

**Foundation Investigation and Design
Proposed MTO Garage and Terminal Building
Sachigo Lake Airport
Agreement No.: 6005-A-000250**

FINAL REPORT

Prepared For:

Ministry of Transportation
Remote Northern Transportation Office
615 James Street South
Thunder Bay, ON
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Part 1 – Foundation Investigation

1.0 Introduction

This report presents the findings of a geotechnical investigation performed by Trow Associates Inc. (Trow) for a proposed MTO garage and terminal building at the Sachigo Lake Airport in Northwestern Ontario.

The Terms of Reference for the assignment were included in Proposal P-03197 prepared by Trow and submitted to MTO on June 15, 2003. The purpose of the geotechnical investigation was to obtain subsurface soils and groundwater information to assist with the design and construction of a new MTO garage and terminal building. This report is intended solely for the project described above and contains all the factual information obtained during the investigation.

2.0 Site Description

The foundation investigation was conducted at the remote MTO airport located near the First Nation community of Sachigo Lake, Ontario (see Figure 1, Key Plan).

The airport and surrounding area is generally flat. Apron, taxiway and runway areas are surfaced with sand and gravel; the remainder of the cleared airport property is covered with long grass. Areas beyond are covered with mature trees and heavy brush.

The key features of the immediate investigation area are detailed on Figure 2, Test Pit Location Plan, which is based on a survey plan of the site by Delta Survey Inc, and illustrated on Photographs 1 to 5 included in Appendix B of this report. As shown on the plan, the current study area is located near the south side of the apron, adjacent to the existing terminal building. As illustrated on the photographs, the investigation area was generally surfaced with minor grass and minor sand and gravel fill. In preparation for the project, trees and other brush had been removed from the southwest portion of the investigation area. A temporary brush pile was observed near the southeast corner of the investigation area.

Other development at the airport site included an MTO housing facility and office, and MTO garage, hydro generating plant and numerous and above and below ground fuel storage tanks. The development was generally located about 50 metres east of the current study area. An aircraft refueling facility was also noted at the northeast corner of the apron, about 60 metres northeast of the current study area.

3.0 Methodology

3.1 Fieldwork

The fieldwork was carried out between July 21 and 22, 2003 and consisted of advancing 11 test pits at the locations shown on Figure 2 as TP1 to TP11, inclusive. The test pits were excavated using a track-mounted Linkbelt excavator owned and operated by the local First Nation Band Office. The test pits were terminated at depths ranging between 2.2 m and 4.1 m. The excavation and field activities took place under the supervision of an experienced geotechnical field personnel from the Trow Thunder Bay branch.

The stratigraphy in the test pits was examined and logged in the field by Trow geotechnical personnel. Representative samples of the various soil strata encountered in the test pits were taken to our laboratory in Thunder Bay for further examination by a geotechnical engineer, and for selection for laboratory testing. Samples remaining after the testing will be stored for three months beyond the date of this report and may be discarded at that time unless we are requested otherwise.

The recovered soil samples were also screened for environmental contamination. The results of the environmental study are reported under separate cover.

The ground surface elevations and the test pit locations were surveyed by Delta Surveying Inc. and referenced to geodetic/UTM benchmarks shown on site drawings provided by the client. Details of the benchmarks used are shown on Figure 1.

Following the test pit program, the proposed source for sand and gravel fill was sampled. The source included a large esker deposit located about 17 kilometres from the site (see Photograph 6, Appendix B). In accordance with standard sampling procedures, a MTO front-end loader was used to dig into the face of the sand and gravel deposit; the material was then dumped and back-bladed. A sample of the sand and gravel was then taken from random locations on the bladed surface to form a composite sample of the gravel source.

3.2 Laboratory Testing

The laboratory testing program for selected samples consisted of the following:

- natural moisture content;
- grain size distribution (hydrometer); and,
- Atterberg limits.

