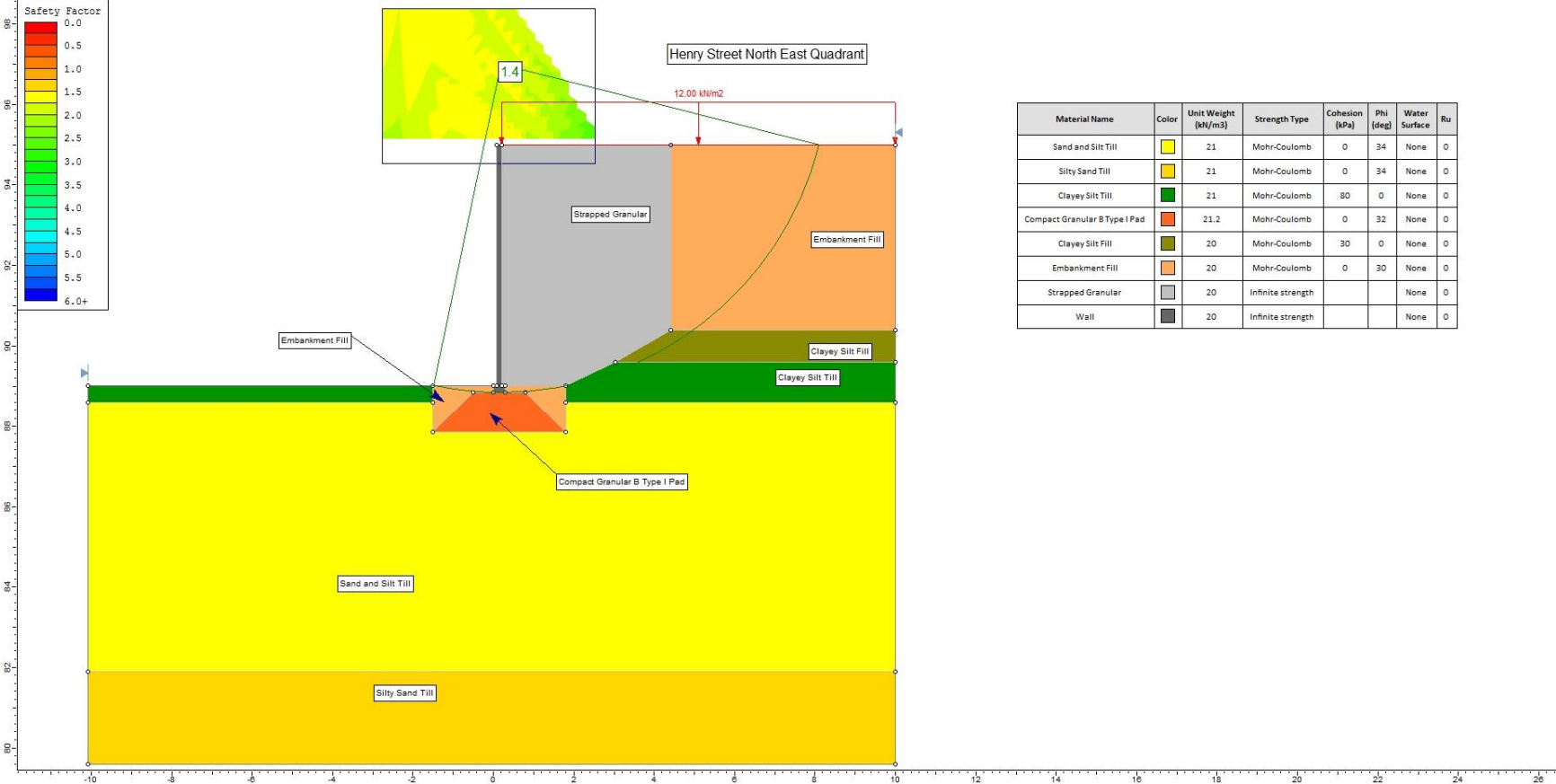


**TABLE 1**  
**LIST OF STANDARD SPECIFICATIONS REFERENCED IN REPORT**

<b>DOCUMENT</b>	<b>TITLE</b>
OPSS.PROV 501	Construction Specification for Compacting
OPSS 803	Construction Specification for Sodding
OPSS 804	Construction Specification for Seed and Cover
OPSS.PROV 501	Construction Specification for Compacting
SP 599S22	Requirements for The Design, Supply and Construction of Retaining Soil Systems (RSS)
SP 599S23	Requirements for Materials, Quality Control and Quality Assurance Testing and Acceptance Criteria for Precast Concrete Facing Elements Including Panels
OPSD 3090.101	Foundation Frost Depth for Southern Ontario



