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W.P. No.

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STR. SITE No.

HWY. No. 410

LOCATION Trinity Common Access Rd. Structure

No. of PAGES - 1

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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11/27/95

Trow

Geotechnical Investigation
Highway #410 and Bovaird Interchange
Brampton, Ontario

GEOCRES # 30M12-251

Trow

Geotechnical Investigation
Highway #410 and Bovaird Interchange
Brampton, Ontario

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BRGE0010896C
July 2, 1998

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PART 1 Foundation Investigation

1.1 Introduction

This submission presents the results of a geotechnical investigation completed by Trow Consulting Engineers Ltd. (Trow) for a proposed new overpass at the Highway 410 and Bovaird Drive Interchange. It is our understanding that a one (1) span structure will be constructed to carry traffic over the a new northeast onramp to Highway 410. This report contains factual information (obtained from the field investigation) pertaining to the design parameters required for the bridge foundations and related earthworks.

1.2 Site Description and Geological Setting

1.2.1 Site Description

The site is located northeast of the Highway 410 and Bovaird Drive interchange in the City of Brampton, Ontario. At present, the interchange consists of a northbound Highway 410 off-ramp, only, which intersects Bovaird Drive east of Highway 410. The Highway 410 off-ramp and Bovaird Drive intersection is controlled by a traffic light which allows traffic to travel either east or west on Bovaird Drive. At the location of the current interchange, Bovaird Drive comprises six (6) lanes running east-west which carries traffic over Highway 410 on a two span bridge.

A vacant field is located northeast of the current Highway 410 and Bovaird Drive interchange. The topography at the site is essentially flat with the exception of the approach embankments to the Highway 410 and Bovaird Drive overpass. At the location of the proposed new bridge structure, Bovaird Drive is approximately 3 metres above the original ground surface and the road embankment is constructed with approximately 2H:1V side slopes.

1.2.2 Geological Setting

According to OGS map P2204 and Ontario Ministry of Northern Development and Mines (OMNDM) maps 2544 and 2556, the subsurface conditions at the site consist of Halton till deposited during the late Wisconsinan Glacial period. This till deposit consists of a predominantly silt to silty clay matrix which is highly calcareous, clast poor and is underlain by Queenston shale (bedrock) at the site.

1.4 Subsurface Conditions

The Borehole locations are shown on Drawing 1 and the subsurface information obtained at the boreholes near the proposed bridge location are summarized on the attached Borehole Logs 1 to 7, inclusive. The following soil layers were encountered at the site during the drilling:

- Topsoil; and
- Compact to Very Dense Silt (Till);

A summary for the description of the various soil strata encountered in the boreholes is presented below.

1.4.1 Topsoil

A thin layer of topsoil, ranging in thickness from 80 mm (Borehole 7) to 460 mm (Borehole 2) was encountered in all boreholes drilled at the site. The topsoil primarily consisted of reworked silt with rootlets, organic matter and some sand and gravel.

1.4.2 Silt (Till)

Compact to very dense silt (till) was found underlying topsoil in all boreholes drilled at the site. Based on the Split Spoon Samples retrieved during drilling operations, the upper 2.0 to 2.5 metres of this deposit is predominantly compact to dense silt (till) with some sand seams, clayey silt pockets, and occasional gravel sizes. The moisture content of the till was generally consistent ranging from 12.2% to 15% and standard penetration N-values varied from 13 to 52 blows/300 mm.

Below Elevation 241.5 m, the silt (till) becomes very dense with standard penetration N-values ranging from 47 blows/300 mm for SS5 in Borehole 2 to 60 blows/ 40 mm for SS6 in Borehole 1. The silt (till) soil layer was found to contain fewer clayey silt pockets below Elevation 241.5 m and some wet silt and fine sand seams were noted at depth in Boreholes 2 and 4. The moisture content for the lower silt (till) ranged from 7.2% to 11%.

Unit weight measurements were obtained on selected samples from Boreholes 2, 4 and 6. In general, the unit weight of the silt (till) was found to increase with depth ranging from 20.3 kN/m^3 for SS2 from Borehole 2 to 22.8 kN/m^3 for SS7 from Borehole 2. Detailed unit weights are reported on the attached borehole logs.

1.5 Groundwater Conditions

Information regarding the groundwater levels at the site were obtained by measuring the water levels in the open boreholes after the completion of drilling. Free standing water was observed in Boreholes 1 through 4 on completion of drilling. The water levels were noted to

have stabilized in Boreholes 1, 2, 3, and 4 on June 10, 1998, at Elevations 239.1 m, 237.2 m, 237.2 m, and 237.9 m, respectively. Freestanding water was not observed in Boreholes 5, 6 and 7 after the completion of drilling.

PART 2 Engineering Discussions and Recommendations

2.1 General

The following sections of this report address the geotechnical considerations relating to the proposed one span bridge and approach fills for the new Highway 410 and Bovaird Drive Interchange. It is understood that the north abutment will be situated approximately 30 m north of the current Bovaird Drive centreline and that the bridge span is approximately 26 m. Based on our current understanding of the bridge structure and the preliminary general arrangement, it is anticipated that a cut of between 2 to 3 metres below current ground elevations will be required for the northeast onramp to Highway 410 to provide adequate clearance. The approach embankment fills will be in the order of 3 to 4 metres above current ground surface elevations.

2.2 Foundations

2.2.1 Footings on Native Silt (till)

Based on the subsoil conditions noted in the boreholes, the dense to very dense silt (till) will be suitable for spread footing foundations. For the purpose of design in accordance with the Ontario Highway Bridge Design Code, the following bearing capacities can be used for spread footings placed directly on the native dense to very dense silt (till) at the site subject to inspection by a qualified geotechnical engineer:

Table 2-1 Spread Footing Capacity on Bedrock

	Spread Footing
Factored Bearing Capacity at ULS	750 kPa
Bearing Capacity at SLS	450 kPa

As per section 6-8.4.2 of the Ontario Highway Bridge design code, a reduction factor shall be applied to the Ultimate Bearing Resistance at ULS to account for the effects of inclined loading. Table 2-2 below contains a summary of reduction factors for inclined loads.

Table 2-2 Reduction Factors to Account for the Effects of Inclined Loads on the Ultimate Bearing Resistance at ULS

Ratio of Horizontal to Vertical Load	Reduction Factor
0.1	0.87
0.2	0.76
0.3	0.66
0.4	0.57

Note: The structural engineer can refer to Figure 6-8.4.2 of the Ontario Highway Bridge Design Code for reduction factors corresponding to ratios of horizontal to vertical loads which are not listed above.

2.2.2 Anticipated Footing Elevations

The following Table summarizes the location and estimated footing base elevations at which the recommended Factored Bearing Capacity (at ULS) is applicable:

Table 2-3 Location and Estimated Elevation of Footing Bases for Bridge Abutments.

Location	Borehole Number	Approximate Elevation (m)
North Abutment	2	242.2
South Abutment	3	242.1

The above elevations are for preliminary design purposes and were estimated based on Boreholes 2 and 3 drilled near the abutment locations. Interpolation between boreholes at the site is approximate, and as such, actual footing elevations will depend on the conditions encountered at the time of construction. The foundation surface at the footing base must be cleared of all loosened debris or deleterious materials and must be inspected by a qualified geotechnical engineer to verify the bearing capacity of the foundation soil prior to placement of concrete.