The laboratory results are summarized on the Test Pit Logs in Appendix A, and on Figures 4 and 5.

In addition, a grain size analyses and moisture density relationship (standard Proctor) test was conducted on the sample of the proposed gravel source. Results of the testing are provided in Appendix C.

4.0 Subsurface Conditions

Details of the subsurface conditions encountered at the test pit locations are provided on Figure 3, Stratigraphic Profile, and on the Test Pit Logs included in Appendix A of this report. The subsurface conditions are summarized in the following sections. It is noted that the compactness/consistency of the soils noted is based on our visual observations of the test pit excavations and our experience with these types of soils.

4.1 Soil Conditions

4.1.1 Sand and Gravel Fill

The test pit locations were generally surfaced with sand and gravel fill (SP to GP). The fill was generally described as brown, damp and compact to dense, and extended to depths ranging between about 0.1 m and 0.3 m.

Sand and gravel fill was not encountered at TP1, TP2 and TP5. These locations had recently been cleared of trees, brush and most of the topsoil as preparation for the proposed construction.

4.1.2 Silt and Silty Clay

The native mineral soil encountered beneath the fill generally consisted of stiff, brown, moist silty clay (CL to CI). Occasional boulders were encountered within the lower portion of the stratum.

Frozen soil was also encountered within the silty clay stratum at TP6 to TP8 and TP10, from depths ranging between about 1.7 m and 3.65 m. It is noted that these four test pit locations were noted to be relatively unprotected (i.e., parking area) relative to the other test pits. Based on the time of year of the investigation (summer), this is probably an area of discontinuous permafrost.

At increased depth within the stratum, mostly silt (ML to CL) was noted. The silt was generally described as dense and moist, with traces of clay and occasional boulders.

The silt and silty clay extended to depths of about 3.7 m at TP1, TP3 and TP6, and beyond the termination depths of the remaining test pits.

In situ field vane testing conducted in the silty clay stratum indicate an undrained shear strength (c_u) ranging between about 98 kPa and 210 kPa at depths ranging between 1.1 m and 1.7 m. The c_u values are shown graphically on the test pit logs included in Appendix A.

Atterberg limits testing conducted on four samples of silty clay indicated that the silty clay is generally of medium plasticity. The natural moisture contents of these specimens were between the plastic and liquid limits. This data are presented on the Plasticity Chart, Figure 5, and summarized in the following Table 1.

Table 1: Summary of Atterberg Limits Testing				
Test Pit/Sample	TP2-3	TP6-3	TP7-3	TP8-3
Liquid Limit, w_L	30	37	34	32
Plastic Limit, w_P	18	19	18	18
Plasticity Index, I_P	12	19	15	15
Moisture Content, w	19.0%	26.9%	22.6%	21.0%

A grain size analyses (hydrometer) was also conducted on one sample of the silty clay. The results are presented on Figure 4. In general, the sample analysed consisted of about 70 percent silt and 30 percent clay size particles.

Based on the results of the Atterberg limits testing and the grain size analysis, the silty clay has an estimated hydraulic conductivity ranging between 10^{-6} and 10^{-7} cm/s. This corresponds to a percolation rate (*t-time*) in excess of 50 min/cm.

4.1.3 Glacial Till

Beneath the silt and silty clay at TP1, TP3 and TP6, glacial till was encountered. The glacial till, comprising of predominantly silty sand (SM), was described as grey, dense and damp with occasional cobbles and boulders.

4.1.4 Refusal

Refusal to the excavator, possibly on bedrock, was encountered at TP2 to TP6 at depths ranging between 2.2 m and 4.1 m. However, the presence of bedrock was not proven by coring and obtaining samples for identification.

4.2 Groundwater Conditions

No evidence of free flowing groundwater was noted in the test pits during and following the excavations and prior to backfilling.

It is noted that the depth to the groundwater table may fluctuate seasonally, or after periods of extended precipitation or drought, and as such may differ at the time of construction.

