PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN REPORT
QEW OVERPASS AT FORD DRIVE - RECONSTRUCTION
QUEEN ELIZABETH WAY/HIGHWAY 403 IMPROVEMENTS
OAKVILLE, ONTARIO

W.O. 09-20007, SITE No. 10-286

Geocres Number: 30M5-297

Report to

McCormick Rankin

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THURBER

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a preliminary foundation investigation conducted for the proposed reconstruction of the Queen Elizabeth Way (QEW) overpass at Ford Drive in the Town of Oakville, Ontario. The existing structures are to be reconstructed and widened by approximately 3.5 m. This investigation is part of the Queen Elizabeth Way (QEW)/Highway 403 Improvements project, from Trafalgar Road to Winston Churchill Boulevard.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, a stratigraphic profile, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained in the course of the investigation.

The information collected in the course of this investigation and presented in this report is intended for preliminary design purposes only. Additional site investigation, field testing and engineering analysis may be required at the detailed design phase. The extent of the additional investigation will depend on the final location and General Arrangement (GA) of the structure.

Thurber carried out the investigation as a sub-consultant to McCormick Rankin (MRC), under the Ministry of Transportation Ontario (MTO) Work Order Number 09-20007.

A previous foundation investigation report was completed in 1978 for the existing overpass structure. The title of the report is as follows:

> Foundation Investigation Report for QEW Over Ford Drive, District 4 (Hamilton), W.P. 125-66-17, (Geocres 30M05-116), Site 10-286, dated January 1978

The Record of Borehole sheets for the four boreholes (BH 3, 4, 5 & 6) drilled during the previous investigation are also included in Appendix A.

2 SITE DESCRIPTION

The QEW overpass structure at Ford Drive is located approximately 2 km west of Winston Churchill Blvd in the Town of Oakville, Regional Municipality of Halton. In general, the lands in the vicinity of the site slope gently to the south (construction west) towards Joshua Creek, which is located approximately 150 m to the south. The lands immediately adjacent to the site consist of undeveloped areas of the MTO right-of-way. To the east, there is a residential area and to the west and south of the QEW, lies the Ford Motors Canada complex.

The site lies within the South Slope physiographic region, characterized by glacially deposited overburden overlying shale bedrock of the Queenston and Dundas Formations of the upper Ordovician age.

Photographs included in Appendix D show the existing structures at this site.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project were completed on May 24 and 25, 2013. Two boreholes were drilled and sampled at this site, identified as 13-23 and 13-24. Borehole 13-23 was drilled near the west abutment to a depth of 9.1 m while Borehole 13-24 was drilled to a depth of 7.9 m near the east abutment. Four boreholes which were drilled during the previous investigation (No.3, No.4, No.5, and No.6) have also been included in this report. The Record of Borehole sheets are included in Appendix A.

The approximate locations of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing included in Appendix E. The coordinates and elevations of the boreholes are given on the drawing and on the individual Record of Borehole sheets.

The borehole locations were marked in the field and utility clearances were obtained prior to commencement of drilling operations. The drilling was carried out using a CME 75 truck-mounted drill rig. A combination of solid stem augers and NQ coring methods were used to advance the boreholes. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). All rock cores were logged, and the Total Core Recovery (TCR), Solid Core Recovery (SCR), Rock Quality Designation (RQD) and the Fracture Indices (FI) were determined.

The drilling and sampling operations were supervised on a full time basis by a member of Thurber’s technical staff. The recovered soil and bedrock samples were logged in the field and processed for transport to Thurber’s laboratory in Oakville, Ontario for further examination and testing.

Groundwater conditions were observed in the open boreholes prior to beginning the coring operations. Due to a narrow shoulder at the existing structure, the boreholes were located on the edge of the travelled lane. Therefore, no standpipe piezometers were installed in the boreholes drilled during the current investigation. Upon completion of drilling, the boreholes were backfilled with bentonite holeplug to a depth approximately 0.3 m below ground level, then concrete from 0.3 m to 0.15 m and asphalt cold patch to surface.

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determinations. Selected samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing, where appropriate. The results of this testing program are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

Point load tests were conducted on selected portions of the rock cores. The UCS values of the rock were assessed from the point load data and these values are reported on the borehole logs (as average per run).

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets included in Appendix A and the Borehole Locations and Soil Strata Drawing included in Appendix E. An overall description of the stratigraphy based on the conditions encountered in the boreholes is given in the following paragraphs. However, the factual data presented in the Record of Borehole sheets governs any interpretation of the site conditions.

The stratigraphy encountered at this overpass generally consists of a thin layer of asphalt overlying layers of sand and gravel fill and silty clay which are underlain by shale bedrock. The boreholes drilled during the previous investigation encountered only clayey silt to silty clay overlying the shale bedrock. More detailed descriptions of the individual strata encountered at the proposed structure site, based primarily on BH 13-23 and 24, are presented below.

5.1 Asphalt

A layer of asphalt, 150 mm thick, was encountered at the surface in both boreholes drilled during the current investigation (13-23 and 13-24). These boreholes were drilled on the left shoulder of westbound (WB) QEW at Ford Drive.

5.2 Sand and Gravel Fill

Sand and gravel fill with some fines was encountered below the asphalt layer in both boreholes drilled during the current investigation (13-23 and 13-24). The fill was 1.3 m thick in both boreholes, with the lower boundary encountered at a depth of 1.5 m (elevation 128.2 and 130.0 m).

SPT ‘N’ values recorded in the cohesionless fill ranged from 19 to 31 blows for 300 mm of penetration, indicating a compact to dense relative density. The moisture content of the fill ranged from 4 to 5%.

Laboratory grain size distribution analyses were carried out on two samples of the fill. The results of these tests are presented on the corresponding Record of Borehole sheets included in Appendix A and the grain size distribution curves are presented in Figure B1 of Appendix B. The results are summarized as:

Gravel %	37 to 39
Sand %	46 to 47
Silt and Clay %	15

5.3 Clayey Silt to Silty Clay

Native reddish brown to grey clayey silt to silty clay was encountered at the surface in the four boreholes drilled during the previous investigation (No.3, No.4, No.5, and No.6) and below the sand and gravel fill in both boreholes drilled during the current investigation (13-23 and 13-24). The clayey silt to silty clay contained trace to some sand, trace gravel, and occasional shale fragments or cobbles.

The thickness of the silty clay layer ranged from 0.3 m to 2.2 m, with the lower boundary of this layer encountered at depths of 1.8 to 3.7 m (elevation 126.1 and 129.7 m).

SPT N-values recorded in the clayey silt to silty clay ranged from 6 to 46 blows for 300 mm of penetration, indicating a firm to hard consistency. Moisture contents of samples ranged from 9 to 25%.