Figure 1





**Figure 2**

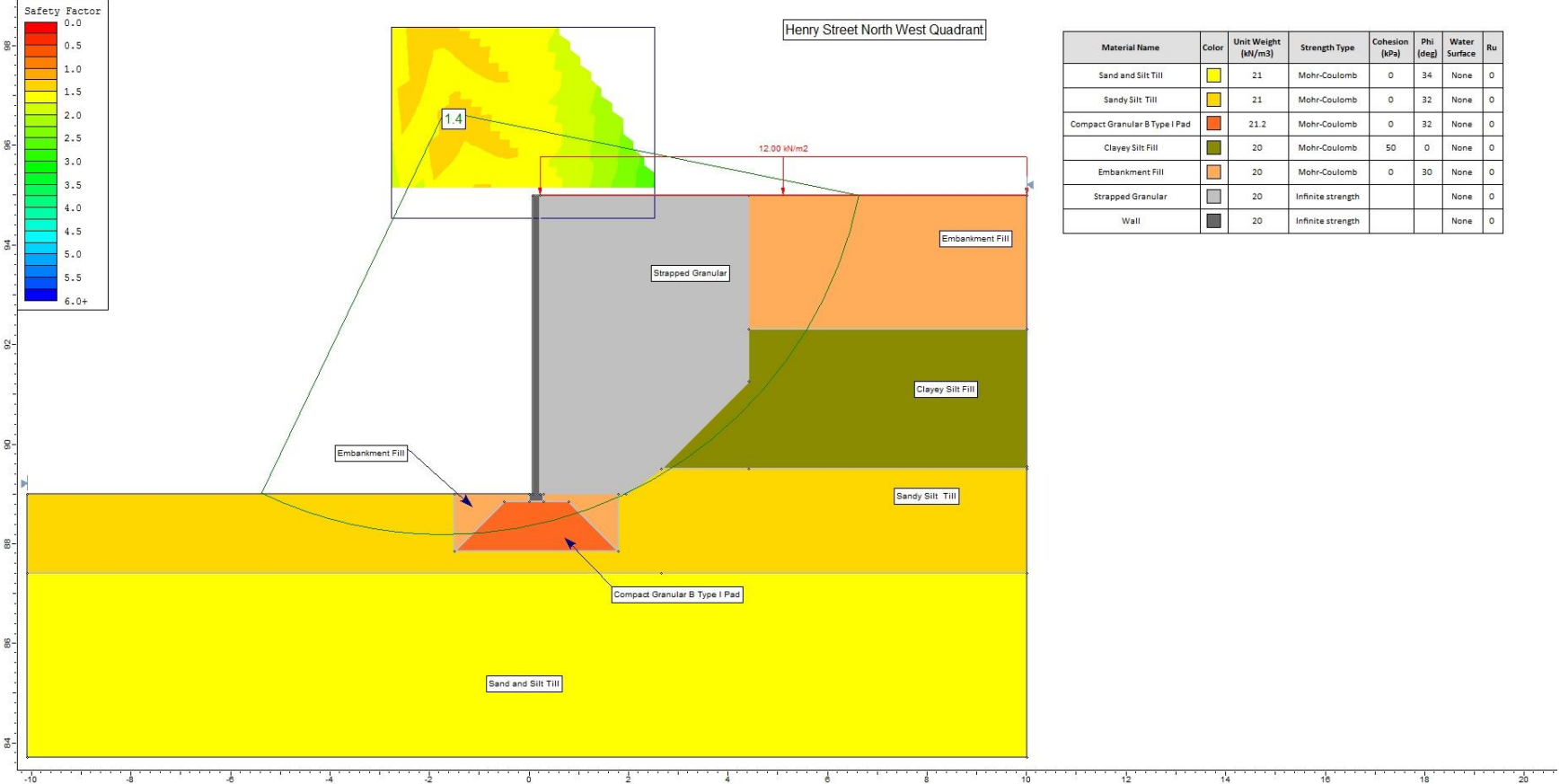
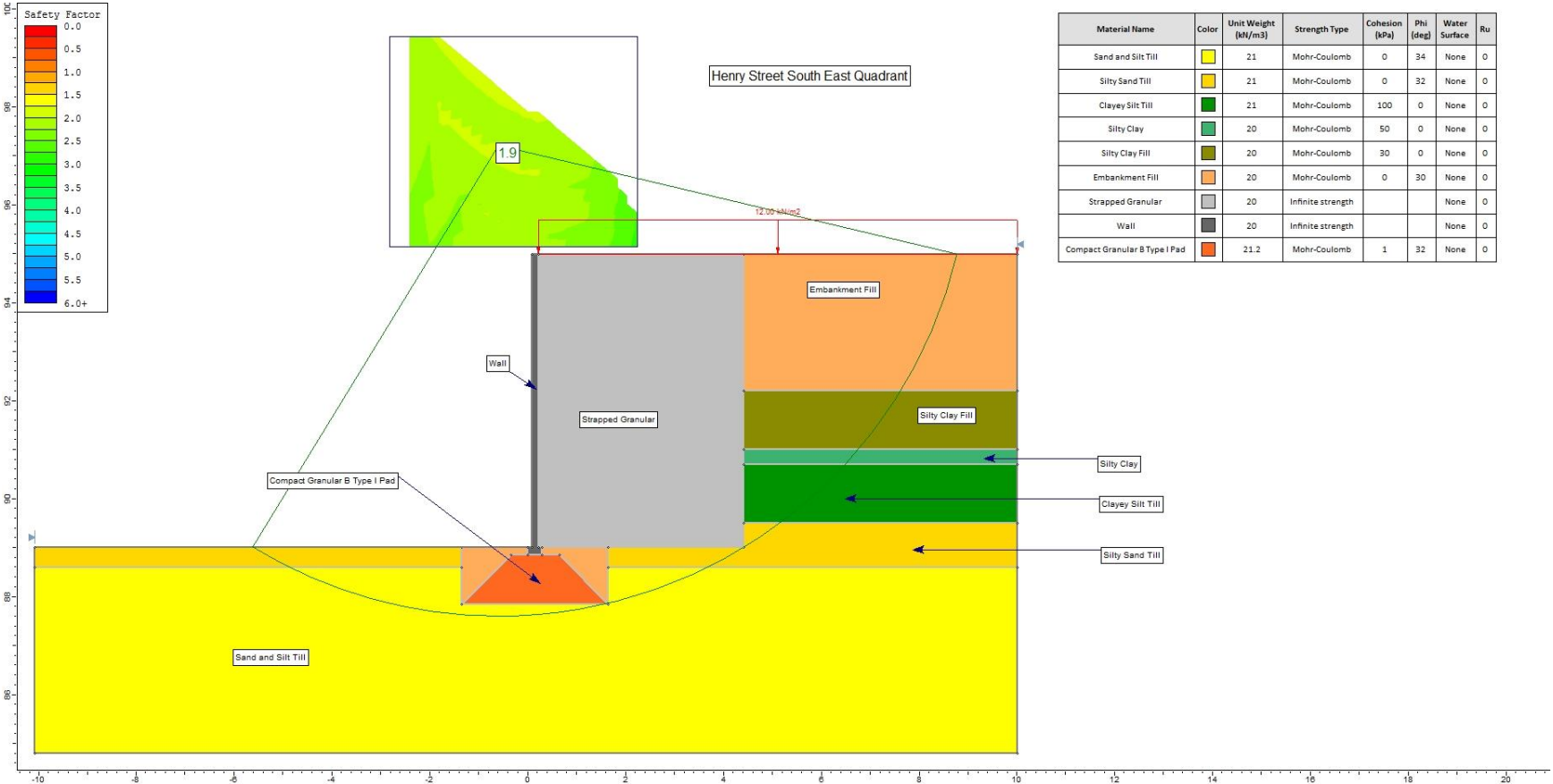