5.0 Subsurface Environmental Conditions

Only minor hydrocarbon staining was noted on the ground surface within the investigation area. Details of environmental conditions at the site are presented under separate cover.

6.0 Proposed Gravel Source

The proposed gravel source consisted of a natural deposit of sand and gravel located some 17 km from the airport site (UTM 54,5293E, 5,975,255N, NAD 83, Zone 15). Based on the results of the grain size analyses, the proposed sand and gravel source appears to meet the gradation specifications for OPSS Granular B. A moisture-density relationship (i.e., Proctor test) conducted on the sand and gravel fill indicated a Standard Proctor Maximum Dry Density (SPMDD) of 1931 kg/m³ at an optimum water content of 8.3% by dry weight. Laboratory test results are presented in Appendix C of this report.

7.0 Closing Comments

A subsurface investigation is a limited sampling of a site and the subsurface conditions have been established only at the test pit locations. Should any conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to allow reassessment of our findings presented herein. It may then be necessary to carry out additional fieldwork and analyses.

Contractors bidding on or undertaking any work at the site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them. As part of any tendering process, it is recommended that test pits be excavated to allow bidding contractors to view the actual excavation and groundwater conditions.

This report has been prepared by Mr. J.P. Lobbezoo, B.Eng., and was reviewed by Mr. D. N. Georgiou, P.Eng. and Mr. S. E. Gonsalves, P.Eng. The field investigation was performed by Mr. E. Farkas, under the supervision of Mr. D. N. Georgiou, P.Eng.

Part 2 - Engineering Discussion And Recommendations

1.0 Introduction

The recommendations provided in Part 2 of this report are based on a geotechnical investigation which is detailed in Part 1. A summary of the findings of the investigation is given as follows.

In short, sand and gravel fill was encountered at the surface of most of the test hole locations, extending to depths ranging between about 0.1 m and 0.3 m. The predominant native mineral soil encountered beneath the fill was stiff silty clay. At increased depth mostly dense silt was noted. Beneath the silt and silty clay (at a depth of about 3.7 m), glacial till was observed. The glacial till, comprising mainly of silty sand, was described as dense. Refusal to the excavator was also encountered at two of the eleven test hole locations, occurring at depths of 2.2 m and 4.1 m. While the refusal was probably due to the presence of bedrock, it is noted that bedrock was not proven coring and obtaining samples for identification.

No evidence of free flowing groundwater was noted in the test pits during and following the excavations and prior to backfilling. It is noted that groundwater levels generally fluctuate seasonally, or after periods of extended precipitation or drought.

Only very minor stained (hydrocarbon) areas were noted on the ground surface within the investigation area. Details of environmental conditions at the site are presented under separate cover.

The following preliminary information has been provided by the client for the purpose of geotechnical design. It is understood that a MTO garage and terminal building are proposed for the subject site. The proposed buildings will generally consist of single-storey wood framed structures with slab-on-grade floors founded on either conventional strip footings or club footings.

The discussions to follow are presented in general terms, and the recommendations are based on the above information and the findings of the investigation. It is noted that bearing resistances and other design and construction recommendations are based on our visual observations at the site, classification testing, limited *in situ* shear vane testing and our extensive experience with these types of soils.

2.0 Frost Penetration

In the Sachigo Lake area, the frost penetration in unprotected areas such as roadways and parking areas can be as deep as 3.65 m. The minimum soil cover for shallow foundations of

unheated structures on soil and for services is 3.65 m. For heated structures, the cover can be reduced to 2.4 m for the perimeter footings. Alternatively, the foundations or underground structures can be founded at shallower depths if insulation is provided around the structure.

Based on the results of the geotechnical investigation, discontinuous areas of permafrost are likely present in unprotected areas of the site. It is noted that the subsurface soils at the site are generally frost susceptible. To avoid heaving and differential settlements of the proposed structure, it is imperative that foundations are not placed on frozen soil or in locations where frozen soil exists beneath the surface. As such, the entire subsurface strata within the building footprints should be thawed prior to construction. Test pits should be excavated around the perimeter of the building sites at the time of construction to ensure subsurface soils are not frozen at depth.