Laboratory grain size distribution analyses were carried out on two samples of the clayey silt to silty clay (one from the current investigation and one from the previous investigation). The results of these tests are presented on the corresponding Record of Borehole sheets included in Appendix A and the grain size distribution curve, from the current investigation, is presented in Figure B2 of Appendix B. The results are summarized as:

Gravel %	0 to 5
Sand %	4 to 31
Silt %	39 to 40
Clay %	25 to 56

A total of five samples of the clayey silt to silty clay underwent Atterberg Limits testing. The results of these tests are presented on the Record of Borehole sheets included in

Appendix A and are also presented in Figure B3 of Appendix B. The results are summarized as:

Liquid Limit %	27 to 44
Plastic Limit %	18 to 22

The results of these tests indicate that the clayey silt to silty clay exhibits low to medium plasticity with a group symbol of CL-CI.

5.4 Shale Bedrock

Bedrock was encountered below the clayey silt to silty clay in the boreholes drilled during the current investigation and in the four boreholes from the previous investigation. The depths and elevations at which bedrock was encountered in the boreholes are summarized in Table 5-1.

Table 5-1. Depths and Elevations of Bedrock Surface

Underpass Element	Borehole	Bedrock Surface	
		Depth (m)	Elevation (m)
West Abutment	5(1)	2.4	126.4
	13-23	3.7	126.0
	3(1)	2.3	126.3
East Abutment	6(1)	2.1	128.5
	13-24	1.8	129.7
	4(1)	2.2	128.0

Note: (1) Geocres 30M05-116, Site 10-286

The bedrock was described as thinly bedded grey shale with frequent hard limestone interbeds up to approximately 0.45 m thick. The bedrock was generally described as weathered at the soil-bedrock interface and described as slightly weathered to fresh within 1 to 2 m of the soil-bedrock interface. Frequent horizontal fractures, occasional vertical fractures, broken zones, and clay seams were observed in the bedrock cores.

Total Core Recovery (TCR) in the bedrock typically ranged from 75 to 100%, except for Run 1 in Borehole 13-24 where no core was recovered. The Rock Quality Designation (RQD) values ranged from 0 to 93%, indicating a variable rock quality ranging from very poor to excellent. The Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, typically ranged from 0 to 4, with occasional highly fractured zones with an FI of greater than 10.

The average estimated unconfined compression strength (UCS) of the shale with hard limestone interbeds ranged from 42 to 97 MPa, indicating a medium strong to strong rock strength classification. These values were interpreted from point load tests conducted on intact cores.

5.5 Groundwater Levels

Water levels were observed in the open boreholes prior to the start of the coring operations where water was added to the boreholes. No standpipe piezometers were installed at this site since the boreholes were located on the travelled lane of the existing highway. The water levels observed in the open boreholes are as follows.

Table 5-2. Groundwater Depths and Elevations

Borehole	Date of Reading	Water Level		Comments
		Depth (m)	Elev. (m)	
13-23	May 25, 2013	Dry	N/A	Measured prior to coring.
13-24	May 24, 2013	Dry	N/A	Measured prior to coring.

Groundwater levels observed in the open boreholes during the previous investigation ranged from 1.2 to 1.8 m (Elev. 127.2 to 129.0 m) below ground surface. An indication was not provided in the previous investigation report if the recorded water level was a result of coring operations.

It should be noted that ground water levels are susceptible to seasonal fluctuations. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of significant and/or prolonged precipitation events.

6 MISCELLANEOUS

Borehole locations were selected and established in the field by Thurber Engineering Ltd. Surveyors from MMM Group provided co-ordinates and the ground surface elevations at the boreholes drilled.

DBW Drilling Ltd. of Ajax, Ontario supplied a truck-mounted CME 75 drill rig and conducted the drilling, sampling and in-situ testing operations.

Overall planning and supervision of the field program was conducted by Ms. Lindsey Blaine, P.Eng. The field investigation was supervised by Mr. George Azzopardi of Thurber.

Routine laboratory testing was carried out by Thurber Engineering Ltd.

Interpretation of the data and preparation of the report were carried out by Ms. Lindsey Blaine, P.Eng. and Mr. Alastair Gorman, P.Eng.. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.

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PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

7 GENERAL

This report presents an interpretation of the geotechnical data in the factual report and presents preliminary foundation recommendations to assist the design team to select and design a suitable foundation system for the reconstruction of the overpass structure.

Our understanding of the project, based on the GA, consists of:

- the proposed new and widened structure will carry Queen Elizabeth Way (QEW) traffic over Ford Drive on the same alignment as the existing structure
- the proposed overpass structure will comprise of a single 39.6 m span, flanked by RSS Walls and carry four lanes of traffic in both the westbound and eastbound direction
- the proposed pavement elevation of QEW at the west and east abutment will be approximately 130.9 and 132.4 m, respectively
- Ford Drive will be at approximate elevation 123.4 m

The discussion and recommendations presented in this report are based on the information provided by MRC and on the factual data obtained in the course of the investigation.

8 STRUCTURE FOUNDATIONS

The stratigraphy identified in the preliminary investigation consisted of a surficial layer of asphalt overlying sand and gravel fill followed by native silty clay which is underlain by shale bedrock. No short term groundwater level was recorded.

It is understood that the existing abutments and spread footings will be removed. In the preparation of the preliminary foundation design recommendations, consideration was given to the following foundation types:

- Spread footings bearing on shale bedrock
- Spread footings bearing on engineered fill
- Steel H-piles socketed into bedrock
- Augered caissons socketed into bedrock

A comparison of the foundation alternatives based on advantages and disadvantages of each is included in Appendix C.

8.1 Spread Footings on Bedrock

Ford Drive is constructed in a cut at the proposed structure location. Due to the shallow depth of overburden, spread footings founded on shale bedrock are considered feasible to support the structural loads.

As interpreted from the boreholes, spread footing should be founded on undisturbed shale bedrock at or below elevation 125.5 and 129.0 m at the west and east abutments, respectively. The elevations presented are the highest recommended founding elevation and must be reviewed during the detail design based on the final bridge arrangement and results of the site investigation and field testing to be completed at that time.

For preliminary design, footings founded on undisturbed shale should be designed using a factored geotechnical resistance at ULS of 1000 kPa. This value includes a resistance factor of 0.5 as per Table 6.1 of the CHBDC. The SLS condition will not govern design of footings founded on bedrock.

The geotechnical resistances quoted above are for concentric, vertical loads only. In the case of eccentric or inclined loading, the geotechnical resistance must be adjusted as shown in the CHBDC (2006) Clause 6.7.3 and Clause 6.7.4. During detail design, the geotechnical resistance must also be reviewed taking account of the position of the footing relative to the forward slope.