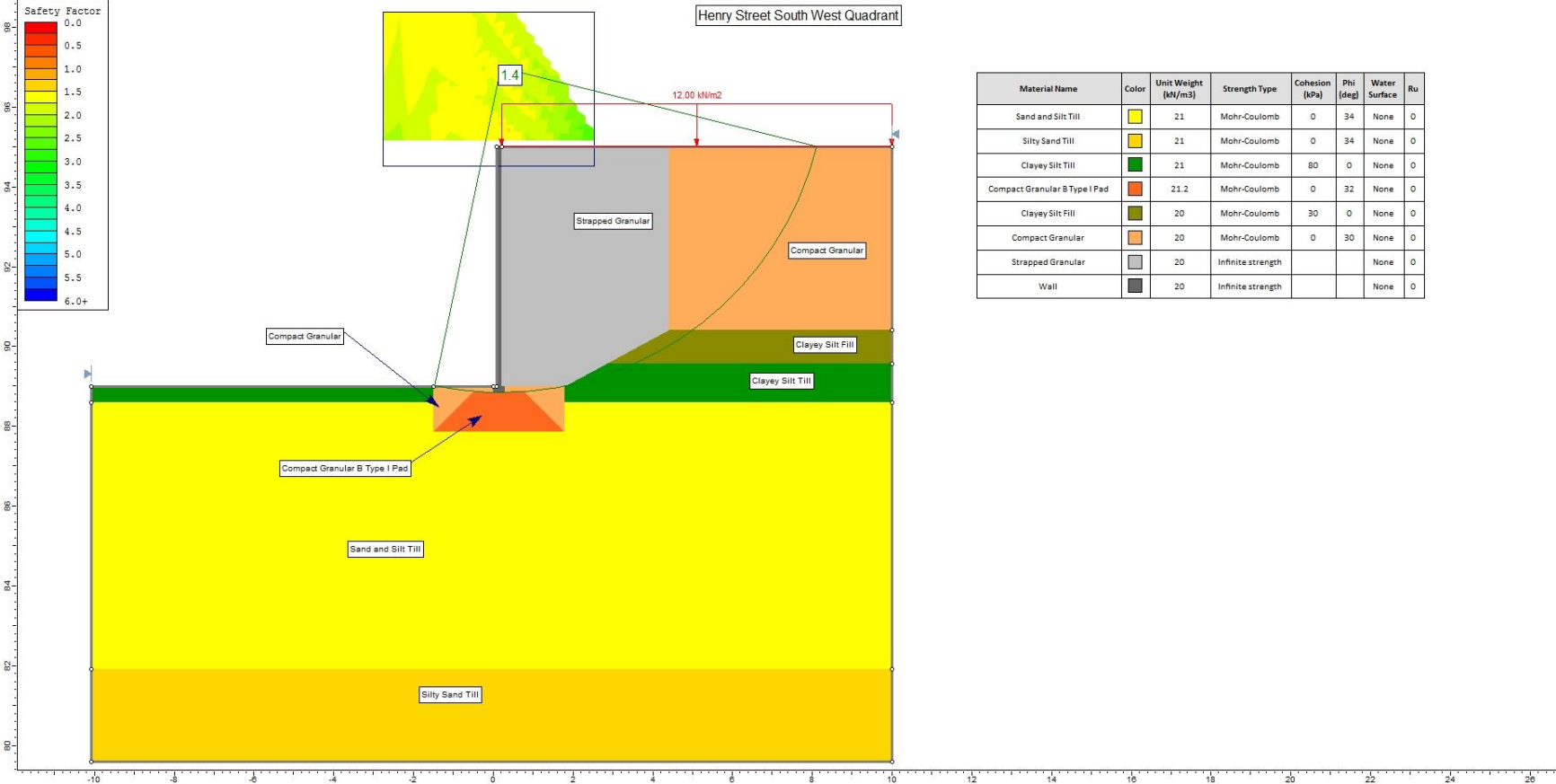


Figure 3





**Figure 4**



## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

**COMPOSITION:** SECONDARY SOIL COMPONENTS ARE DESCRIBED ON THE BASIS OF PERCENTAGE BY MASS OF THE WHOLE SAMPLE AS FOLLOWS:

PERCENT BY MASS	0 - 10	10 - 20	20 - 30	30 - 40	> 40
	TRACE	SOME	WITH	ADJECTIVE (SILTY)	AND (AND SILT)

**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 (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

S S SPLIT SPOON	T P THINWALL PISTON
W S WASH SAMPLE	O S OSTERBERG SAMPLE
S T SLOTTED TUBE SAMPLE	R C ROCK CORE
B S BLOCK SAMPLE	P H T W ADVANCED HYDRAULICALLY
C S CHUNK SAMPLE	P M T W ADVANCED MANUALLY
T W THINWALL OPEN	F S FOIL SAMPLE
F V FIELD VANE	

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$u$	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

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /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 = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL











$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE
$\gamma_s$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	$S_r$	%	DEGREE OF SATURATION	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\gamma_w$	kN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$w_L$	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_p$	%	PLASTIC LIMIT	$D_n$	mm	n PERCENT - DIAMETER
$\gamma$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_s$	%	SHRINKAGE LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
$\gamma_d$	kN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
$\gamma_{sat}$	kN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	i	1	HYDRAULIC GRADIENT
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL	WTP		WETTER THAN PLASTIC LIMIT	j	kN/m <sup>3</sup>	SEEPAGE FORCE
e	1, %	VOID RATIO						

# RECORD OF BOREHOLE No. H-1

1 of 1

**METRIC**

G.W.P. 09-20009		LOCATION Co-ord: 4 858 717.8 N; 349 644.4 E	ORIGINATED BY F.P.
DIST Durham	HWY 401	BOREHOLE TYPE Continuous Flight Solid Stem Augers	COMPILED BY A.D.
DATUM Geodetic	DATE April 25, 2014		CHECKED BY G.D.

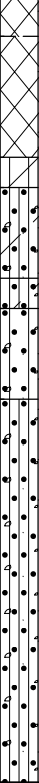
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT   NATURAL LIMIT   MOISTURE   LIQUID CONTENT   LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE													
92.0 0.0 91.7 0.3	Ground Surface Sand and gravel (PAVEMENT FILL) Clayey silt, trace sand topsoil inclusions Stiff      Brown      Moist to wet		1	SS	12		91								○						
90.6 1.4	(FILL) Silty clay trace sand, trace gravel Very stiff Brown      Moist		3	SS	26		90									○					
89.0 3.0	(TILL) Sandy silt trace clay, trace gravel Very dense Brown      Moist		4	SS	30		89									○					
	(TILL)		5	SS	104/23cm		88									○					
	(TILL)		6	SS	100/15cm		87									○					
	seams of sand		7	SS	112/25cm		86									○					
	85.5 6.5	End of borehole		8	SS		105/20cm										○				
<div>*      2014   04   25</div> <div>      Water level observed during drilling</div> <div>      Water level measured after drilling</div>																					

**RECORD OF BOREHOLE No. H-2**

1 of 1

**METRIC**

**P.O. #** 09-20009      **LOCATION** Co-ord: 4 858 703.1 N; 349 650.7 E      **ORIGINATED BY** F.P.  
**DIST** Durham      **HWY** 401      **BOREHOLE TYPE** Continuous Flight Solid Stem Augers      **COMPILED BY** A.D.  
**DATUM** Geodetic      **DATE** April 25, 2014      **CHECKED BY** G.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
92.6 0.0 92.2 0.4	125mm asphalt over sand and gravel  Loose Brown Moist (PAVEMENT FILL)  Silty clay trace sand, trace gravel topsoil inclusions						92									9 34 33 24  16 43 30 11   15 39 38 8				
91.0 1.6 90.7 1.9	Firm Brown Moist (FILL)  Silty clay trace sand, trace gravel  Firm Brown Moist Clayey silt, sandy trace gravel		1	SS	8															
			2	SS	7															
			3	SS	6															
			4	SS	39															
89.5 3.1	Stiff to Brown Moist hard  cobbles (TILL)		5	SS	54															
88.6 4.0	Silty sand some clay, some gravel  Very dense Brown Moist (TILL)		6	SS	100/13cm															
	Sand and silt some gravel, trace clay  Very dense Grey Moist (TILL)		7	SS	101/25cm															
			8	SS	100/13cm															
84.8 7.8	End of borehole  Refusal on probable boulder  																			

# RECORD OF BOREHOLE No. H-3

1 of 1

METRIC

G.W.P. 09-20009 LOCATION Co-ord: 4 858 698.6 N; 349 669.7 E ORIGINATED BY S.A.

DIST Durham HWY 401 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY A.D.

DATUM Geodetic DATE May 07, 2014 CHECKED BY G.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL																
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																									
91.5						20	40	60	80	100	20	40	60																				
0.0	Clayey silt, rootlets topsoil inclusions layers of sand		1	SS	9											4 30 39 27																	
	Stiff Dark brown Moist (FILL)		2	SS	10													14 37 35 14															
90.1	Clayey silt with sand, trace gravel		3	SS	19																												
1.4	Very stiff Brown/ Moist grey																																
89.3	(TILL)		4	SS	23																												
2.2	Sand and silt some clay, trace gravel cobbles																																
	Compact to Brown Moist very dense (TILL)		5	SS	50/10cm																												
87.0																																	
4.5	some gravel Grey		6	SS	78/28cm																												
			7	SS	50/10cm																												
84.5																																	
7.0	trace clay Wet		8	SS	50/8cm																												
82.2				9	SS	70/13cm																											
9.3	End of borehole																																
	<div><div><div>* 2014 05 07</div><div> Water level observed during drilling</div><div> Water level measured after drilling</div></div><div>NOTE: Piezometer was installed just south of borehole at location with the same ground surface elevation.</div><div>Piezometer Readings:<table><thead><tr><th>Date</th><th>Depth (m)</th><th>Elev.</th></tr></thead><tbody><tr><td>06/18/2014</td><td>3.1</td><td>88.4</td></tr><tr><td>07/09/2014</td><td>3.4</td><td>88.1</td></tr></tbody></table></div><div>Piezometer Legend:<table><tbody><tr><td></td><td>Bentonite seal</td></tr><tr><td></td><td>Native</td></tr><tr><td></td><td>Filter sand</td></tr><tr><td></td><td>Screen</td></tr></tbody></table></div></div>																	Date	Depth (m)	Elev.	06/18/2014	3.1	88.4	07/09/2014	3.4	88.1		Bentonite seal		Native		Filter sand	
Date	Depth (m)	Elev.																															
06/18/2014	3.1	88.4																															
07/09/2014	3.4	88.1																															
	Bentonite seal																																
	Native																																
	Filter sand																																
	Screen																																