In light of the likely presence of discontinuous permafrost at the site, consideration should be given to protecting the building sites during the winter prior to construction in order to limit the frost penetration depth during the cold season (i.e., placing straw bales or equivalent on the building sites). Should frozen soil be encountered at the time of construction, the building project should be delayed until the soil thaws. Alternatively, the frozen soils should be excavated and replaced with structural fill prior to construction of the buildings. The requirements for structural fill are given in the following Section 3.0.

3.0 Excavation And Dewatering

All work associated with design and construction relative to excavations must be in accordance with Part III of Ont. Reg. 213/91 under the Occupational Health and Safety Act. Based on the results of the geotechnical investigation and in accordance with Section 226 of Ont. Reg. 213/91, the fill and native mineral soils are classified as Type 2 soil.

For excavations carried out above the groundwater table, the sidewalls can be sloped back to a slope of 1 horizontal to 1 vertical (1H:1V). Sidewalls of slopes below the water table should stand at a 2H:1V slope. Should groundwater inflow loosen the above soils, it may be necessary to provide flatter slopes. Dewatering of the soils may allow steeper slopes.

Alternatively, braced excavations can be considered for excavations in excess of 1.2 m or where space limitations do not allow grading of excavation sidewalls to the required slope. If shoring and bracing is required, an active coefficient of earth pressure (K_a) of 0.33 can be used for the native soil, along with a total unit weight of 19 kN/m^3 .

Trenched excavations will be required for buried services. A trench is defined as an excavation in which the width of the base of the excavation is less than twice the excavation depth, and conformance with the above noted regulation is required. Regardless of the excavation method

undertaken, surface loads from construction equipment and stockpiled materials must be included in the design.

Beneath the footprint of the proposed buildings, any fill, organics and/or otherwise deleterious soils should be removed to expose the native silty clay. This will likely involve the removal of up to 0.3 m, or more, of soils. Additional excavation may also be required, as outlined in the following Section 4.0.

At the design elevation, the exposed soil surface should be inspected to ensure all fill and otherwise deleterious are removed. These should be excavated and replaced with compacted structural fill.

The material used as structural fill should be a well graded, free-draining granular fill such as OPSS Granular B. Based on the results of laboratory testing, the sand and gravel from the proposed source sampled appears suitable for use as structural fill.

The structural fill should be placed in lifts of not greater than 300 mm in thickness and compacted to at least 100% standard Proctor maximum dry density (SPMDD). Fill or concrete must not be placed on frozen soil and the fill itself must not contain frozen chunks of soil or ice.

Additionally, when excavating the pipe trenches, care should be taken to not undermine or damage any existing buried utilities or structures.

Based on conditions observed during the investigation, excessive infiltration is not expected within the building area. In the event that free flowing groundwater and/or surface runoff is encountered, pumping from strategically placed sumps should be sufficient to dewater the excavations. The collected water should be discharged a sufficient distance away from the excavated area to prevent the discharge water from returning to the excavation. Sediment control measures should be provided at the discharge point of the dewatering system. Caution should also be taken to avoid any adverse impacts to the environment.

4.0 Foundations

The proposed buildings can be supported by conventional strip and spread footings, or, as an alternative, thickened slab-on-grade (or club footings) foundations. Recommendations for both conventional strip and spread footings and club footing foundations are provided in the following sections.

4.1 Conventional Strip and Spread Footings

As discussed in Section 2.0, the perimeter strip and spread footings should be founded at a minimum depth of 2.4 m below the finished grade, or otherwise be insulated. Based on the

stratigraphy encountered in the boreholes, the founding stratum will likely be native silty clay.