8.2 Spread Footings on Engineered Fill

If higher founding elevations are required, than those provided in Section 8.1, spread footings could be constructed on an engineered fill pad consisting of Granular "A" material. This option would be suitable for abutment footings which may be perched within the approach embankment and above the existing bedrock surface elevation.

For preliminary design, footings founded on engineered fill should be designed using a factored resistance at ULS of 900 kPa and a SLS of 350 kPa.

The engineered fill must bear on undisturbed shale at or below elevations provided in Section 8.1. The Granular "A" pad must be placed in 150 mm lifts and compacted to 100% standard proctor maximum dry density (SPMDD) at optimum moisture content

±2%. The geometry of the fill pad must conform to the general requirements shown in Figure 1.

The geotechnical resistances quoted above are for concentric, vertical loads only. In the case of eccentric or inclined loading, the geotechnical resistance must be adjusted as shown in the CHBDC (2006) Clause 6.7.3 and 6.7.4. During detail design, the geotechnical resistance must also be reviewed taking account of the position of the footing relative to the forward slope.

8.3 Steel H-Piles Socketed into Bedrock

Since bedrock is shallow at this site, driven H-piles would typically not be considered cost effective or practical from a foundation point of view. However, piles socketed into the bedrock could be used to provide axial geotechnical resistance and to accommodate the design of an integral abutment, if required.

In the case of an integral abutment, excavation of bedrock will be required within the abutment footprint and special considerations must be given to the details of the pile installation in order to provide the required flexibility in the upper 3.0 m length. Preliminary recommendations are provided but must be reviewed during detail design based on the final alignment, final bridge arrangement and the results of the site investigation and field testing to be completed at that time.

For HP 310x110 steel H-piles placed in rock sockets, a factored axial geotechnical resistance at ULS of 2,000 kN is recommended. This value includes a geotechnical resistance factor of 0.4 as per the CHBDC. The SLS condition will not govern for piles founded in bedrock.

The structural resistance of the pile must be checked by the structural designer.

Downdrag on the piles is not considered to be an issue at this site.

8.4 Augered Caissons Socketed into Bedrock

Drilled shaft foundations socketed into shale bedrock are not considered appropriate for this site and have not been developed further.

8.5 Abutment Design Considerations

From a geotechnical perspective, the conditions at this site are considered to be suitable for conventional or semi-integral abutment design, principally due to the shallow depth to bedrock.

However, if other design and/or maintenance issues favour the use of integral abutment design, this can be accommodated through excavation of shale bedrock within the abutment area to accommodate the use of steel H-pile foundations.

8.6 Frost Cover

The design depth of frost penetration at this site is 1.2 m. It is recommended that all footings be provided with a minimum of 1.2 m of earth cover above the underside of the pile cap or footing. Frost protection is also required for footings founded on shale bedrock.

8.7 Recommended Foundation

From a geotechnical perspective, and based on current information, the recommended foundation consists of spread footing bearing on undisturbed shale bedrock.

9 DEWATERING

Excavation for spread footings at the elevations given in Section 8.1 are not expected to penetrate below the groundwater level. However, if deeper excavations are required they may penetrate below the groundwater level and some seepage into the excavation may occur. However, due to the relatively low permeability of the shale, the volumes are expected to be small. Similarly, minor seepage from the fill may be encountered and surface water flow may enter the excavations.

Given the small volumes of water that are expected, it is considered that pumping from sumps will be adequate for dewatering excavations at this site. The exposed shale at the base of the foundation excavation must be protected from deterioration within 24 hours of completion of the excavation.

In the case of sockets drilled in the bedrock for deep foundations, pumping accumulated water from the socket prior to concreting will be adequate, in conjunction with cleaning all loosened material from the socket.

10 APPROACH EMBANKMENTS

Based on the current and previous boreholes drilled at this site, the approach embankments will be constructed over foundation soils consisting of stiff to very stiff native silty clay and shale bedrock. The foundation soils are considered to provide adequate stability for approach embankments if constructed at 2H:1V using SSM or granular fill.

Constructing the approach embankments with cohesive fill may be possible but will be dependent on the mechanical properties of the material. An embankment constructed of cohesive material will typically not perform as well as an embankment constructed using SSM or granular fill and will require flatter slopes which will extend the footprint of the embankment.

Preliminary analysis indicates that settlement of the foundation soils under the imposed embankment loading is expected to be less than 25 mm. Considering the competency of the foundation soils the settlement will be essentially completed when construction of the fill is completed.

Further settlement analysis and the global, internal and surficial stability of the approach embankment fills should be further evaluated during the detailed design phase. Additionally, permanent drainage and slope protection requirements must be addressed during the detailed design.

11 ROADWAY PROTECTION

Excavation support systems will be required for temporary roadway protection during foundation construction where stable slopes cannot be maintained. The temporary excavation support system should be designed and constructed in accordance with OPSS 539. In general, the lateral movement of the temporary shoring system should meet Performance Level 2 as specified in OPSS 539. The feasibility of installing protection systems should be assessed once further subsurface investigation is carried out during detailed design.

12 CONSTRUCTION CONCERNS

Potential construction concerns include, but are not necessarily limited to:

- The shale bedrock exposed at the base of the footing must be concreted within 24 hours after the bedrock surface has been properly prepared and is free of loose debris to prevent softening and deterioration.
- Excavation must not undermine the footings of any portion of the existing QEW-Ford Drive overpass that is still in service

13 INVESTIGATION FOR DETAILED DESIGN

During the detail design phase of this project, additional site investigation and field testing may be required. The scope and results of this investigation must be reviewed at that time based on the final GA to determine if they meet the current Ministry requirements and if additional investigation and analysis is necessary.

14 CLOSURE

Engineering analysis and preparation of the report were carried out by Mr. Stephen Peter, P.Eng. and Mr. Alastair Gorman, P.Eng.. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.