2.2.3 Footing on Compacted Granular Pad - East and West Abutments

At the abutment locations, it may be desirable to raise the grades and place the footing on a compacted Granular "A" (or equivalent) pad. In order to place the granular pad, all existing topsoil and loose silt (till) should be sub-excavated to provide a good foundation for the

granular pad. The granular pad should be constructed using Granular "A" or equivalent compacted to 100% Standard Proctor Maximum Dry Density (SPMDD). The granular pad must extend horizontally a minimum of 1.0 metres beyond the plan limits of the footing and have side slopes no steeper than 2 horizontal to 1 vertical.

The bearing capacities recommended for the abutment footings placed on a compacted granular pad (based on the Ontario Highway Bridge Design Code) are as follows:

Table 2-4 Spread Footing Capacity on Granular Pad Overlying Native Silt Till

Granular Thickness (m)	Factored Bearing Capacity at ULS	Bearing Capacity at S. L. S. Type II
2.0	400 kPa	400 kPa
4.0	400 kPa	200 kPa

2.2.4 Frost Protection

Due to the nature of bridges and the open exposure, a minimum frost cover of 1.5 m (or equivalent insulation) should be provided for all footings placed on the native silt (till) and for footings placed on a compacted granular pad.

2.2.5 Sliding Resistance

The computation of the sliding resistance of the spread footings shall be carried out in accordance with the O.H.B.D.C. An unfactored friction angle, ϕ', of 28 degrees can be used for sliding along the native silt (till) and the footing base. An unfactored friction angle, ϕ', of 35 degrees can be used for sliding along the compacted Granular 'A' pad and the footing base.

If the factored resistance against sliding failure is inadequate based on friction alone, then additional sliding resistance should be provided using a passive resistance key. An unfactored coefficient of passive earth pressure, K_p', equal to 3.7 can be used for design of a passive resistance key in Ganular "A". An unfactored coefficient of passive earth pressure, K_p', equal to 2.8 can be used for design of a passive resistance key in the native silt (till) encountered at the site.

2.2.6 Piled Foundation

In general, driven pile foundations are not considered to be practical for this site. Given the dense to very dense silt (till) soils, it will be very difficult to drive piles further than 1 to 2 metres into the silt (till) at this site. If driven piles are considered, it will be necessary to use pre-augered holes in order to meet M.T.O. minimum pile length requirements. An integral

abutment system, however, may be feasible for this project (subject to minimum pile length and flexibility requirements). For pre-augered piles driven into the dense to very dense silt (till) at the site, the following Limit States design values in accordance with the O.H.B.D.C. can be assumed:

Table 2-5 Design Pile Capacities - West and East Abutments

	HP 310x79	HP 310x110
Factored Axial Capacity at ULS	1150 kN	1600 kN
Axial Capacity at SLS	825 kN	1150 kN
Ultimate Capacity for Hiley Formula	2475 kN	3450 kN

2.3 Backfill

Backfill to abutments or retaining walls must consist of free draining granular materials such as Granular 'A', Granular 'B' or rock fill. Computation of earth pressures shall be in accordance with Section 6.7.4 of the Ontario Highway Bridge Design Code. Unfactored properties for backfill materials are provided in the following table.

Table 2-6 Material Types and Unfactored Properties.

Material	Friction Angle, ϕ'	γ (kN/m^3)	K_a	K_p	K_o
Granular A	35 degrees	22.5	0.27	3.7	0.43
Granular B	30 degrees	21.2	0.33	3.0	0.50
Rock Fill	35 degrees	18.0	0.27	3.7	0.43

Note: K_a is the earth pressure coefficient corresponding to the active state.
K_p is the earth pressure coefficient corresponding to the passive state.
K_o is the earth pressure coefficient at rest.

2.4 Excavations

Excavations in the topsoil and silt overburden soils may be required to construct the abutments. The overburden silt (till) at the site is classified as Type I soil in accordance with the Occupational Health and Safety Regulations for Construction Projects. Also, the maximum depth of excavation anticipated at the site is approximately 2.0 to 3.0 metres. The resulting base of the potential abutment excavations will be above the groundwater elevations measured during the field investigation. As such, excavations in accordance with the Occupational Health and Safety Regulations for Construction Projects for Type I soils will be adequate. If groundwater seepage resulting from perched groundwater is encountered during excavation in the native silt (till), it is expected that the amount of water will be small and can be handled using conventional sump pumping techniques in conjunction with perimeter drainage ditches.

2.5 Approach Embankments and Cuts

No stability problems are anticipated for the approach embankments founded on the compact to very dense silt (till) soils at the site. All topsoil must be removed from the plan limits of the approach embankments. If rockfill is used to construct the approach embankments, the side slopes and forward slopes should be constructed at a gradient of 1.5H(minimum):1V. If Granular 'A' or Granular 'B' are used, the forward slopes and side slopes should be constructed at 2H(minimum):1V. Provided that the above geometric constraints are satisfied, the factor of safety against failure of the approach embankment fills will be adequate.

It is likely that drainage ditches will be required for the northeast Highway 410 onramp. As a result, there will be a potential for scour and erosion at the base of the forward slopes near the abutments and adjacent to the onramp drainage ditches. To prevent excessive erosion and loss of protective soil cover (frost barrier) for the abutment footings, rock rip rap should be placed on the forward slopes for the full abutment width. The rock rip rap size will depend on the design flow velocities for the onramp perimeter ditches and should be sized accordingly. The rock rip rap should also be underlain by a Class II non-woven geotextile.

The native soil at the site is very susceptible to erosion and sediment transport. Re-vegetation of disturbed and/or bare soil at the site will be required to prevent excess silting of the Highway 410 onramp ditches. Consideration should be given to the use of a channel liner for the onramp drainage ditches until vegetation can be established. For the native silt (till) at the site, cuts of up to 3 metres in height are expected to remain stable in the long term. It is recommended that all slopes cut into the silt (till) at the site be cut at a slope gradient of 2.5H:1V.

In addition to stability and erosion considerations, it will be necessary to key the south approach embankment for the new overpass into the existing Bovaird Drive embankment. All top soil should be removed from the side slopes of the Bovaired Drive road embankment. The side slopes of the Bovaird Drive embankment fill should then be benched in a step like

fashion so that the new approach fill can be properly keyed into the existing embankment. If the Bovaird Drive embankment was constructed using fine grained soils, the benching should be shaped to provide proper drainage of perched water in the new embankment fill.

2.6 General

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the current geotechnical conditions at the site of the proposed Highway 410 and Bovaird Drive Interchange. The conclusions presented in this report reflect site conditions existing at the time of the investigation. It is noted that the soil boundaries indicated on the Borehole Logs are inferred from discontinuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Trow Consulting Engineers Ltd.

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Geotechnical Division

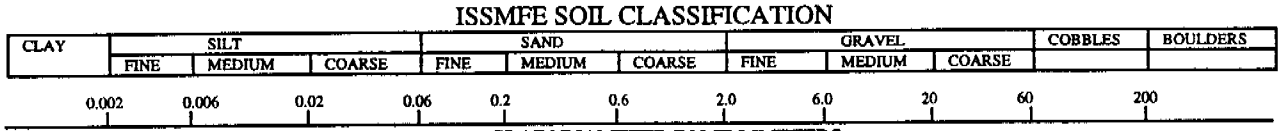
Lloyd Gonsalves, P.Eng.
Manager
Geotechnical Division

Notes On Sample Descriptions

Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by Trow also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