A minimum of 300 mm of structural fill is required beneath the footings. Excavation and placement of the structural fill must extend beyond the edges for a distance equal to the thickness of structural fill below the proposed foundation elements. The requirements and preparation of the subgrade and structural fill are given in previous Section 3.0.

The Ultimate Limit States (ULS) bearing resistances for footings with a width ranging between 0.6 m and 1.2 m and founded at a depth ranging between 1.0 m and 2.4 m (on structural fill as discussed above) are provided in the following Table 2.

Table 2: Factored Bearing Resistance at ULS				
		Width of Footing (m)		
		0.6	0.9	1.2
Depth of Footing (m)	1.0	340	325	310
	1.6	370	360	350
	2.4	375	370	360
Notes: 1. Bearing resistances are expressed in kPa.				

For the conventional footing described above, the following Serviceability Limit States (SLS) bearing resistance is given:

Bearing resistance at SLS for 25 mm of settlement 120 kPa

As implied, the total expected settlement would be about 25 mm under these loading conditions. Differential settlements are expected to be within 20 mm. Most of the settlement will be completed soon after the construction and application of loads.

It is expected that the floor will be an independent slab-on-grade. Structural fill will be required beneath the concrete floor slab after the removal of existing fill and/or otherwise deleterious materials, as discussed previously. The structural fill requirements are given in the previous Section 3.0. As with the club footings, the top of the slab should be at least 200 mm above perimeter grade and a vapour barrier or poly sheet should be provided beneath the slab. For design, the modulus of subgrade reaction can be taken as 33 MN/m^3 for a minimum of 300 mm structural fill constructed as specified.



Construction of this type on soil at a depth of less than 2.4 m for a heated structure and less than 3.65 m for an unheated structure will require insulation to provide against frost action. The thickness and lateral extent of the insulation will depend upon the inside temperature and configuration of the proposed structure, as well as the amount of soil cover. Insulation should consist of rigid board extruded polystyrene, such as *DOW SMTM*, placed at a minimum depth of 600 mm. The following Table 3 provides recommendations for thickness and lateral extension of insulation for a heated structure based on the founding depth of the footings. Note that insulation is also required along the outside face of exterior subwalls above the lateral insulation.

Table 3: Insulation Requirements		
Founding Depth of Footing (m)	Recommended Thickness of Insulation (mm)	Minimum Lateral Extension (m) ¹
1.0	75	1.65
1.6	50	1.65
2.4	0	n/a
Notes: 1. Minimum lateral extension beyond the outside edge of footing based on the placement of insulation at a depth of 0.6 m below ground surface.		

4.2 Stiffened Slab-on-Grade (Club Footings)

A stiffened slab-on-grade foundation can also be considered for supporting the proposed building, constructed in accordance with the following recommendations.

After the removal of all existing fill and/or otherwise deleterious materials, the club footings and slab should be supported on a minimum of 300 mm of structural fill. Excavation and placement of the structural fill must extend beyond the edges for a distance equal to the thickness of structural fill below the proposed foundation elements. The requirements and preparation of the subgrade and structural fill are given in previous Section 3.0.

The ULS bearing resistance for the club footings foundation is similar to the ULS bearing resistance given for the conventional strip and spread footings (see Table 2).

For slabs with thickened section widths ranging between 0.6 m and 1.2 m and constructed on the structural fill as discussed above, the following Serviceability Limit States (SLS) bearing resistance is given for the thickened sections (club footings):

Bearing resistance at SLS for 25 mm of settlement 150 kPa

As discussed in the previous Section 4.1, the SLS bearing resistance given is based on a total settlement of 25 mm. Differential settlements are expected to be within 20 mm. Most of the settlement will be completed soon after the construction and application of loads.



The top of the slab should be at least 200 mm above perimeter grade and a vapour barrier or poly sheet should be provided beneath the slab. For design, the modulus of subgrade reaction can be taken as 33 MN/m^3 for a minimum of 300 mm structural fill constructed as specified.