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Report reviewed by:
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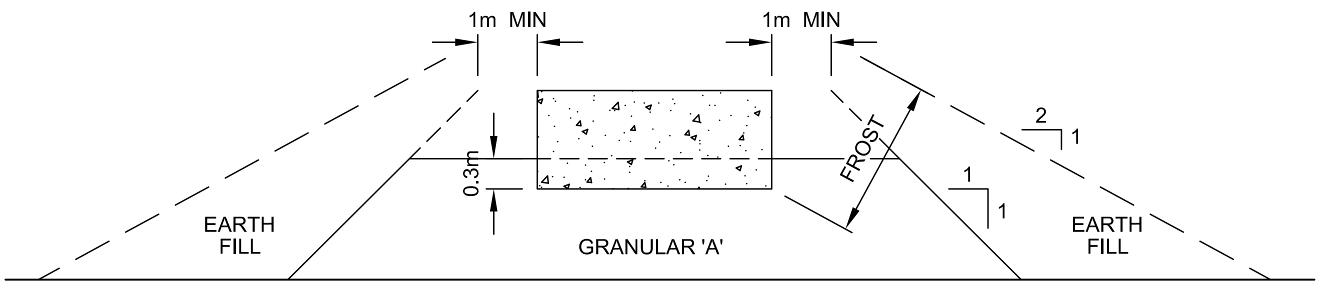
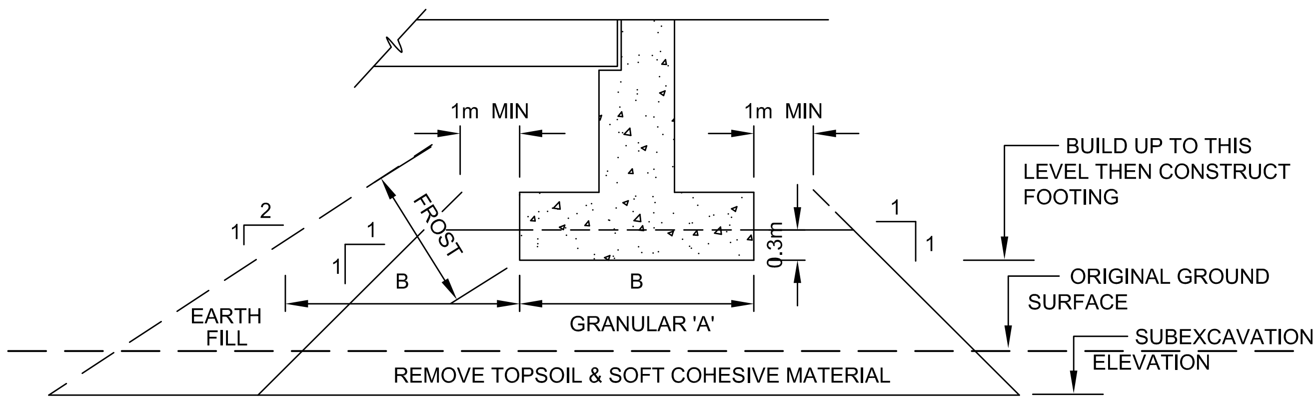
Review Principal



CROSS-SECTION



LONGITUDINAL SECTION

NOTES:

1. REMOVE TOPSOIL AND OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' AND EARTH FILL.
2. PLACE GRANULAR 'A' AND EARTH FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO O.P.S.S. 501.
3. CONSTRUCT CONCRETE FOOTING.
4. PLACE REMAINDER OF GRANULAR 'A' AND EARTH FILL AS REQUIRED.
5. SOURCE M.T.C. 1982.

ABUTMENT ON COMPACTED FILL
SHOWING GRANULAR 'A' CORE

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
SBP	MFA	AEG
DATE : OCTOBER 2013	SCALE : N.T.S.	DRAWING No. FIGURE 1

Appendix A

Record of Borehole Sheets

EXPLANATION OF ROCK LOGGING TERMS

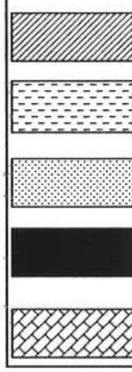
ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

DISCONTINUITY SPACING

Bedding	**Bedding Plane Spacing**
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

SYMBOLS



CLAYSTONE

SILTSTONE

SANDSTONE

COAL

BEDROCK

STRENGTH CLASSIFICATION

Rock Strength	**Approximate Uniaxial Compressive Strength (MPa)**	**(psi)**	**Field Estimation of Hardness***
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery:(SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation:(RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index:(FI)	Frequency of natural fractures per 0.3m of core run.

UNIFIED SOILS CLASSIFICATION

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

SYMBOLS AND TERMS USED ON TEST HOLE LOGS

TEXTURAL CLASSIFICATION OF SOILS

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

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

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

TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)		APPROX. SPT[(1)] "N" VALUE
Very Soft	< 10		< 2
Soft	10 to 25	(POCKET PEN)	2 to 4
Firm	25 to 50	(0.5-1)	4 to 8
Stiff	50 to 100	(1-2)	8 to 15
Very Stiff	100 to 200	(2-4)	15 to 30
Hard	> 200	(>4)	> 30

(1) Standard Penetration Test – the number of blows from a 63.5kg hammer falling through 0.76m to advance a 60 degree truncated cone 0.3m

TERMS DESCRIBING DENSITY(COHESIONLESS SOILS)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

HIERARCHY OF SOIL STRENGTH PREDICTION

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

LEGEND FOR TEST HOLE LOGS

■ Shelby Tube A – Casing ⧄ SPT ▥ Grab/Auger sample ◫ Core ⊠ No Recovery

• MC – Moisture Content (% by Weight) as determined by sample

▽	Water Level
C_{vane}	Shear Strength Determination by Field Insitu Vane
C_{pen}	Shear Strength Determination by Pocket Penetrometer
C_{lab}	Shear Strength Determination using a Laboratory Vane Apparatus
C_U	Undrained Shear Strength determined by Unconfined Compression Test
AS/GS/BS	Auger Sample/Grab Sample/ Block Sample
SS	Split-spoon
SC	Soil core
AED	Oedometer test
TXL	Triaxial test

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 13-23

METRIC

W.P. ______ LOCATION N 4 817 184.8 E 290 769.4 ORIGINATED BY GA

HWY 403/QEW BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2013.05.25 - 2013.05.25 CHECKED BY LRB

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	SAMPLE TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	FI	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
129.7								
0.0	**ASPHALT:** (150mm)							
0.2	**SAND** and **GRAVEL**, some silt Dense to Compact Brown to Reddish Brown Damp (FILL)	1	SS	31				39 46 15 (SI+CL)
		2	SS	19		129		
128.2 1.5	Silty **CLAY**, trace sand Firm to Very Stiff Reddish Brown	3	SS	6		128		
		4	SS	8		127		0 4 40 56
		5	SS	19				
126.1 3.7	**SHALE**, with limestone interbeds, highly weathered, grey					126		
		6	SS	50/ 0.125	∇	125		
	Start coring at 6.1m					124		
	Slightly weathered to fresh, thinly bedded, grey, occasional limestone interbeds Clay seam (200mm) at 6.1m Limestone interbeds (25mm to 75mm) at 6.3m, 6.4m, 6.5m, 6.7m, 6.8m, 7.0m, 7.2m and (125mm) at 7.4m Vertical fracture (125mm) at 7.4m	1	RUN			123	0 4 3 0 0	RUN #1 TCR=100% SCR=80% RQD=53% UCS=97MPa (Average)
	Horizontal fracture at 6.4m, 6.5m, 6.6m, 6.7m, 6.8m, 6.9m, 7.7m, 7.9m, 8.1m, 8.5m, 8.7m Limestone interbeds (25mm) at 7.6m, 7.9m, 8.0m, 8.2m, 8.5m, 8.9m, 9.1m and (75mm) at 8.7m	2	RUN			122 121	1 2 0 2 0	RUN #2 TCR=100% SCR=97% RQD=83% UCS=72MPa (Average)
120.6 9.1	END OF BOREHOLE AT 9.1m. BOREHOLE OPEN TO 9.1m AND WATER LEVEL AT 4.8m UPON COMPLETION OF CORING. BOREHOLE BACKFILLED WITH							