## RECORD OF BOREHOLE No. H-4

1 of 1

**METRIC**

P.O. #	09-20009	LOCATION	Co-ord: 4 858 655.4 N; 349 660.0 E	ORIGINATED BY	F.P.
DIST	Durham	HWY	401	BOREHOLE TYPE	Continuous Flight Solid Stem Augers
				COMPILED BY	A.D.
DATUM	Geodetic	DATE	April 28 & 29, 2014	CHECKED BY	G.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL LIMIT   MOISTURE   CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		ELEVATION SCALE	SHEAR STRENGTH kPa					w <sub>p</sub>	w		w <sub>L</sub>	GR	SA	SI	CL
								○ UNCONFINED   +   FIELD VANE ● QUICK TRIAXIAL   ×   LAB VANE												
87.6 0.0	225mm asphalt over sand and gravel						20	40	60	80	100									
86.9 0.7	Compact Brown Moist (PAVEMENT FILL)		1	SS	14							○					13	46	34	7
86.2 1.4	Silty sand some gravel, trace clay		2	SS	101							○					3	33	56	8
85.5 2.1	Compact to Grey Moist very dense (TILL)		3	SS	115							○								
84.9 2.7	Sandy silt trace clay, trace gravel		4	SS	71/15cm	▽*						○								
	Very dense Grey Moist shale fragments		5	SS	59	▽*						○								
	(TILL)		6	SS	91	▽*						○					2	32	59	7
			7	SS	107/23cm							○								
			8	SS	73							○								
			9	SS	100/13cm							○								
			10	SS	103							○								
75.7 11.9	Shale bedrock		11	SS	100/10cm															
75.2 12.4	End of borehole																			
*    2014   04   28/29																				
▽    Water level observed during drilling																				
▼    Water level measured after drilling																				

## RECORD OF BOREHOLE No. H-5

1 of 2

**METRIC**

G.W.P. <u>09-20009</u>		LOCATION <u>Co-ord: 4 858 654.2 N; 349 682.4 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Durham</u>	HWY <u>401</u>	BOREHOLE TYPE <u>C.F.S.S.A. and Rock Coring</u>	COMPILED BY <u>A.D.</u>
DATUM <u>Geodetic</u>		DATE <u>May 02, 2014</u>	CHECKED BY <u>G.D.</u>

[illegible]



**RECORD OF BOREHOLE No. H-5**

2 of 2

**METRIC**

**G.W.P.** 09-20009      **LOCATION** Co-ord: 4 858 654.2 N; 349 682.4 E      **ORIGINATED BY** F.P.  
**DIST** Durham      **HWY** 401      **BOREHOLE TYPE** C.F.S.S.A. and Rock Coring      **COMPILED BY** A.D.  
**DATUM** Geodetic      **DATE** May 02, 2014      **CHECKED BY** G.D.

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 (%)  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					w <sub>p</sub> w                      w <sub>L</sub>					
72.6						20	40	60	80	100	20	40	60					
	Shale bedrock with interbedded limestone  Unweathered  Soft to medium strength  Fair to good quality  <div>(Cont'd.)</div>		9	RC	REC 90%		72								24.2	RQD 74%		
							71											
			10	RC	REC 99%		70											RQD 86%
69.4 18.2	End of borehole																	
	<div>*    2014   05   02</div> <div>    Water level observed during drilling</div> <div>*    Borehole charged with drilling water</div> <div>UCS    denotes Unconfined Compressive Strength</div>																	

**RECORD OF BOREHOLE No. H-6**

1 of 2

**METRIC**

**G.W.P.** 09-20009      **LOCATION** Co-ord: 4 858 614.9 N; 349 666.5 E      **ORIGINATED BY** S.A.  
**DIST** Durham      **HWY** 401      **BOREHOLE TYPE** Continuous Flight Solid Stem Augers      **COMPILED BY** A.D.  
**DATUM** Geodetic      **DATE** April 28, 2014      **CHECKED BY** G.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	20						40	60	W <sub>p</sub>
90.4							20	40	60	80	100	20	40	60						
0.0	Clayey silt, rootlets topsoil inclusions		1	SS	1															
89.6	Soft to Dark Moist firm brown (FILL)																			
0.8	Silty clay, trace gravel Stiff Grey Moist (TILL)		2	SS	13															
88.6	Sandy silt, some clay trace gravel, cobbles		3	SS	11															
1.8	Compact to Brown/ Moist very dense grey to wet (TILL)		4	SS	50/13cm															
			5	SS	80												7 39 41 13			
			6	SS	50/13cm															
			7	SS	50/13cm															
			8	SS	50/8cm															
81.9	Silty sand trace clay, trace gravel Very dense Grey Moist to wet (TILL)		9	SS	70												8 45 38 9			
79.6	End of borehole		10	SS	50/13cm															
10.8																				

\* 2014 05 07

▽ Water level observed  
during drilling

▼ Water level measured  
after drilling





Cont'd

**RECORD OF BOREHOLE No. H-6**

2 of 2

**METRIC**

**G.W.P.** 09-20009      **LOCATION** Co-ord: 4 858 614.9 N; 349 666.5 E      **ORIGINATED BY** S.A.  
**DIST** Durham      **HWY** 401      **BOREHOLE TYPE** Continuous Flight Solid Stem Augers      **COMPILED BY** A.D.  
**DATUM** Geodetic      **DATE** April 28, 2014      **CHECKED BY** G.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)								
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																	
75.4						○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE					WATER CONTENT (%)														
						20	40	60	80	100	20	40	60												
<p><u>Piezometer Readings:</u></p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev.</th> </tr> </thead> <tbody> <tr> <td>06/18/2014</td> <td>3.8</td> <td>86.6</td> </tr> <tr> <td>07/09/2014</td> <td>4.6</td> <td>85.8</td> </tr> </tbody> </table> <p><u>Piezometer Legend:</u></p> <p>  Bentonite seal   Native   Filter sand   Screen         </p> <p>NOTE: Piezometer was installed 1m south of borehole at location with ground surface elevation about 0.3m higher than that of the borehole. The difference in elevation has been taken into account in determination of the piezometric water level.</p>																	Date	Depth (m)	Elev.	06/18/2014	3.8	86.6	07/09/2014	4.6	85.8
Date	Depth (m)	Elev.																							
06/18/2014	3.8	86.6																							
07/09/2014	4.6	85.8																							

## RECORD OF BOREHOLE No. H-7

1 of 1

**METRIC**

P.O. #	09-20009	LOCATION	Co-ord: 4 858 618.4 N; 349 683.0 E	ORIGINATED BY	F.P.
DIST	Durham	HWY	401	BOREHOLE TYPE	Continuous Flight Solid Stem Augers
DATUM	Geodetic	DATE	April 25, 2014	COMPILED BY	A.D.
				CHECKED BY	G.D.