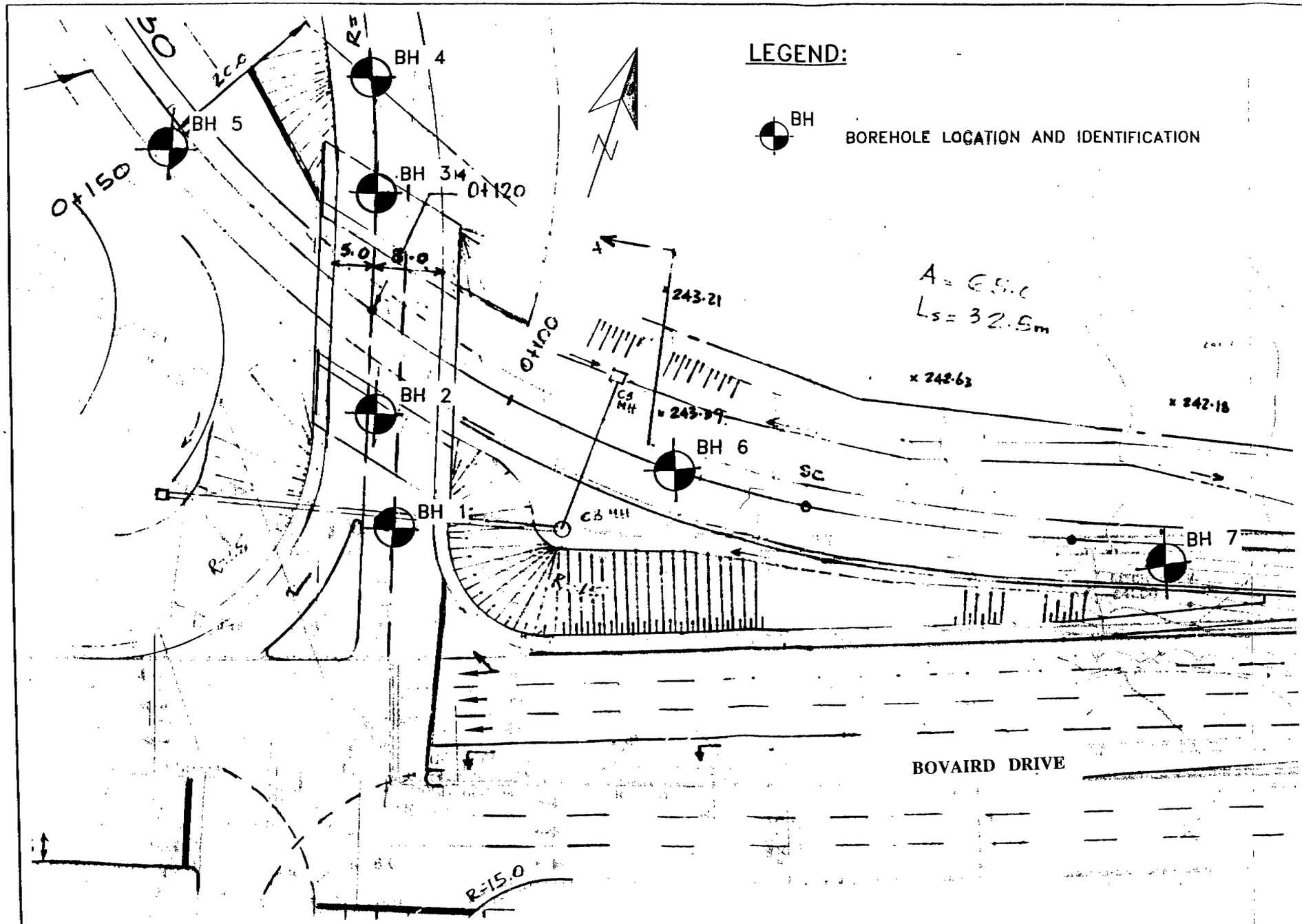


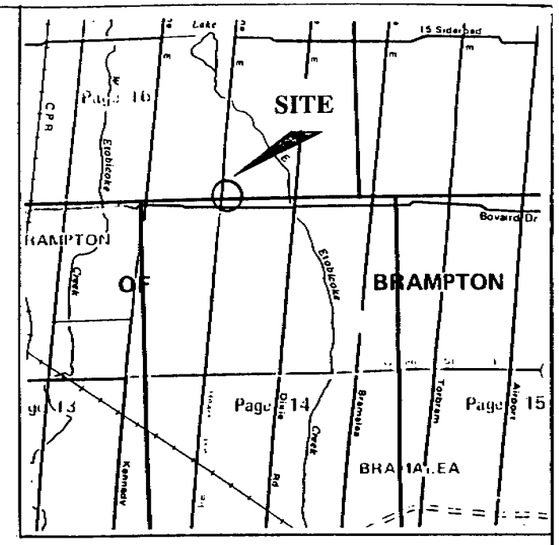
CLAY (PLASTIC) TO SILT (NONPLASTIC	FINE	MEDIUM	CRS.	FINE	COARSE
	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.





General Notes

1) The boundaries and soil types have been established only at Borehole locations. Between boreholes they are assumed and may be subject to considerable error.
2) Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.
3) Topsoil quantities should not be established from the information provided at the borehole locations.
4) Borehole elevations should not be used to design building(s) or floor slab(s) or parking lot(s) grades.
5) This drawing forms part of the report, project number as referenced, and should be used only in conjunction with this report.

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SCALE: ~1: 500		DWG. TITLE AND PROJECT: BOREHOLE LOCATION PLAN HIGHWAY 410 AND BOVAIRD DRIVE BRAMPTON, ONTARIO	
DATE: JUNE 25, 1998			
DWN.:	CHKD.:	PROJECT NO.: BRGE-0010896-C	DWG. NO.: 1

Appendix A: Borehole Logs

RECORD OF Borehole 1

Highway 410 Overpass

METRIC

W.P. BRGE-0010896-C LOCATION South Approach Embankment ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 9, 1998 CHECKED BY S.H.

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST / SHEAR STRENGTH: Cu, kPa (UNCONFINED QUICK TRIAXIAL, FIELD VANE LAB VANE)	WATER CONTENT (%) (PLASTIC LIMIT wp, NATURAL MOISTURE CONTENT w, LIQUID LIMIT wl)	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA (SI & CL)
244.0	Ground SURFACE							20 40 60 80	20 40 60 80		
0.0	230 mm Topsoil over SILT TILL: Occasional gravel, sand seams, clayey silt pockets, brown, moist, compact to dense.		1	SS	10						
			2	SS	27		243				
			3	SS	39		242				
	- becoming very dense		4	SS	51		241				
			5	SS	83	▽	240	83/290 mm			
	- becoming grey		6	SS	102		239	102/190 mm 102			
237.61			7	SS	60		238	60/130mm			
6.37	End of Borehole										

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RECORD OF Borehole 2

Highway 410 Overpass

1 OF 1

METRIC

W.P. BRGE-0010896-C LOCATION South Abutment ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 9, 1998 CHECKED BY S.H.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST; SHEAR STRENGTH: Cu, KPa (UNCONFINED QUICK TRIAXIAL, FIELD VANE LAB VANE); WATER CONTENT (%) (PLASTIC LIMIT, NATURAL MOISTURE CONTENT, LIQUID LIMIT)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION	
ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20 40 60 80	kN/m³	GR	SA (SI & CL)
244.2	Ground SURFACE						244				
0.0	~460 mm Topsoil over SILT TILL: Occasioanl gravel, sand seams, cohesive pockets, brown and grey, moist, compact to dense.		1	SS	17						
			2	SS	27		243		20.26		
			3	SS	34				20.53		
			4	SS	33		242		21.34		
	- becoming less cohesive below ~3m depth (Elev. 241.2m)		5	SS	47		241				
	- becoming grey						240				
	- becoming very dense with occasional rock fragments		6	SS	62				21.45		
							239				
			7	SS	67	▽	238				
							237				
	- becoming sandy with wet seams		8	SS	57				22.78		
							236				
			9	SS	60		235	60/130mm			
							234				
			10	SS	60			60/125mm			
							233				
231.84			11	SS	60		232	60/150mm			
12.34	End of Borehole								22.70		

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RECORD OF Borehole 3

Highway 410 Overpass

1 OF 1

METRIC

W.P. BRGE-0010896-C LOCATION North Abutment ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 9, 1998 CHECKED BY S.H.