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m^3

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 13-23

METRIC

W.P.		LOCATION	N 4 817 184.8 E 290 769.4
ORIGINATED BY	GA	HWY	403/QEW
BOREHOLE TYPE	Solid Stem Augers/NQ Coring	COMPILED BY	AN
DATUM	Geodetic	DATE	2013.05.25 - 2013.05.25
CHECKED BY	LRB		

SOIL PROFILE: ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL
	Continued From Previous Page										
	BENTONITE HOLEPLUG TO 0.3m, CONCRETE TO 0.15m, THEN ASPHALT COLD PATCH TO SURFACE.										

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1184.GPJ 2012TEMPLATE(MTO).GDT 11/10/13

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 13-24

METRIC

W.P. ______ LOCATION N 4 817 241.5 E 290 767.3 ORIGINATED BY GA

HWY 403/QEW BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2013.05.24 - 2013.05.25 CHECKED BY LRB

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT / FI	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.5									
0.0	**ASPHALT:** (150mm)								
0.2	**SAND** and **GRAVEL**, some silt Compact Brown Damp (FILL)	1	SS	30		131	o		
		2	SS	28			o		37 47 15 (SI+CL)
130.0 / 1.5	Silty **CLAY**, trace sand, occasional shale fragments Very Stiff Reddish Brown	3	SS	16		130	o		
129.7 / 1.8	**SHALE**, with limestone interbeds, highly weathered, grey	4	SS	50/ 0.150		129	o		
	Start coring at 3.3m	5	SS	50/ 0.100			o		
		1	RUN		∇	128, 127			No Recovery
	Slightly weathered to fresh, thinly bedded, grey, occasional limestone interbeds Clay seam (25mm) at 5.5m, 5.6m, 5.7m Horizontal fracture at 5.5m, 5.6m, 5.9m, 6.0m Limestone interbeds (25mm) at 5.9m, 6.0m, 6.1m and (100mm) at 5.5m	2	RUN			126		FI >10 >10 4 2 0	RUN #2 TCR=100% SCR=60% RQD=40% UCS=42MPa (Average)
	Highly broken zones: 250mm at 4.8m 50mm at 5.2m 50mm at 5.4m Limestone interbeds (25mm to 75mm) at 6.6m, 6.9m, 7.0m, 7.3m, 7.6m, 7.7m Horizontal fracture at 6.4m, 6.5m, 6.6m, 6.7m, 6.9m, 7.0m, 7.4m, 7.8m	3	RUN			125, 124		4 2 2 1 1	RUN #3 TCR=100% SCR=97% RQD=70% UCS=85MPa (Average)
123.6 / 7.9	END OF BOREHOLE AT 7.9m. BOREHOLE OPEN TO 7.9m AND WATER LEVEL AT 3.9m UPON COMPLETION OF CORING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.3m, CONCRETE TO 0.15m, THEN ASPHALT COLD PATCH TO SURFACE.								

Column headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³

+3, ×3: Numbers refer to Sensitivity   20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

W P 125-66-17 LOCATION Co-ords N 15 803 724; E 954 012 ORIGINATED BY CTJ

DIST 4 HWY Q.E.W. BOREHOLE TYPE Solid Stem Auger, BXL Core COMPILED BY CTJ

DATUM Geodetic DATE March 23, 1977 CHECKED BY RS

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%)
422.0	Ground Level						
0.0	Clayey Silt To Silty Clay, Some Sand, Trace Of Gravel – Red / Grey	1	SS	46	▽	420	
		2	SS	32			
414.5	Hard	3	SS	112/10"			
412.5 / 9.5	(Weathered) / (Sound)						
	Shale Bedrock (See Below)*	4	BXL	91% REC		410	RQD 30%
		5	BXL	100% REC		400	RQD 63%
392.3 / 29.7	End Of Borehole						

*Intermittent shale, shaly limestone & limestone, fine texture, soft to med.hard light grey, shale is fissile, thin bedding with Limestone (med. hard, fine texture, light grey, fossiliferous) seams from
12'8" to 13'6"
19'6" to 20'2"
25'3" to 26'2"

Dynamic Cone Penetration Resistance Plot: 20 40 60 80 100
Shear Strength: ○ Unconfined + Field Vane ● Quick Triaxial × Lab Vane
Plastic Limit W_p, Natural Moisture Content W, Liquid Limit W_L – Water Content (%): 10 20 30
Unit Weight γ
Grain size: GR SA SI CL

$+^3$, $\times^5$: Numbers refer to Sensitivity

15 ⌖ 5 (%) STRAIN AT FAILURE (20 above, 10 below)

Ministry of Transportation and Communications Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

W P 125-66-17 LOCATION Co-ords N 15 803 823; E 954 023 ORIGINATED BY CTJ

DIST 4 HWY Q.E.W. BOREHOLE TYPE Solid Stem Auger, BXL Core COMPILED BY CTJ

DATUM Geodetic DATE March 22, 1977 CHECKED BY RS

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
427.1	Ground Level								
0.0	Clayey Silt To Silty Clay, Some Sand Traces Of Gravel (Reworked) Very Stiff		1	SS	16	▼		~19	5 31 39 25
420.0 / 7.1			2	SS	111/8"		420		
417.1 / 10.0	(Weathered) (Sound)		3	SS	131/9"				
	Shale Bedrock (See Below)*		4	BXL	84% REC				RQD 25%
			5	BXL	100% REC		410		RQD 15%
			6	BXL	97% REC				RQD 60%
397.9							400		
29.2	End Of Borehole								

*Intermittent Shale, Shaly Limestone & Limestone Beds, Soft To Hard, Fine Texture, Shale Is Fissile, Light Grey Colour, Thin horizontal Bedding With Limestone (Hard, Fine Texture fossiliferous) seams from
11'10" to 12'4"
13' 6" to 14'2"
22' 2" to 22'6"
23' 0" to 23'10"
28'10" to 29'2"