[illegible]

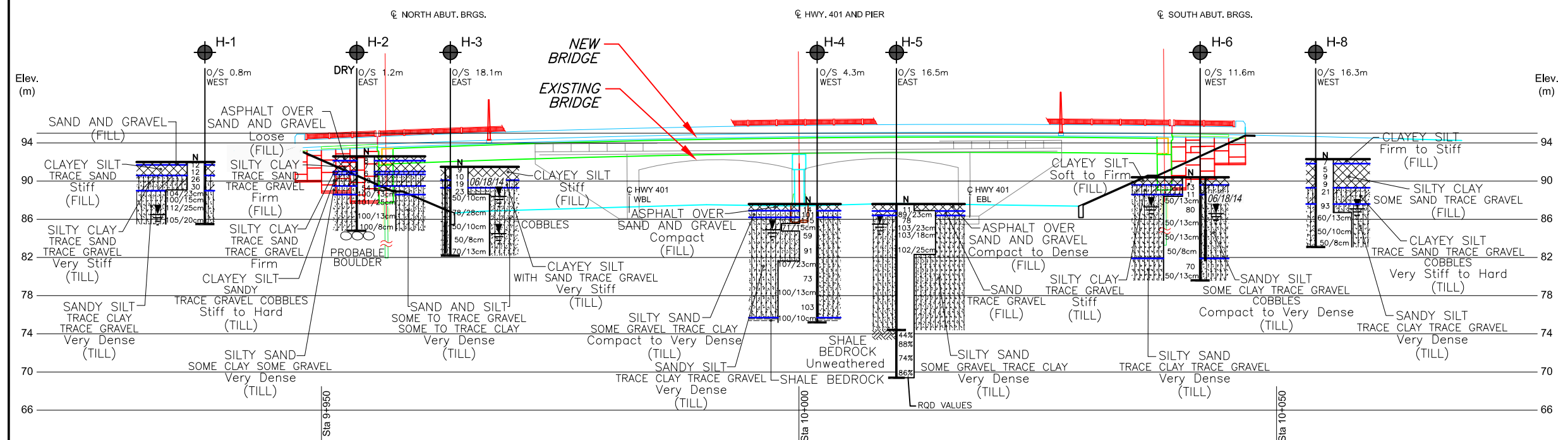
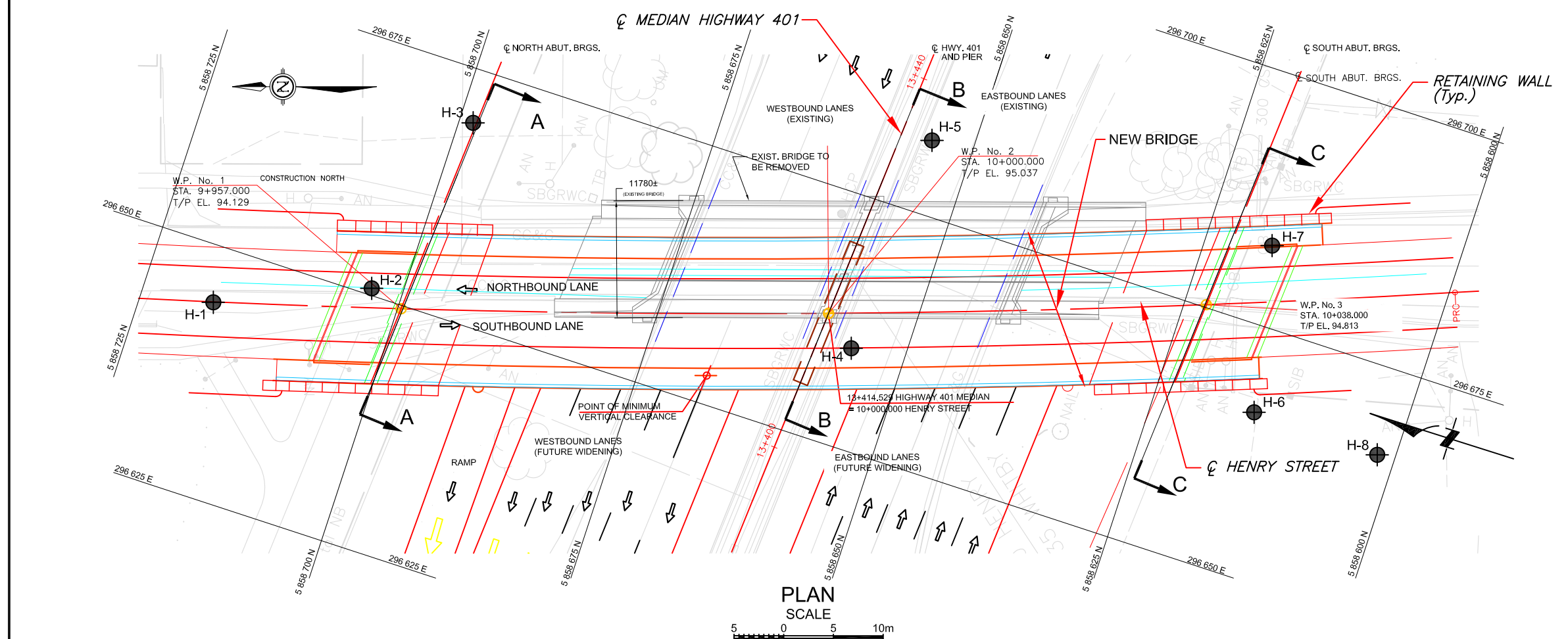
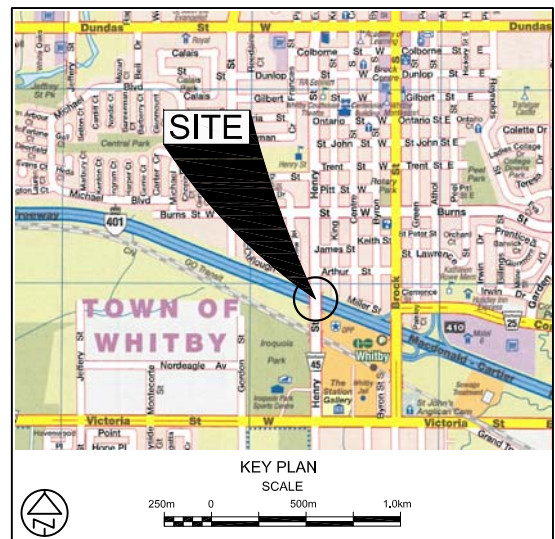
**RECORD OF BOREHOLE No. H-8**