Construction of this type on soil at a depth of less than 2.4 m for a heated structure and less than 3.65 m for an unheated structure will require insulation to provide against frost action. The thickness and lateral extent of the insulation will depend upon the inside temperature and configuration of the proposed structure, as well as the amount of soil cover. For a heated building and a foundation edge depth of at least 600 mm, **100 mm** of rigid board extruded polystyrene, such as *DOW SMTM*, placed at a depth of 300 mm with a 2.0 m lateral extension can be used. A minimum soil cover of 300 mm is required over the insulation.

5.0 Backfill And Drainage

Backfill against the foundation walls should be a clean, free draining, non-frost susceptible granular material, such as OPSS Granular B, to reduce the effects of adfreeze. The on-site excavated soil is not suitable as backfill adjacent to the structure. To further reduce problems associated with adfreeze, it is recommended that concrete block walls be avoided below grade and that cast-in-place concrete foundation walls be connected to footings with re-bar. The fill should be placed in lifts not greater than 300 mm in thickness and compacted to not less than 95% SPMDD. Smaller lifts and lighter compaction equipment should be used adjacent to foundation walls to prevent over-stressing and damage. Care should be taken to place and compact fill simultaneously on both sides of any subwalls.

The fill surface around the perimeter of the structure should be sloped in such a way that the surface run-off water does not accumulate around the structure. It is recommended that an impermeable seal, such as clay, asphalt or concrete, be provided on the surface to minimize water infiltration.

6.0 Septic Field

Based on the results of the investigation, the native silty clay at the site has a percolation rate in excess of 50 min/cm. The Ontario Building Code indicates that leaching beds must not be constructed in soils having a percolation time of less than 1 min/cm or greater than 50 min/cm (OBC 1997 Sect. 8.7.2.1.). An optimal percolation rate for the design and construction of the septic field is about 8 min/cm to 10 min/cm.

Accordingly, it would appear that soil for the proposed septic field must be imported.

7.0 Construction Quality Control

Construction quality control of the earthworks should be provided by experienced geotechnical personnel. This includes inspection of the excavation and subgrade prior to the placement of the structural fill, pile driving, foundations, pipe bedding, site grading fill or backfill, to ensure that any and all deleterious materials have been removed and to ensure that the actual conditions are not markedly different than those on which the recommendations made herein are based. Compaction control of structural fill is also recommended as standard practice, as is sampling and testing of aggregates and concrete.

If winter construction is undertaken, care should be taken to ensure that structural fill, concrete or bedding material is not placed on ground that is frozen and that the fill does not itself contain frozen soil or ice chunks. Freezing of the subgrade, structural fill, pipe bedding and concrete should also be prevented as appropriate.

8.0 Closing Comments

The recommendations made in this report are in accordance with our present understanding of the project and are provided solely for MTO and the team responsible for the design of the proposed garage and terminal building, at the site investigated and described herein.

We recommend that we be retained to review our recommendations as the design nears completion to ensure that the final design is in agreement with the assumptions on which our recommendations are based and that our recommendations have been interpreted as intended. If not accorded this review, Trow will assume no responsibility for the interpretation and use of the recommendations in this report.

A subsurface investigation is a limited sampling of a site and the subsurface conditions have been established only at the test pit locations. Should any conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to allow reassessment of our recommendations. It may then be necessary to carry out additional fieldwork and analyses.

It should be recognized that unanticipated conditions might be encountered during construction. It is therefore recommended that Trow be retained to observe construction and perform testing relative to the geotechnical issues, as discussed in previous sections of this report. Such observation and testing is intended to minimize the risk of problems occurring during and following construction. It is not insurance however, nor does it constitute a warranty or guarantee of any type. In all cases, contractors *et al* retain responsibility for the quality of their work and for adhering to plans and specifications. Should Trow not be retained to provide such observations and testing, Trow would not have had the ability to perform a complete service and



therefore assumes no responsibility for problems during or after construction that allegedly result from findings, conclusions, recommendations, plans or specifications developed by Trow.