Column headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; PLASTIC LIMIT W_p, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ

+3, ×5 : Numbers refer to Sensitivity   20 / 15 -○- 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

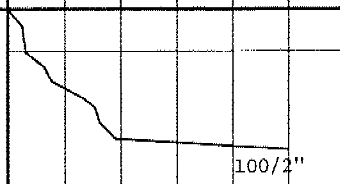
RECORD OF BOREHOLE No 5

W P 125-66-17 | LOCATION Co-ords N 15 803 726; E 953 841 | ORIGINATED BY VK

DIST 4 HWY Q.E.W. | BOREHOLE TYPE Solid Stem Auger, BXL Core & Cone Test | COMPILED BY VK

DATUM Geodetic | DATE March 22, 1977 | CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT WL; WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
422.7	Ground Level										
0.0	Clayey Silt To Silty Clay, Trace Of Sand Very Stiff To Hard, Brown / Grey		1	SS	16	▽	420		o (moisture near 20%, range to ~35%)		
414.7 / 8.0			2	SS	37						
411.7 / 11.0	(Weathered) / (Sound)		3	SS	100/4"			100/2"			
	Shale Bedrock* (See Below)		4	BXL	100% REC		410				RQD 0%
			5	BXL	100% REC						RQD 0%
			6	BXL	100% REC		400				RQD 70%
391.7			7	BXL	90% REC						RQD 20%
31.0	End Of Borehole										



*Intermittent Thin Beds Of Shale, Shaly Limestone & Limestone (Dark Grey Colour, Fine Texture, Soft To Hard, Shale Is Fissile, Thin Horizontal Bedding) With Limestone Seams (Light Grey, Fine Texture, Hard)

From
14'4" to 15'4"
17'3" to 18'6"
21'0" to 21'9"
26'0" to 27'6"

$+^3, \times^5$: Numbers refer to Sensitivity

15 ⟡ 5 (%) STRAIN AT FAILURE (20)

Ontario Ministry of Transportation and Communications

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6

W P 125-66-17 | LOCATION Co-ords N 15 803 824; E 953 833 | ORIGINATED BY VK

DIST 4 HWY Q.E.W. | BOREHOLE TYPE Solid Stem Auger, BXL Core & Cone Test | COMPILED BY VK

DATUM Geodetic | DATE March 21, 1977 | CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
428.5	Ground Level										
0.0	Clayey Silt To Silty Clay, Trace Of Sand Occ. Cobbles Hard, Brown		1	SS	37						
421.5			2	SS	113						
7.0	Shale Bedrock * (See Below)		3	SS	100/5"		420				
			4	SS	136/11"						
414.0	(Weathered)										
14.5	(Sound)		5	BXL	100% REC		410				
			6	BXL	75% REC						
			7	BXL	100% REC						
			8	BXL	100% REC		400				
398.5											RQD 15%
30.0	End Of Borehole										

*Intermittent Shale, Shaly Limestone And Shale Beds (Soft To Med. Hard, Fine Texture Shale is Fissile, Thin Horizontal Bedding With Limestone Seams (Med. Hard, Fine Texture, Light Grey Colour, Fossiliferous, Shale Seams Present)

From 21'3" to 24'2"
26'3" to 27'5"

Note: Waterlevel not established

$+^3, \times^5$: Numbers refer to Sensitivity

15 -◇- 5 (%) STRAIN AT FAILURE (20 above, 10 below)

Appendix B

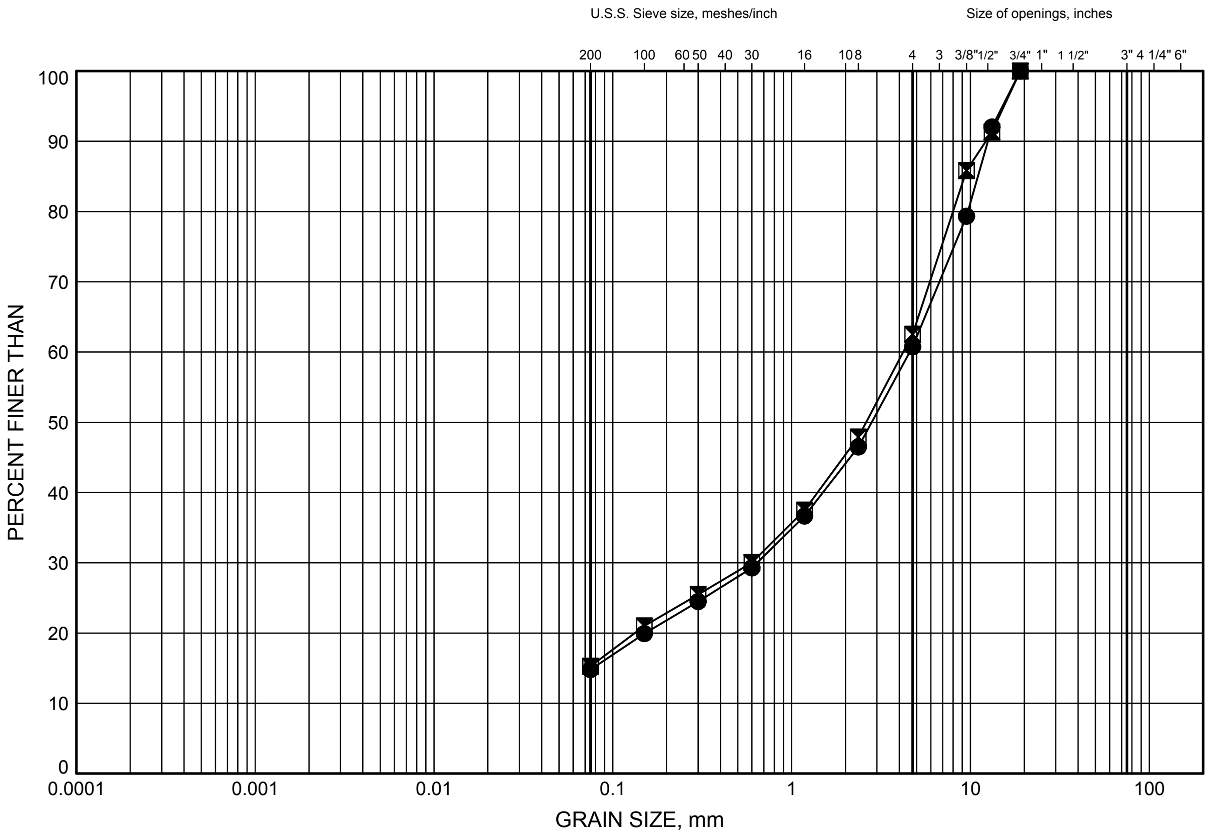
Laboratory Test Results

QEW and Hwy 403

GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND and GRAVEL FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	13-23	0.38	129.35
⧗	13-24	1.07	130.42

GRAIN SIZE DISTRIBUTION - THURBER 1184.GPJ 7/8/13

Date August 2013

W.P.