1 of 1

**METRIC**

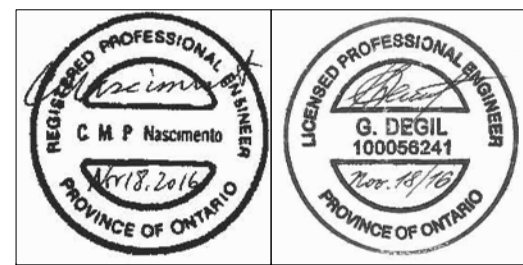
**P.O. #** 09-20009      **LOCATION** Co-ord: 4 858 601.8 N; 349 666.3 E      **ORIGINATED BY** S.A.  
**DIST** Durham      **HWY** 401      **BOREHOLE TYPE** Continuous Flight Solid Stem Augers      **COMPILED BY** A.D.  
**DATUM** Geodetic      **DATE** April 28, 2014      **CHECKED BY** G.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
92.3							20	40	60	80	100								
0.0	Clayey silt, rootlets topsoil inclusions		1	SS	7														
91.9																			
0.4	Firm to Dark Moist																		
91.5	stiff brown																		
0.8																			
	silty sand seams organic inclusions		2	SS	5														
	Silty clay, some sand trace gravel, rootlets organic inclusions		3	SS	9														
	(FILL)		4	SS	9														
89.3																			
3.0	Clayey silt trace sand, trace gravel cobbles		5	SS	21														
	Very stiff Brown/ Moist to hard grey																		
	(TILL)																		
87.6																			
4.7	Sandy silt trace clay, trace gravel		6	SS	93														
	Very dense Grey Wet																		
	(TILL)																		
			7	SS	60/13cm														
			8	SS	50/10cm														
			9	SS	50/8cm														
83.1																			
9.2	End of borehole																		
	</																		



LEGEND			
	Borehole		
	Borehole and Cone		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation April & May 2013		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
H-1	92.0	4 858 717.8	349 644.4
H-2	92.6	4 858 703.1	349 650.7
H-3	91.5	4 858 698.6	349 669.7
H-4	87.6	4 858 655.4	349 660.0
H-5	87.6	4 858 654.2	349 682.4
H-6	90.4	4 858 614.9	349 666.5
H-7	93.2	4 858 618.4	349 683.0
H-8	92.3	4 858 601.8	349 666.3

- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
  - REFER TO DRAWING H-2 FOR SECTIONS A-A, B-B AND C-C.
  - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
  - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



**- NOTE -**

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

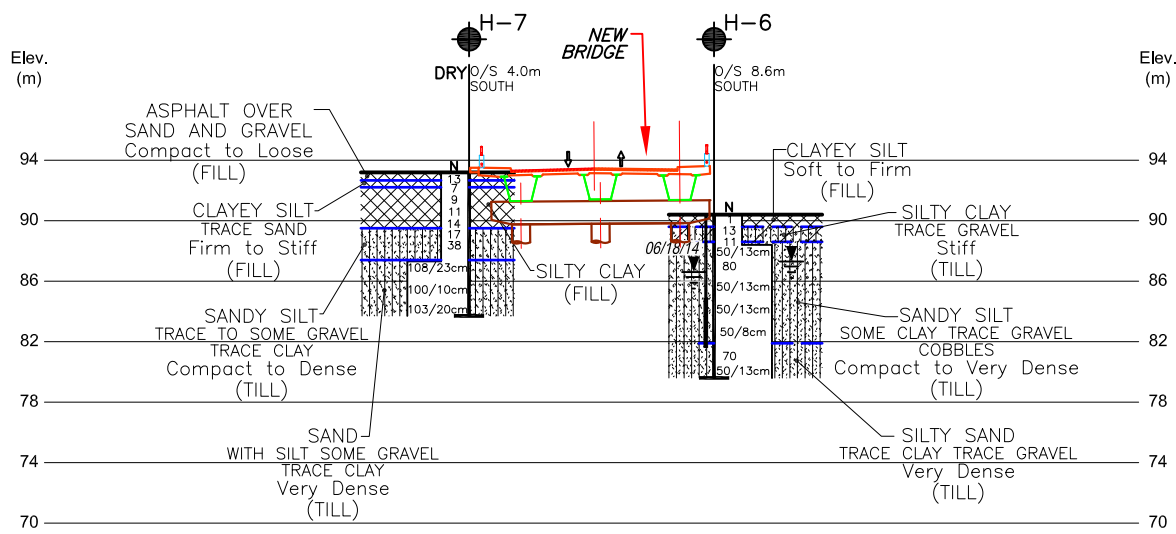
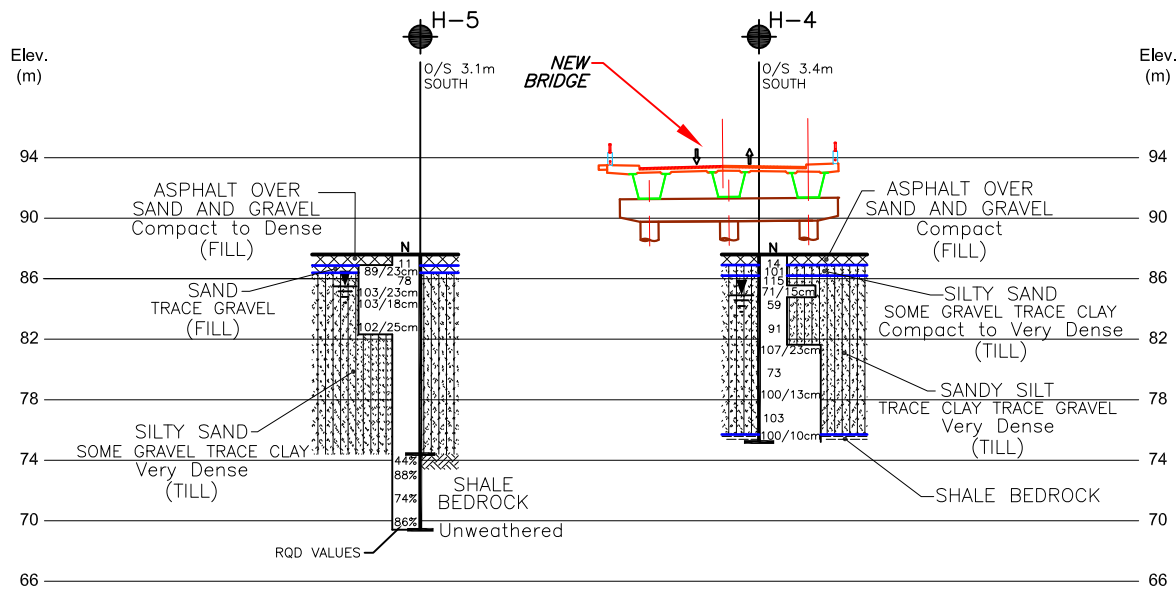
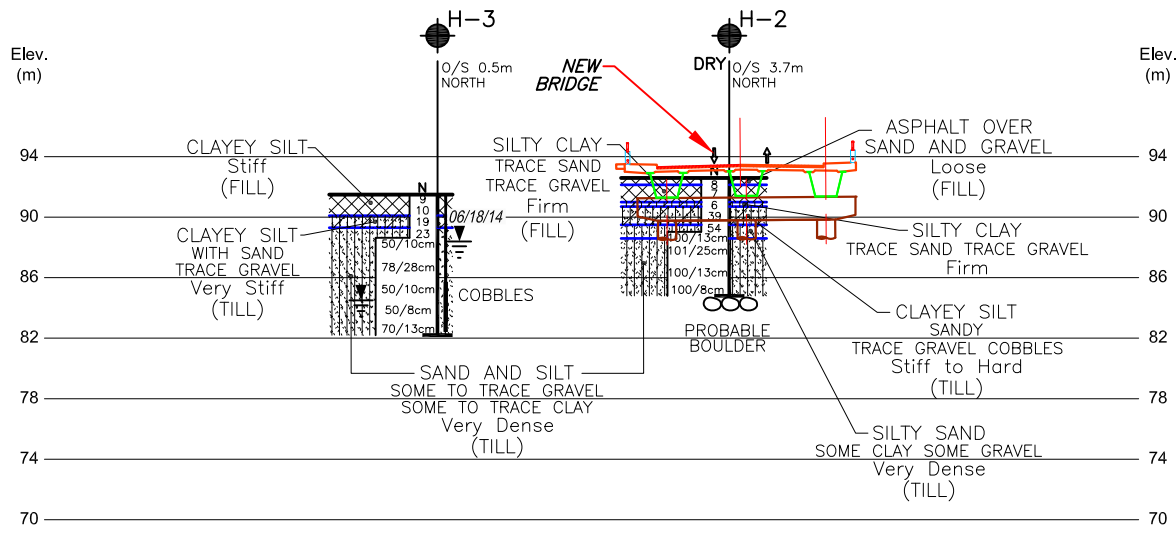
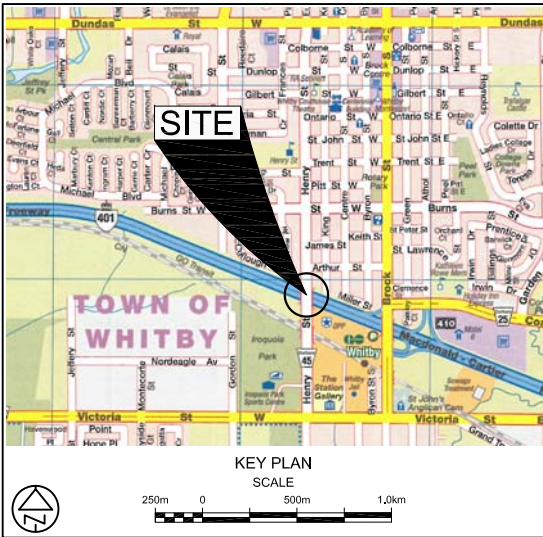
<b>REVISIONS</b>	12/07/2016	CN	GEOCRES NUMBER ADDED, AS PER MTO MEMORANDUM DATED DECEMBER 02, 2016	
	DATE	BY	DESCRIPTION	
	Geocres No. 30M15-199 / 30M15-298			
<b>HWY No</b>	401			<b>DIST</b> Central
<b>SUBM'D</b>	NA	<b>CHECKED</b>	GD	<b>DATE</b> NOV. 18, 2016
<b>SITE</b>				22-152
<b>DRAWN</b>	NA	<b>CHECKED</b>	GD	<b>APPROVED</b> CN
				<b>DWG</b> H-1