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST 20 40 60 80	SHEAR STRENGTH: Cu, KPa ○ UNCONFINED QUICK TRIAXIAL ✕ FIELD VANE LAB VANE 20 40 60 80	PLASTIC LIMIT wp — NATURAL MOISTURE CONTENT w — LIQUID LIMIT wl WATER CONTENT (%) 20 40 60 80	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA (SI & CL)
244.1	Ground SURFACE						244					
0.0	200 mm Topsoil over SILT TILL: Occasional gravel, sand seams, cohesive pockets, brown, moist, compact to dense.		1	SS	14			⊗				
			2	SS	29		243		⊗			
			3	SS	52				⊗			
			4	SS	26		242		⊗			
			5	SS	37		241		⊗			
							240					
	- becoming grey		6	SS	43				⊗			
							239					
	- becoming very dense with rock fragments, very moist		7	SS	60	▽	238		60/90mm			
	Est. Base of Pile El.						237					
			8	SS	82				⊗			
							236					
			9	SS	60		235		60/50mm			
							234					
			10	SS	60				60/13mm			
							233					
231.78			11	SS	60		232		60/130mm			
12.32	End of Borehole											

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Trow

RECORD OF Borehole 4

Highway 410 Overpass

METRIC

W.P. BRGE-0010896-C
DIST N/A HWY 410
DATUM Geodetic

LOCATION North Approach Embankment
BOREHOLE TYPE Solid Stem Augers
DATE June 9, 1998

ORIGINATED BY A.H.
COMPILED BY N.A.
CHECKED BY S.H.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST (20 40 60 80)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (wp, w, wl)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			SHEAR STRENGTH: Cu, KPa (UNCONFINED QUICK TRIAXIAL ⊗, FIELD VANE LAB VANE ✱) (20 40 60 80)	WATER CONTENT (%) (20 40 60 80)	kN/m³	GR SA (SI & CL)
243.4	Ground SURFACE										
0.0	~280 mm Topsoil over SILT TILL: Occasional gravel, sand seams, cohesive pockets, brown, moist, compact.		1	SS	11		243	⊗	○		
			2	SS	24			⊗	○		
							242				
			3	SS	23			⊗	○	20.28	
	- becoming very dense, less cohesive with rock fragments below ~2.3m depth (Elev. 241.1m)		4	SS	76		241	⊗	○	21.08	
	- becoming grey		5	SS	74		240	⊗	○	20.72	
							239				
			6	SS	98	▽		98/280mm ⊗ ○			
							238				
	- wet sand seams		7	SS	103		237	103/290mm ⊗ ○ 103			
236.86											
6.54	End of Borehole										

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RECORD OF Borehole 5

Highway 410 Overpass

1 OF 1

METRIC

W.P. BRGE-0010896-C LOCATION Hwy 410 NE On Ramp Sta. 0+150 ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 9, 1998 CHECKED BY S.H.

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST (20 40 60 80)	SHEAR STRENGTH: Cu, KPa (UNCONFINED QUICK TRIAXIAL ● / FIELD VANE LAB VANE ✖) (20 40 60 80)	PLASTIC LIMIT wp / NATURAL MOISTURE CONTENT w / LIQUID LIMIT wl — WATER CONTENT (%) (20 40 60 80)	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA (SI & CL)
244.4	Ground SURFACE											
0.0	~180 mm Topsoil over SILT TILL: Occasional gravel, sand seams, cohesive pockets, brown and grey, moist, compact to dense.		1	SS	13		244	⊗				
			2	SS	31			⊗				
							243					
			3	SS	36			⊗				
	- becoming very dense		4	SS	51		242		⊗			
			5	SS	53		241		⊗			
							240					
	- becoming grey with rock fragments		6	SS	60				60/150mm ⊗			
							239					
237.88			7	SS	99		238			99/266mm ⊗		
6.52	End of Borehole											

MTO 0896C 06/25/98

Trow

RECORD OF Borehole 6

Highway 410 Overpass

1 OF 1

METRIC

W.P. BRGE-0010896-C LOCATION Hwy 410 NE On Ramp Sta. 0+078 ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 10, 1998 CHECKED BY S.H.

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST; SHEAR STRENGTH: Cu, KPa (UNCONFINED QUICK TRIAXIAL, FIELD VANE LAB VANE)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; WATER CONTENT (%)	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA (SI & CL)
243.3	Ground SURFACE							20 40 60 80	wp wl; 20 40 60 80		
0.0	~130 mm Topsoil over SILT TILL: Occasional gravel, sand seams, cohesive pockets, brown, moist, compact to dense.		1	SS	13		243				
			2	SS	27		242				
			3	SS	31		241				
	- becoming less cohesive below ~2.3m depth (Elev. 241.0m)		4	SS	48					21.25	
	- becoming very dense		5	SS	70		240			20.82	
							239				
	- becoming grey with rock fragments		6	SS	90			60/40mm		20.94	
							238				
236.72			7	SS	56		237				
6.55	End of Borehole										

MTO 0896C 06/25/98

Trow

RECORD OF Borehole 7

Highway 410 Overpass

METRIC

W.P. BRGE-0010896-C LOCATION Hwy 410 NE On Ramp Sta. 0+020 ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 10, 1998 CHECKED BY S.H.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) ⊗ / CONE PENETRATION TEST —— 20 40 60 80	PLASTIC LIMIT wp	NATURAL MOISTURE CONTENT w	LIQUID LIMIT wl	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			SHEAR STRENGTH: Cu, kPa ○ UNCONFINED QUICK TRIAXIAL ⊗ FIELD VANE ✕ LAB VANE 20 40 60 80	WATER CONTENT (%) 20 40 60 80			kN/m³	GR SA (SI & CL)
242.3	Ground SURFACE												
0.0	~80 mm Topsoil over SILT TILL: Trace rootlets and topsoil staining to ~1.2 m depth, occasional gravel, sand seams, cohesive pockets, brown, moist, compact.		1	SS	15		242	⊗					
			2	SS	14			⊗					
							241						
			3	SS	22			⊗					
	- becoming dense to very dense						240						
			4	SS	48			⊗					
			5	SS	96		239	⊗					
							238						
	- becoming grey		6	SS	56			⊗					
237.33													
5.02	End of Borehole												

MTO 0896C 06/25/98

Trow

Trow Brampton Branch

Trow Consulting Engineers Ltd.
1595 Clark Boulevard, Brampton
Ontario, Canada. L6T 4V1
Telephone: (905) 793-9800
Facsimile: (905) 793-0641

FAXMITTAL

Project No. BRGEO0108961C **Date:** July 31/98

To: Cole Sherman & Assoc.

Attention: Mr. Rick Krutzler.

Subject: Hwy 410 & Bovaird Drive

Fax No.: 905-882-4399 **Total No. of Pages (including this page)** 7

FROM: S. Hinchberger

Trow Brampton - Geotechnical Division

COMMENTS:

Original will be sent: **Yes-Courier** ____ **Yes-Mail** ____ ____ **No** ____

Operator: Joan ____ **Ext:** 276 ____ File: JKF/hal/Document2

Please call the above operator or the originator, if this transmission is incomplete or unclear, or if it is mis-addressed.

Trow

Trow Consulting Engineers Ltd.