THURBER

Prep'd SBP

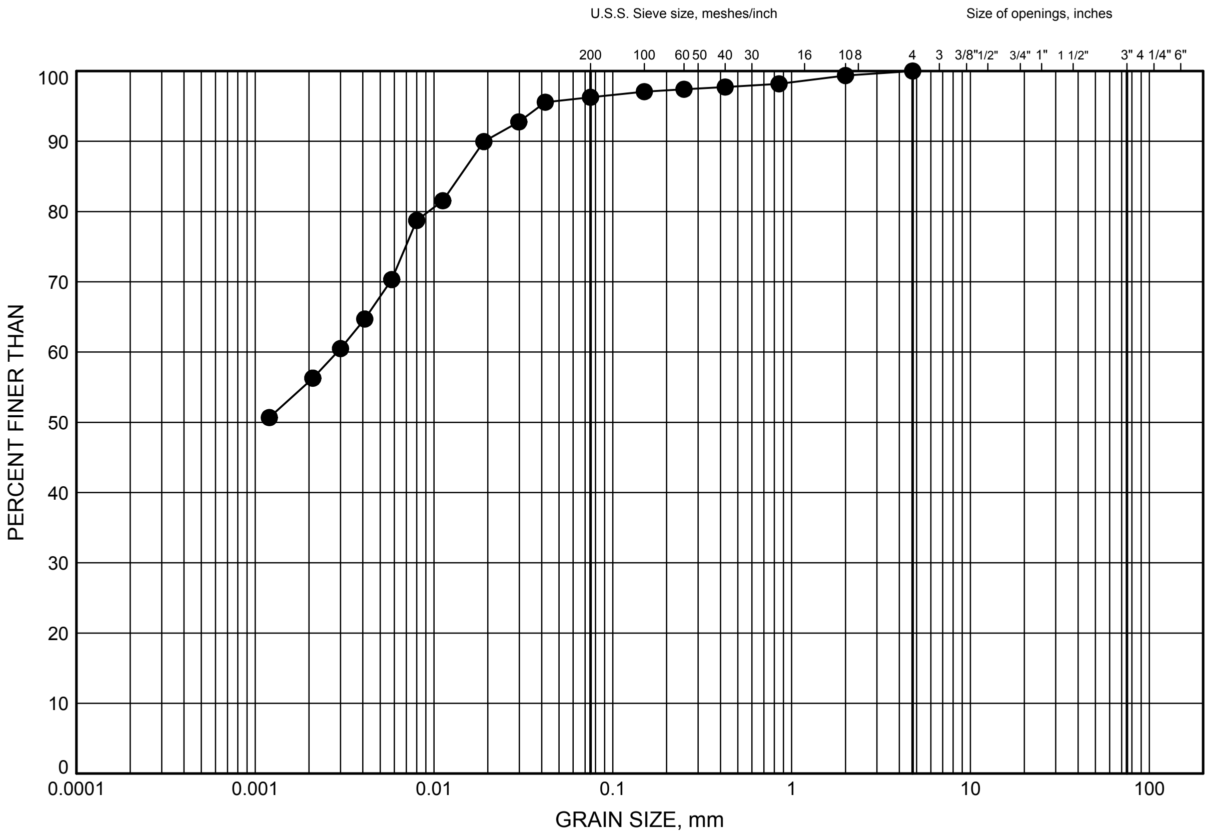
Chkd.

QEW and Hwy 403

GRAIN SIZE DISTRIBUTION

FIGURE B2

Silty CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	13-23	2.59	127.14

Date August 2013

W.P.

THURBER

Prep'd SBP

Chkd.

GRAIN SIZE DISTRIBUTION - THURBER 1184.GPJ 7/8/13

Appendix C

Foundation Comparison

COMPARISON OF FOUNDATION ALTERNATIVES FOR EACH FOUNDATION ELEMENT

Spread Footing on Shale Bedrock	Spread Footings on Engineered Fill	Steel H-Piles Socketed into Shale Bedrock
Advantages: i. Generally less costly construction than deep foundation elements.	***Advantages:*** i. Economical to install ii. Accommodates perched abutment	***Advantages:*** i. High geotechnical resistance available by socketing piles into bedrock. ii. Provide uplift and overturning resistance iii. Installation less influenced by weather and groundwater than spread footings. iv. Permits integral abutment design v. Comparatively short abutment possible
Disadvantages: i. Dewatering may be required, depending on depth of excavation ii. Ineffective for resistance to uplift or overturning.	***Disadvantages:*** i. Dewatering may be required, depending on depth of excavation ii. Lower geotechnical resistance than spread footings on bedrock iii. Ineffective for resistance to uplift or overturning.	***Disadvantages:*** i. Higher unit cost compared to spread footings ii. Difficulty in unwatering, cleaning and inspecting bases iii. Pre-drilling required for installation of socketed piles. iv. Potential for difficulty in drilling through hard limestone interbeds
RECOMMENDED	**FEASIBLE**	**FEASIBLE**

Appendix D

Site Photographs

Photograph 1: Existing structures carrying EB and WB QEW (and ramps) over Ford Drive.

Photograph 2: On the right - west abutment of the structure carrying the EB QEW at Ford Drive.

Appendix E

Borehole Locations and Soil Strata Drawing

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

CONT No
WP No

SHEET

Q.E.W. OVERPASS
AT FORD DRIVE
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN
A member of MMM GROUP