Contractors bidding on or undertaking the works should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them. As part of the tendering process, it is recommended that test pits be excavated to allow bidding contractors to view the actual excavation and groundwater conditions.

This report has been prepared by Mr. J.P. Lobbezoo, B.Eng., and was reviewed by Mr. D. N. Georgiou, P.Eng. and Mr. S. E. Gonsalves, P.Eng.

We trust that this report is satisfactory to your present requirements. Should you have any questions, please contact the undersigned at your convenience.

All the foregoing and attachments respectfully submitted,

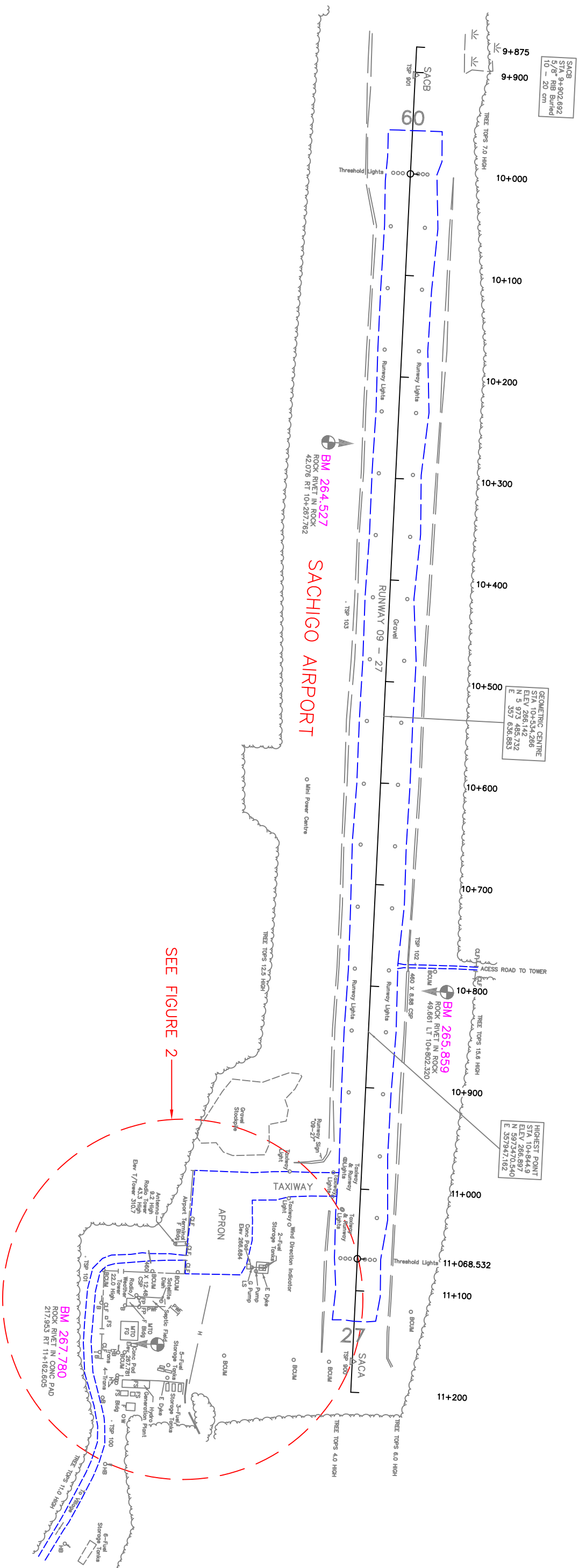
Trow Associates Inc.

John Lobbezoo, B.Eng.