CONT No  
P.O. No 09-20009  
GWP No

HENRY STREET UNDERPASS  
HIGHWAY 401  
GEOGRAPHIC TOWNSHIP OF WHITBY  
SOIL STRATA

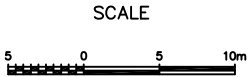
SHEET



NOTES:

- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
- REFER TO DRAWING H-1 FOR BOREHOLE LOCATION PLAN AND CENTRE LINE PROFILE.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

SECTION C-C



LEGEND

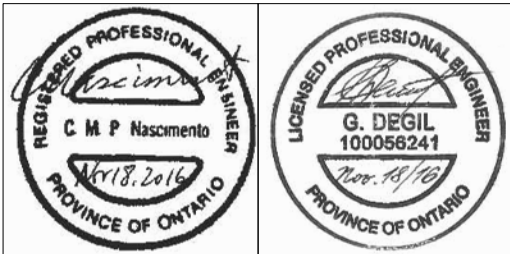
- Borehole
- Borehole and Cone
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60 Cone, 475 J/blow)
- WL at time of investigation April & May 2013
- WH Penetration due to weight of hammer
- Head
- ARTESIAN WATER
- Encountered
- PIEZOMETER

BH No	ELEVATION	NORTHINGS	EASTINGS
FOR DETAILS, REFER TO DRAWING H-1			

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION
12/07/2016	CN		GEOCRES NUMBER ADDED, AS PER MTO MEMORANDUM DATED DECEMBER 02, 2016
Geocres No. 30M15-199 / 30M15-298			
HWY No	401		DIST Central
SUBM'D	NA	CHECKED GD	DATE NOV. 18, 2016
DRAWN	NA	CHECKED GD	APPROVED CN
			SITE 22-152
			DWG H-2



Reference AECOM Drawing: 60154317-HENRY-GA.dwg dated Sept. 2014



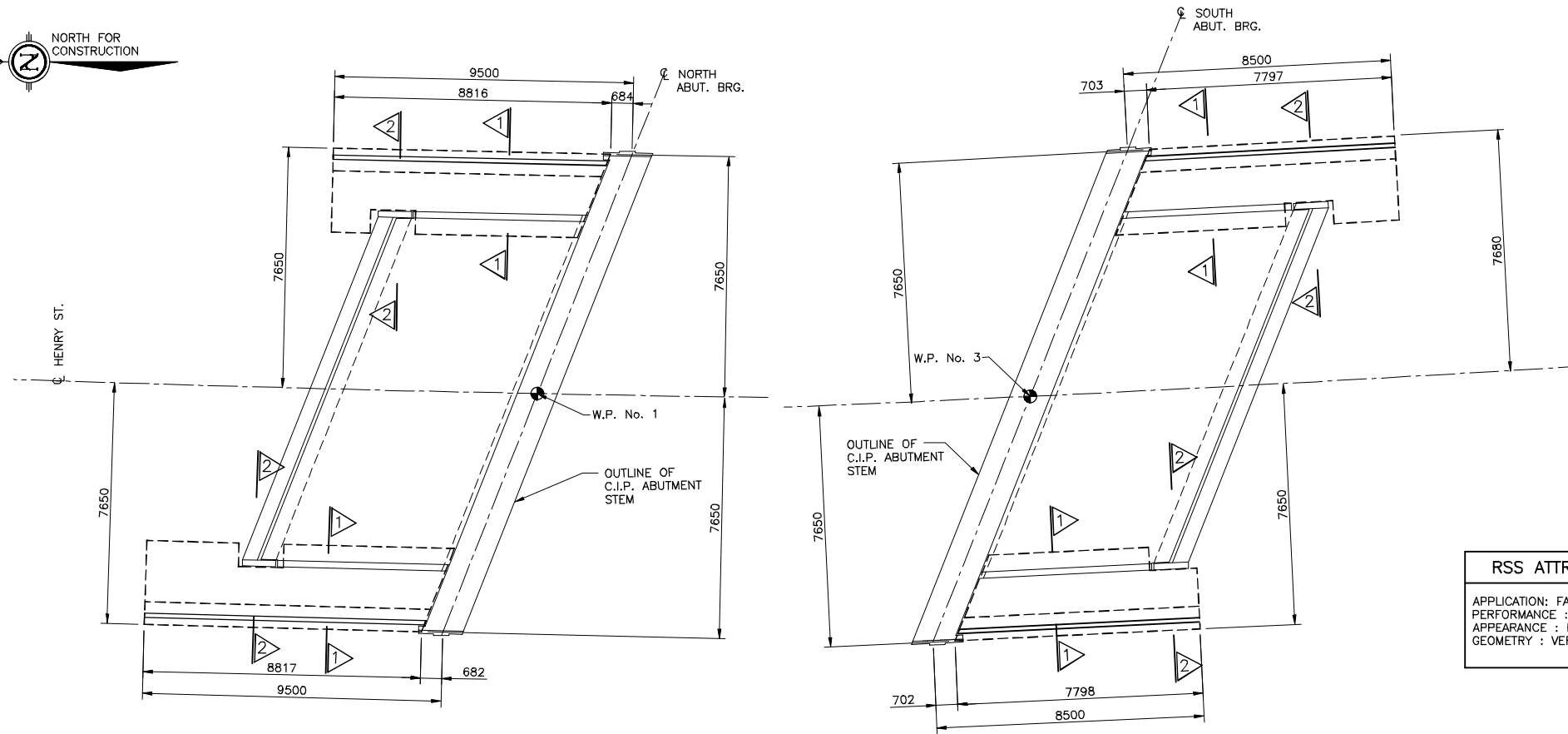
## **APPENDIX TM-A**

### Retained Soil System Layout Drawing



DRAWING NAME: P:\60154317 (Ministry Of Transportation) Highway 401 - Salem Road To Brock Street\000-CADD-BIM\08 Structural\Henry Street\0154317-HENRY STREET\_OB\_RETAINED SOIL SYSTEM.dwg  
CREATED: 2016-11-17 2:03 PM  
MODIFIED: 2016-11-17