1595 Clark Boulevard
Brampton, Ontario
L6T 4V1

Telephone: (905) 793-9800
Facsimile: (905) 793-0641

Reference: BRGE0010896C

July 28, 1998

Rick Krutzler, P.Eng.
Structural Engineer
Cole Sherman and Associates Ltd.
75 Commerce Valley Drive East,
Thornhill, Ontario
L3T 7N9

Via Facsimile
905-882-4399

Dear Mr. Krutzler:

Geotechnical Investigation - Highway 410 and Bovaird Drive Interchange, Brampton, Ontario

It is understood that integral abutments have been chosen for the Highway 410 and Bovaird Drive Interchange and that you require the following design information:

1. The horizontal modulus of subgrade reaction for Granular 'A', and the native Silt Till at the site, and

2. The likely driven depth of the piles to give the Ultimate Limit State (ULS) and Serviceability Limit State (SLS) design values listed in Table 2-5 of Trow Report No. BRGE0050645C dated July 2, 1998.

The proposed abutment detail (received July 27, 1998) is attached for reference.

1. Horizontal Modulus of Subgrade Reaction

For the purpose of the abutment pile design, Table 1 below lists the estimated horizontal modulus of subgrade reaction expected for each soil type at the abutment locations and for the pile types and sizes on this project:

Table 1: Horizontal Modulus of Subgrade Reaction - HP310x79 and HP310x110 Piles

Soil Description	Modulus of Subgrade Reaction
Granular 'A' Fill	40, 000 kN/m^3 PREAUGER 20,000 kN/m^3
Native Silt Till (Between El. 244 m and 239 m)	80, 000 kN/m^3
Native Silt Till (Below El. 239m)	120, 000 kN/m^3

2. Depth of Driven Piles

We have reviewed the borehole information presented in Trow Report No. BRGE0010896C dated July 2, 1998. The native soils at the site consist of compact to dense silt till becoming very dense below El. 239.0 m (see Boreholes 2 and 3). It is anticipated that piles at the abutment locations will be driven through about 3600 mm of compacted Granular 'A' Fill and into the underlying Silt Till at the site.

Based on the available borehole information, we would expect HP 310x79 piles to be driven to end bearing on or within the very dense silt till at the site. The expected end bearing elevations are approximately El. 236.0 m at Borehole 2 (South Abutment) and El. 238.0 m at Borehole 3 (North Abutment). In general, it is anticipated that a pile driving hammer with a minimum rated energy of about 70 kJ will be required to achieve the ULS and SLS design capacities recommended in Table 2-5 of Trow Report No. BRGE0011896C. Table 2 below summarizes the end bearing elevations at the borehole locations and the depth of penetration into the native silt till at the site.

Table 2: End Bearing Elevations and Estimated Penetration Depths

Borehole	Location on Structure	End Bearing Elevation (m)	Depth of Penetration into Silt Till (m)
2	South Abutment	236.0±	8.2
3	North Abutment	238.0±	6.1

MTO standards SS103-10 and SS103-11 specify that pile driving can be controlled using the Hiley Formula to ensure the design ULS pile capacities specified in Table 2-5 of Trow Report No. BRGE0011896C. Alternatively, current practice is to use the w e equation techniques to estimate bearing capacities from pile driving data. Wave Equation analysis can be conducted with our Pile Driving Analyzer to ensure that the design ULS pile capacities are achieved.

It should be noted that the end bearing elevations listed above in Table 2 are based on the available borehole information (Boreholes 2 and 3) at the site. Since the soil conditions vary from borehole to borehole, the termination level of the piles may vary in the field during driving.

If you have any further questions or concerns, please contact this office.

Yours truly,

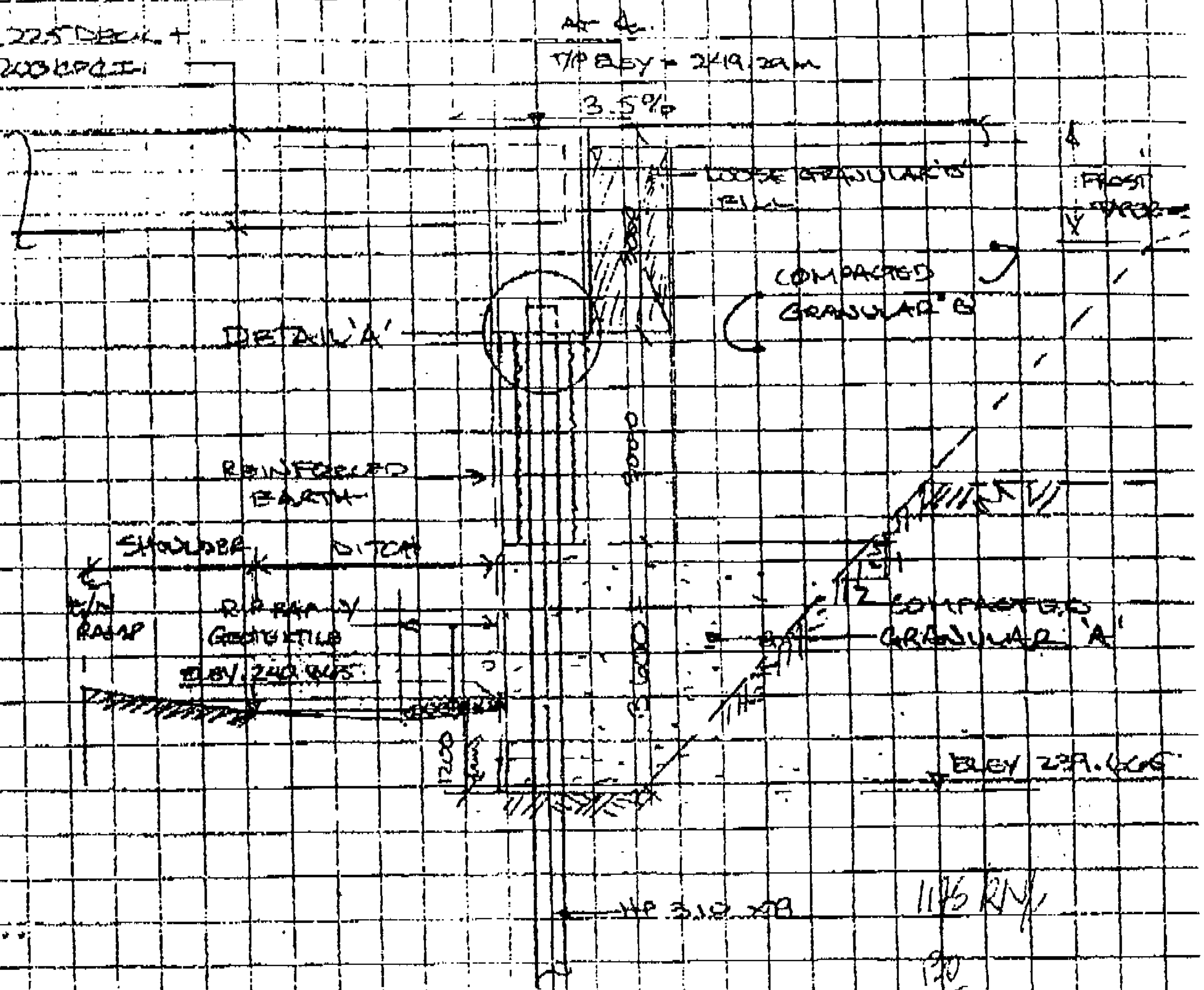
Trow Consulting Engineers Ltd.