THURBER ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Oct 15/13
PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ...
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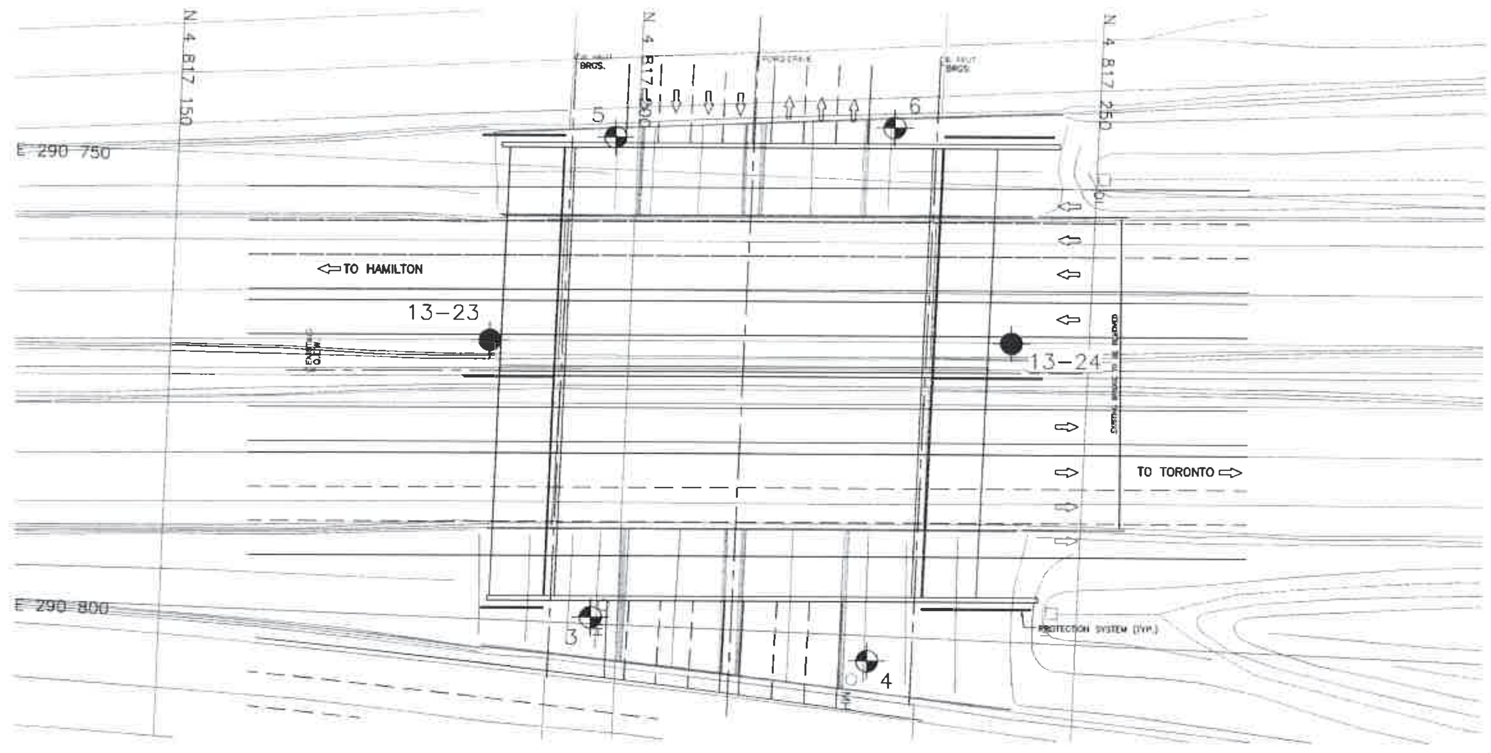
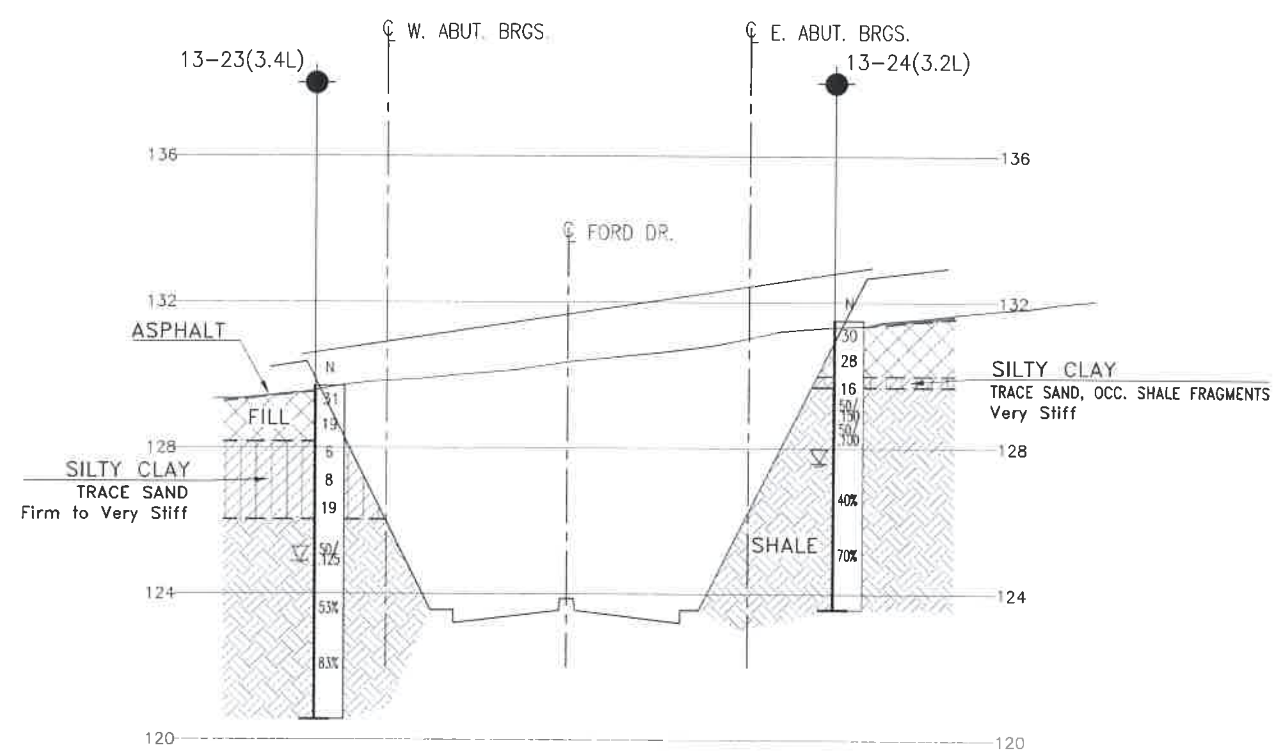
PROVINCE OF ONTARIO



PLAN

SCALE 1:800



PROFILE ALONG ℄ OF Q.E.W.

H 1:800

V 1:200

KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
13-23	129.7	4 817 184.8	290 769.4
13-24	131.5	4 817 241.5	290 767.3

-NOTES-

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

2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 30M5-297

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION

DESIGN SBP	CHK AEG	CODE	LOAD	DATE AUG 2013
DRAWN MFA	CHK SBP	SITE	STRUCT	DWG 1

FILENAME: H:\Drafting\19\1351\184\ted184-Plan&Profile-303(QEW over Ford Dr).dwg
PLOTDATE: 10/11/2013 5:13 PM