PR-D-707 88-05  
MINISTRY OF TRANSPORTATION, ONTARIO



LAYOUT PLAN  
SCALE 1:200

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

HWY. 401  
CONT. 2016-2038  
WP No. 2123-10-00  
HENRY STREET  
UNDERPASS  
RETAINED SOIL SYSTEM  
LAYOUT

SHEET  
39

AECOM

NOTES:

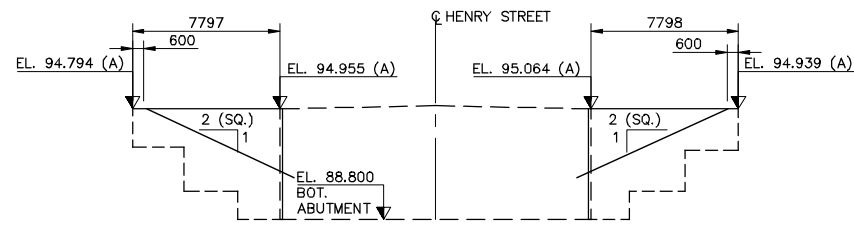
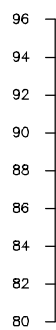
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DWG. Nos. 1, 4, 6 & 7.
2. CONTRACTOR SHALL ESTABLISH/REVISE THE PRECAST RSS CAP DIMENSIONS TO SUIT THE GEOMETRIC REQUIREMENTS OF THE SPECIFIC PROPRIETY SYSTEM TO BE UTILIZED. ALL DIMENSION CHANGES ARE SUBJECT TO REVIEW BY THE CONTRACT ADMINISTRATOR.

LIST OF ABBREVIATIONS:

W.P. DENOTES WORKING POINT  
C.I.P. DENOTES CAST-IN-PLACE

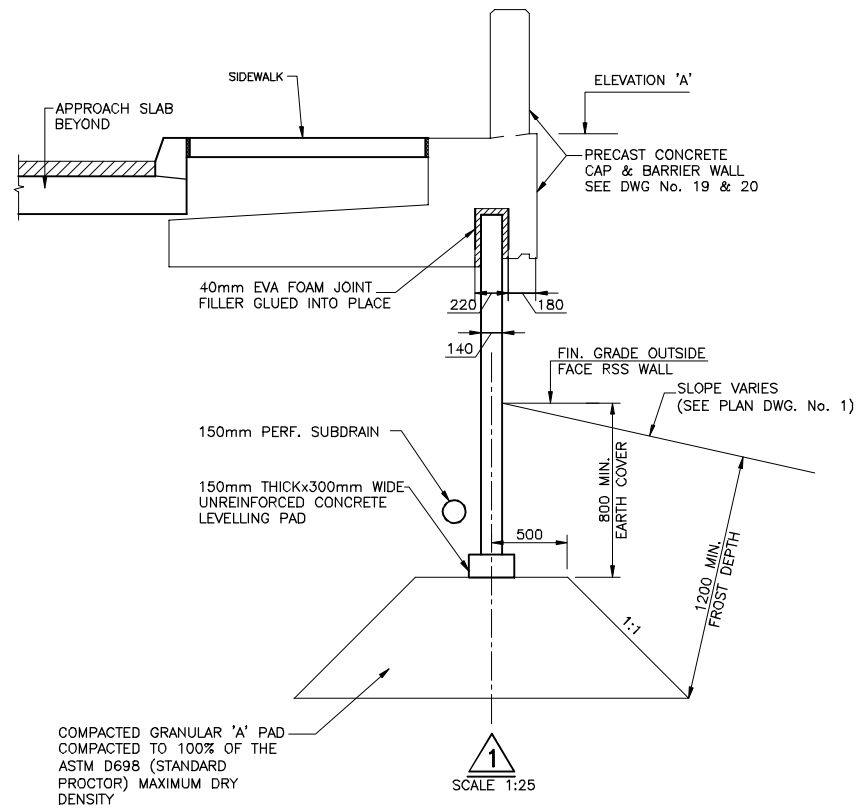
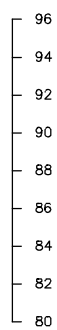
RSS ATTRIBUTES  
APPLICATION: FALSE ABUTMENT  
PERFORMANCE : HIGH  
APPEARANCE : HIGH  
GEOMETRY : VERTICAL

EAST

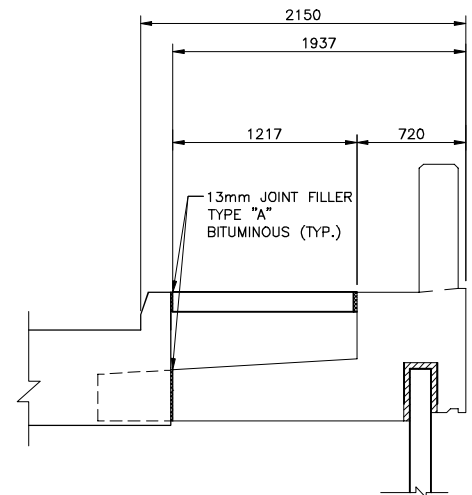


FRONT ELEVATION - SOUTH ABUTMENT  
SCALE 1:200

WEST



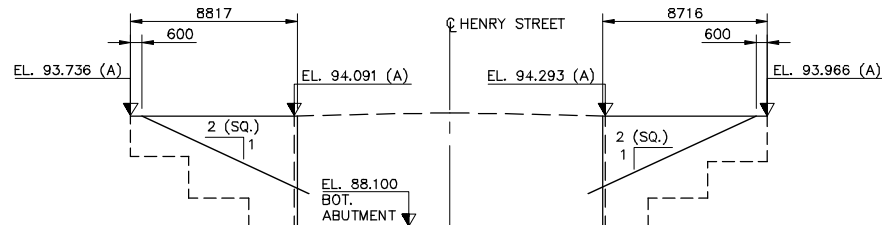
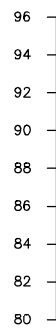
SCALE 1:25



AT SLEEPER SLAB LOCATION

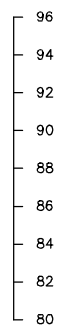
SCALE 1:25

WEST



FRONT ELEVATION - NORTH ABUTMENT  
SCALE 1:200

EAST



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS		DESCRIPTION				
DESIGN	HK	CHK	NDL	CODE	CHBDC-14	LOAD CL625-ONT
DRAWN	PSH	CHK	HK	SITE	22-152	DATE SEP, 15
					DWG	8