Sean Hinchberger, Ph.D., P.Eng.
Project Engineer, Geotechnical Division

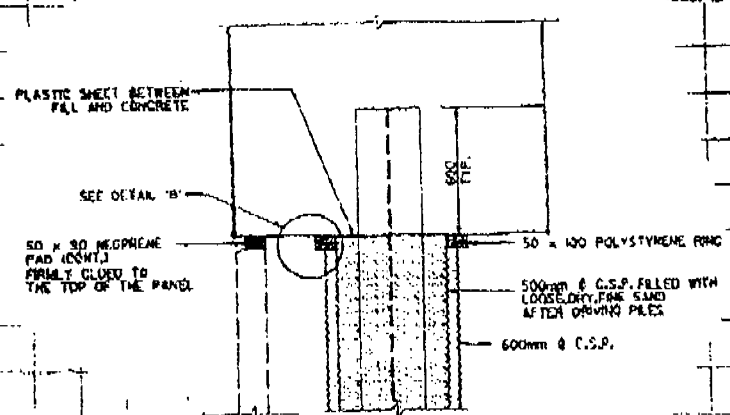
Chris Thompson, M.E.Sc., P.Eng.
Principal

Enclosures: Abutment Design Detials
Borehole Logs 2 and 3

Distribution: Rick Krutzler, P.Eng.
Structural Engineer, Cole Sherman



SECTION AT NORTH ABUTMENT



DETAIL 'A'

RECORD OF Borehole 3

1 OF 1

Highway 410 Overpass

METRIC

W.P. BRGE-0010396-C LOCATION North Abutment ORIGINATED BY A.H.

DIST N/A HWY 410 BOREHOLE TYPE Solid Stem Augers COMPILED BY N.A.

DATUM Geodetic DATE June 9, 1998 CHECKED BY S.H.

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST 20 40 60 80	SHEAR STRENGTH: Cu, KPa (UNCONFINED QUICK TRIAXIAL ⊗, FIELD VANE LAB VANE ◆) 20 40 60 80	PLASTIC LIMIT wp — NATURAL MOISTURE CONTENT w — LIQUID LIMIT wl	WATER CONTENT (%) 20 40 60 80	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA (SI & CL)
244.1	Ground SURFACE						244						
0.0	200 mm Topsoil over SILT TILL: Occasional gravel, sand seams, cohesive pockets, brown, moist, compact to dense.		1	SS	14								
			2	SS	29		243						
			3	SS	52		242						
			4	SS	26								
			5	SS	37		241						
							240						
	- becoming grey		6	SS	43		239						
	- becoming very dense with rock fragments, very moist		7	SS	60	▽	238	60/90mm					
							237						
			8	SS	82		236						
			9	SS	60		235	60/50mm					
							234						
			10	SS	60			60/13mm					
							233						
			11	SS	60		232	60/10mm					
231.76 12.32	End of Borehole												

RECORD OF Borehole 2

Highway 410 Overpass

1 OF 1

METRIC

W.P. BRGE 0010896-C
DIST N/A HWY 410
DATUM Geodetic

LOCATION South Abutment
BOREHOLE TYPE Solid Stem Augers
DATE June 9, 1998

ORIGINATED BY A.H.
COMPILED BY N.A.
CHECKED BY S.H.

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) / CONE PENETRATION TEST (20 40 60 80)	SHEAR STRENGTH: Cu, kPa (UNCONFINED QUICK TRIAXIAL ⊗, FIELD VANE LAB VANE ⊗) (20 40 60 80)	PLASTIC LIMIT wp	NATURAL MOISTURE CONTENT w	LIQUID LIMIT wl	WATER CONTENT (%) (20 40 60 80)	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION GR SA (SI & CL)
264.2	Ground SURFACE						244								
0.0	460 mm Topsoil over SILT TILL: Occasioanl gravel, sand seams, cohesive pockets, brown and grey, moist, compact to dense.		1	SS	17										
			2	SS	27		243							20.26	
			3	SS	34									20.53	
			4	SS	33		242							21.34	
	- becoming less cohesive below 3m depth (Elev. 241.2m)		5	SS	47		241								
	- becoming grey						240								
	- becoming very dense with occasional rock fragments		6	SS	62									21.45	
							239								
			7	SS	67	▽	238								
							237								
	- becoming sandy with wet seams		8	SS	57									22.78	
							236								
			H	SS	60		235		60/130mm						
							234								
			10	SS	60				60/125mm						
							233								
							232		60/150mm						
231.84			11	SS	60									22.70	
12.36	End of Borehole														

Trov

Trow

Trow Consulting Engineers Ltd.

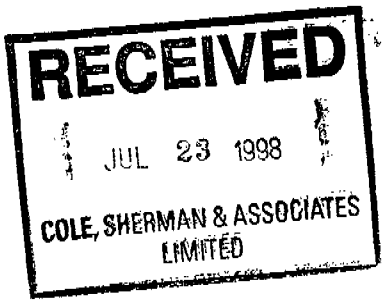
1595 Clark Boulevard
Brampton, Ontario
L6T 4V1

Telephone: (905) 793-9800
Facsimile: (905) 793-0641

Reference: BRGE-0010896-C

July 14, 1998

Mr. Art Welter
Trinity Development Group Inc.
2275 Lakeshore Boulevard West
Suite # 400
Etobicoke, Ontario
M8V 3Y3



Via Facsimile
416-255-8355

Dear Mr. Welter:

Soil Disposal Options
Highway 410 and Bovaird Interchange
Brampton, Ontario

Reference is made to Trow Report BRGE0010896-C dated July 2, 1998 in which foundation recommendations for the proposed Highway 410/Bovaird Drive interchange are given. As part of the investigation for the project, selected soil samples were analyzed to determine disposal options for excess soil generated at the site and to determine any requirements for the use of special concrete types on the project.

Three samples of the native soil (one each from Boreholes 1, 3 and 7) were tested for selected inorganic parameters given in the MOEE's Guideline For Use At Contaminated Sites In Ontario- February, 1997 and for classification under the MTRCA/MOEE Lakefill and Dredged Model criteria. Since groundwater is not used for potable purposes in the area, criteria for fine grained soils given in Table B were selected as being most appropriate for comparison of test results in this case. One of the soil samples (Borehole 3) was also analyzed for pH and Sulphate content.

The certificates of analysis for the samples are attached. The test results indicate that with the exception of marginal exceedance in the measured pH of all the samples analyzed, concentrations of all parameters tested meet the Residential/Parkland landuse criteria listed in Table B of the MOEE's Guideline For Use At Contaminated Sites In Ontario- February, 1997. Since pH is not a health related parameter, the exceedances noted are not considered cause for concern. From an environmental standpoint, the excavated soils are considered suitable for re-use on the site.

Minor exceedances of the MTRCA criteria for Copper and Nickel were recorded in the soil samples taken from Boreholes 3 and 1, respectively. Exceedances of the published criterion for Iron were also recorded in all soil samples analyzed. However, the MTRCA usually accepts soil with iron concentrations up to 40,000 ppm (well in excess of the concentrations measured in these samples). Also, the averages of the three Copper and three Nickel concentrations meet the respective MTRCA guideline limits. Subject to MTRCA approval, excess soil from the site may be acceptable for disposal as Lakefill.

Test results indicate conformance with MOEE Dredged Model criteria for Unrestricted and Restricted landuse. Based on these results, excess soil from the site is considered suitable for reuse at any landbased site being developed, subject to the owner's approval. Alternatively, the excess soils may be disposed of at a licensed landfill facility.

The soil sample analyzed from Borehole 3 yielded a pH value of 9.03 and a sulphate concentration of 1.62 ppm (16.2×10^{-5} %). The test results indicate a negligible degree of potential for attack on subsurface concrete and no special requirements for concrete type are indicated. For information regarding selection of cement type for subsurface concrete construction, reference is made to the C.S.A. Standard CAN3-A.23.

We trust this information is satisfactory for your purposes. If you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

Trow Consulting Engineers Ltd.

David Dennison, P.Eng.
Project Engineer

Lloyd Gonsalves, P. Eng.
Manager
Geotechnical Division

Distribution: Cole Sherman, Attention David Le Blanc (Facsimile - 905-882-4399)

DD/dd/10896CLET

ENTECH
A Division of Agri-Service Lab Inc.
6820 Kitimat Rd., Unit #4
Mississauga, ONT L5N 5M3

TEL: (905) 821-1112
FAX: (905) 821-2095

Client: **Trow Brampton**
Attention: **David Dennison**
Project: **BRGE-0010896-C**
P.O. :
Sample Type: **Soil**
Date Received: **Jun 23/98**
Date Analysed: **Jun 24 to Jun 26/98**
Date Reported: **Jun 26/98**

Sam Sanyal, M.Sc., C.Chem.
Manager, Inorganic Analysis.

CERTIFICATE OF CHEMICAL ANALYSIS - MOEE SOIL DECOMM. GUIDELINES FOR CONTAMINATED SITES IN ONTARIO (GENL. & INORGANIC)

PARAMETER	Soil Remediation Criteria (µg/g)		Method Detection Limit (ug/g)	CONTROL SAMPLE			SAMPLE DATA (ug/g)			
	Tables A & B Res./Ind. Comm	Tables C & D Res./Ind. Comm		Expected Concentration (ug/g)	Concentration Found (ug/g)	Recovery %	47939 B10896-B1S4	47940 B10896-B3S4	47941 B10896-B7S4	47941 B10896-B7S4 Duplicate
Dry Matter (%)	-	-	-	-	-	-	85.79	89.53	88.48	86.75
pH (units)	5 to 9	5 to 11	-	9.05	9.04	100	9.20	9.03	9.10	9.27
E C (umhos/cm)	700/1400	N.A./N.A.	-	1413	1366	97	52	55	126	130
SAR	5/12	N.A./N.A.	-	-	-	-	0.29	3.83	0.28	0.26
Arsenic	20/40	40/N.V.	1	2	1.98	99	7	5	5	5
Cadmium	12/12	41/41	0.3	1	1.03	103	<0.3	<0.3	<0.3	<0.3
Chromium (VI)	8/8	600/1100	1	1	1.03	103	<1	<1	<1	<1
Chromium (total)	750/750	2500/5000	0.5	1	1.00	100	13.6	11.8	16.6	17.4
Cobalt	40/80	2500/3400	0.5	1	1.03	103	12.9	7.0	8.4	8.7
Copper	225/225	2500/2500	0.5	1	1.01	101	19.6	31.0	22.4	22.6
Lead	200/1000	1000/N.V.	1	1	1.07	107	24	7	8	8
Mercury	10/10	57/57	0.01	0.28	0.279	100	0.03	0.03	0.04	0.04
Molybdenum	40/40	550/550	1	1	1.01	101	<1	<1	<1	<1
Nickel	150/150	710/710	1	1	1.00	100	26	14	17	17
Boron(HWE)	1.5/2.0	2.0/N.V.	0.5	1	0.98	98	<0.5	<0.5	<0.5	<0.5
Cyanide Free	100/100	100/390	0.1	0.20	0.209	105	<0.1	<0.1	<0.1	<0.1
Selenium	10/10	2500/2500	1	2	2.10	105	<1	<1	<1	<1
Silver	20/40	240/240	0.2	0.2	0.209	105	0.3	<0.2	<0.2	<0.2
Zinc	600/600	2500/5000	0.3	1	1.04	104	66.8	34.4	41.3	43.6
Antimony	13/40	44/44	1	2	1.86	93	<1	<1	<1	<1
Barium	750/1500	2500/4100	0.5	1	1.00	100	37.7	38.0	66.4	69.9
Beryllium	1.2/1.2	1.2/3.1	0.3	1	1.00	100	3.7	<0.3	<0.3	<0.3
Vanadium	200/200	910/910	0.3	1	0.98	98	12.6	14.5	20.1	20.9

a) Table A: Surface soil criteria for a potable groundwater condition
b) Table B: Surface soil criteria for a non-potable groundwater condition
c) Table C: Sub-surface soil criteria for a potable groundwater condition
d) Table D: Sub-surface soil criteria for a non-potable groundwater condition
Sample Disposal: 90 Days from the Reporting Date.

All guideline criteria are for coarse textured soil
HWE - Hot water extractable
All units are in ug/g unless othewise specified

Analyst(s): AV, KK, CN, SF, GM, MB

ENTECH
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6820 Kitimat Rd., Unit#4
Mississauga, ONT L5N 5M3
TEL: (905) 821-1112
FAX: (905) 821-2095

Client: **Trow Brampton**
Attention: **David Dennison**
Project: **BRGE-0010896-C**
P.O.:
Sample Type: **Soil**
Date Received: **Jun 23/98**
Date Analysed: **Jun 24 to Jun 26/98**
Date Reported: **Jun 26/98**

Sam Sanyal, MSc., C. Chem.
Manager, Inorganic Analysis.

MTRCA GUIDELINES

PARAMETER	UNITS	MTRCA GUIDELINES	MOE Dredged Material Guidelines		Method Detection Limit (µg/g)	SAMPLE DATA (µg/g) *			
			Unrestricted	Restricted		47939 B10896-B1S4	47940 B10896-B3S4	47941 B10896-B7S4	47941 B10896-B7S4 Duplicate
Moisture	%	N/A	N/A	N/A		14.21	10.47	11.52	13.25
Dry Matter	%	N/A	N/A	N/A		85.79	89.53	88.48	86.75
Oil & Grease	µg/g	1500	-	-	20	89	88	95	96
Arsenic	µg/g	8	14	20	1	7	5	5	5
Cadmium	µg/g	1	1.6	4	0.3	<0.3	<0.3	<0.3	<0.3
Lead	µg/g	50	60	500	1	24	7	8	8
Mercury	µg/g	0.3	0.5	0.5	0.01	0.03	0.03	0.04	0.04
Total Phosphorus	µg/g	1000	-	-	5	540	505	589	592
Volatile Solids	µg/g	60000	-	-	-	455	598	447	452
Ammonia	µg/g	100	-	-	1	<1	<1	<1	<1
Copper	µg/g	25	100	100	0.5	19.6	31.0+	22.4	22.6
Cobalt	µg/g	50	20	25	0.5	12.9	7.0	8.4	8.7
Chromium	µg/g	25	120	120	0.5	13.6	11.8	16.6	17.4
Iron	µg/g	10000	35000	35000	0.5	21821+	15842+	18529+	19086+
Nickel	µg/g	25	32	60	1	26+	14	17	17
Silver	µg/g	0.5	-	-	0.2	0.3	<0.2	<0.2	<0.2
Zinc	µg/g	100	220	500	0.3	66.8	34.4	41.3	43.6
TKN	µg/g	2000	-	-	100	553	459	387	388
Molybdenum	µg/g	-	4	4	1	<1	<1	<1	<1
Selenium	µg/g	-	1.6	2	1	<1	<1	<1	<1
Cyanide	µg/g	0.1	-	-	0.1	<0.1	<0.1	<0.1	<0.1

NOTE: + Exceeds Guidelines
* = Unless otherwise specified in the parameter column
Sample Disposal: 90 Days from the Reporting Date.
Analyst(s): AV, KK, SF, CN, GM

Client: Trow - Brampton
Attention: David Dennison
Client Reference: BRGE-0010896-C
Date Received: June 23/98
Date Analyzed: June 25/98
Date Reported: June 26/98
Sample Type: Soil

ENTECH

A Division of Agri-Service Laboratory Inc.
Professional Analytical Services
6820 Kitimat Rd., Unit 4
Mississauga, Ontario
L5N 5M3
Tel: 905-821-1112
Fax: 905-821-2095

Certificate of Analysis

Units are ug/g (ppm)	MDL	Lab Blank	47939 B10896-B1S4	47940 B10896-B3S4	47941 B10896-B7S4	47941* B10896-B7S4
Total PCB and Organochlorine Pesticides						
Gamma-BHC (Lindane)	0.003	<	<	<	<	<
Hexachlorobenzene	0.005	<	<	<	<	<
p,p-DDE	0.005	<	<	<	<	<
p,p-DDD	0.005	<	<	<	<	<
o,p & p,p-DDT	0.005	<	<	<	<	<
Total PCB	0.01	<	<	<	<	<
Surrogate Recovery (%)		79	81	70	72	91

Comment:
MDL = Method Detection Limit; < = Not Detected (less than MDL); * Sample replicate analyzed.
Method: EPA 3550A/8080A: Solvent Extraction GC/ECD
Total PCB quantification based on a mixture of Aroclors 1254 and 1260.

Dr. Asit Raksit, Ph.D., C. Chem

CHARTERED
Asit Raksit PhD

Analysts: Anita Hinmann, B.Sc.

Client: Trow Brampton
Attention: David Dennison
Project: BRGE-0010896-C
P.O.:
Sample Type: Soil
Date Received: Jun 23/98
Date Analysed: Jun 24 & Jun 26/98
Date Reported: Jun 26/98

ENTECH
A Division of Agri-Service Lab Inc.
6820 Kitimat Rd., Unit #4
Mississauga, ONT L5N 5M3
TEL: (905) 821-1112
FAX: (905) 821-2095

MISC. SAMPLE TESTS

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)			
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	47940 B10896-B3S4	47940 B10896-B3S4 Duplicate		
pH (units)	-	9.05	9.04	100	9.03	9.04		
Sulphate	0.1	2	1.99	100	1.62	1.66		

Sample Disposal: 90 Days from the Reporting Date.
Analyst(s): MB, GM

Sam Sanyal, M.Sc., C. Chem.
Manager, Inorganic Analysis.

Ministry of Transportation

Ministère des Transports

Ontario

Phone: (416) 235-3527
Fax: (416) 235-4267
E-mail: roszler@mto.gov.on.ca

Central Region Operations
Corridor Management Office
1st Floor, Atrium Tower
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

January 28, 1999

Cole Sherman & Associates Ltd.
75 Commerce Valley Drive East
Thornhill, Ontario
L3T 7N9

Attention: Mr. Tim Sorochinsky, P. Eng.

Dear Tim:

Subject: Comments for Trinity Common West Access Road Structure Over Future Highway 410 Extension E-N Ramp, City of Brampton

We have reviewed the structural drawings along with the foundation design report, and while we are still awaiting the contract documents for a complete review (NSSP's for Stainless Steel Reinforcing and HPC Concrete, for example), we do offer the following comments for your consideration.

1. With reference to Drawing S1, a table of Working Point Data must be shown, including Northings and Eastings with Stations and Top of Pavement Elevations.

2. On Drawing S3, several areas on the abutment are shown with 180-hook bars fitting into a component only 180 mm wide. How is the minimum required cover of 70mm +/- 20 mm maintained? For example, a 15M 180-hook is usually given as 110 mm minimum; (180 - 110) / 2 = 35 mm.

3. Drawing S6, showing a plan of the deck reinforcing, calls up 25M "fan" bars in acute corners as Coated, and while this is acceptable, the ministry prefers either stainless or black steel be used instead. Also, the call-up of barrier wall dowel spacing contradicts the dowel spacing shown on the barrier wall on Drawing S7.

4. Clarification is required for electrical conduit at abutments shown on Drawing S14, as to whether it is to be embedded or surface mounted.

2...

5. We will require the addition of Standard Drawing SS116-40 " As Constructed Elevations and Dimensions", which is the placing of steel pins at specified locations along the barrier walls which, at the end of construction, are surveyed as a reference for monitoring structure movement/settlement.

6. With reference to the pile embedment length, the pile layout drawing includes a section of the pile foundation. Based on this section, it would appear that the excavation for the RECO wall at the face of the abutment extends to within 2 to 3 m of the pile tip elevations. It must be confirmed that the designer has checked that the fixity of the piles will be developed.

Once the contract documents are ready for final review, we will require 5 (five) sets in order to facilitate concurrent reviews. If you have any questions or require further clarification, please contact me any time.

Sincerely,

Greg Roszler
Corridor Management Technician

copy to: N. Garland, MTO
R. Yeung, MTO
B. Bennett, MTO

memorandum

TO FILE

Ontario

To: Greg Roszler
Corridor Management Technician
1st Floor, Atrium Tower

January 26, 1999

From: Pavements and Foundations Section
Room 315, Central Building

Phone: 235-4333
Fax: 235-5240

Re: Trinity Common Access Road Structure
Over Proposed Hwy 410 E-N Ramp
City of Brampton

The foundation component of the proposed access structure crossing the proposed Highway 410 N-E Ramp has been reviewed as requested.

We have one comment that concerns the pile embedment length. The pile layout drawing includes a section of the pile foundation. Based on this section, it would appear that the excavation for the RECO wall at the face of the abutment extends to within 2 to 3 m of the pile tip elevations. It should be confirmed that the designer has checked that the fixity of the piles will be developed.

If there are any questions regarding the above, please advise.

B Bennett

Betty Bennett, P.Eng.
Foundation Engineer

c.c. T. Kazmierowski
N. Garland

0+671 HIGHWAY 410 EXTENSION
=16+932.277 HIGHWAY 410 (88-67)

10+000 BOVAIRD DRIVE
=1+000 HIGHWAY 410 EXTENSION

HIGHWAY 410

HEART LAKE ROAD

R=90

E-S

R=50

N-EW

R=160

Ls=96.023

R=50

W-N

E-N

R=130

PROP. WEST ACCESS ROAD

PROPOSED STRUCTURE

1+500

R=2000

2+000

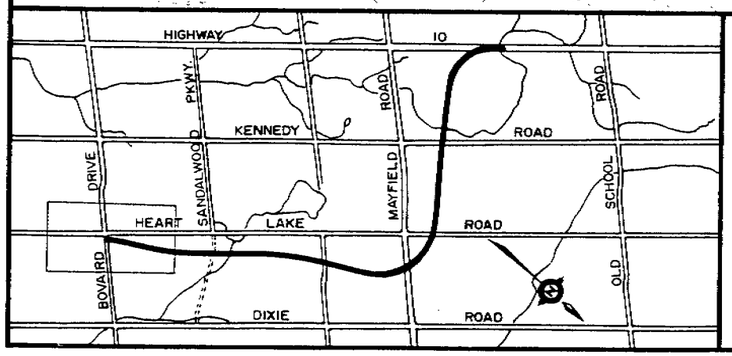
FUTURE HWY 410 EXTENSION

Ls=70.312

BOVAIRD DRIVE

TRINITY COMMON DEVELOPMENT

DESIGN SPEED 120 km/h



HIGHWAY 410 PLANNING STUDY
RECOMMENDED ROUTE HIGHWAY 410
BOVAIRD DRIVE
TO
HIGHWAY 10

PLATE
2

SCALE
HORIZONTAL 1:5000
VERTICAL 1:500

241
239 2.4

241.3
2.4
(9.2)

238.3
235.5
2.8