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

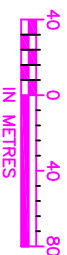
S.E. Gonsalves, M.Eng., P.Eng.
Principal Engineer/Vice President
Designated MTO Representative

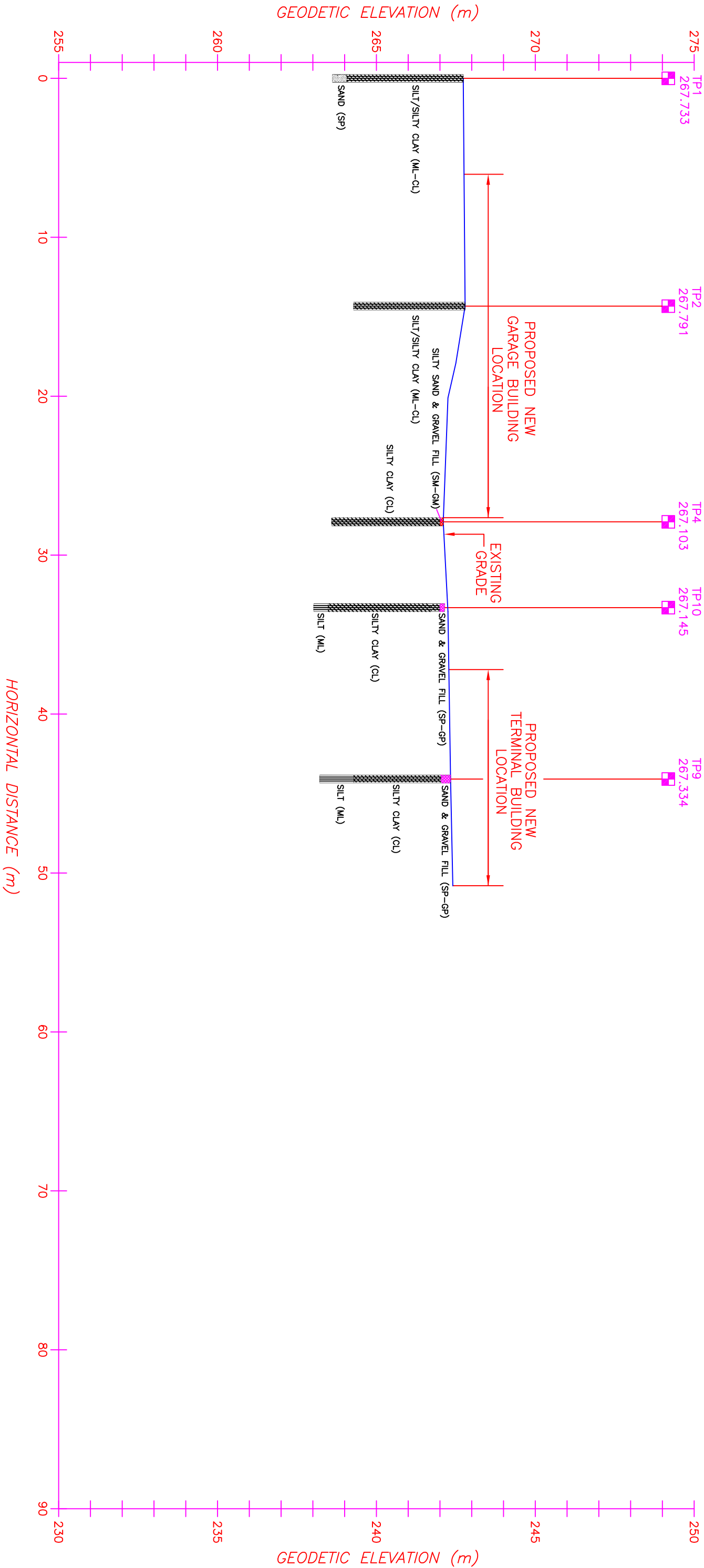
Figures



Notes:

1) Reference: drawing provided by MTO.





Notes:

1) Reference: based on plan by Delta Survey.

2) Elevations are geodetic and in metres, referenced to BM described as rock rivet in rock 450m NW of apron.

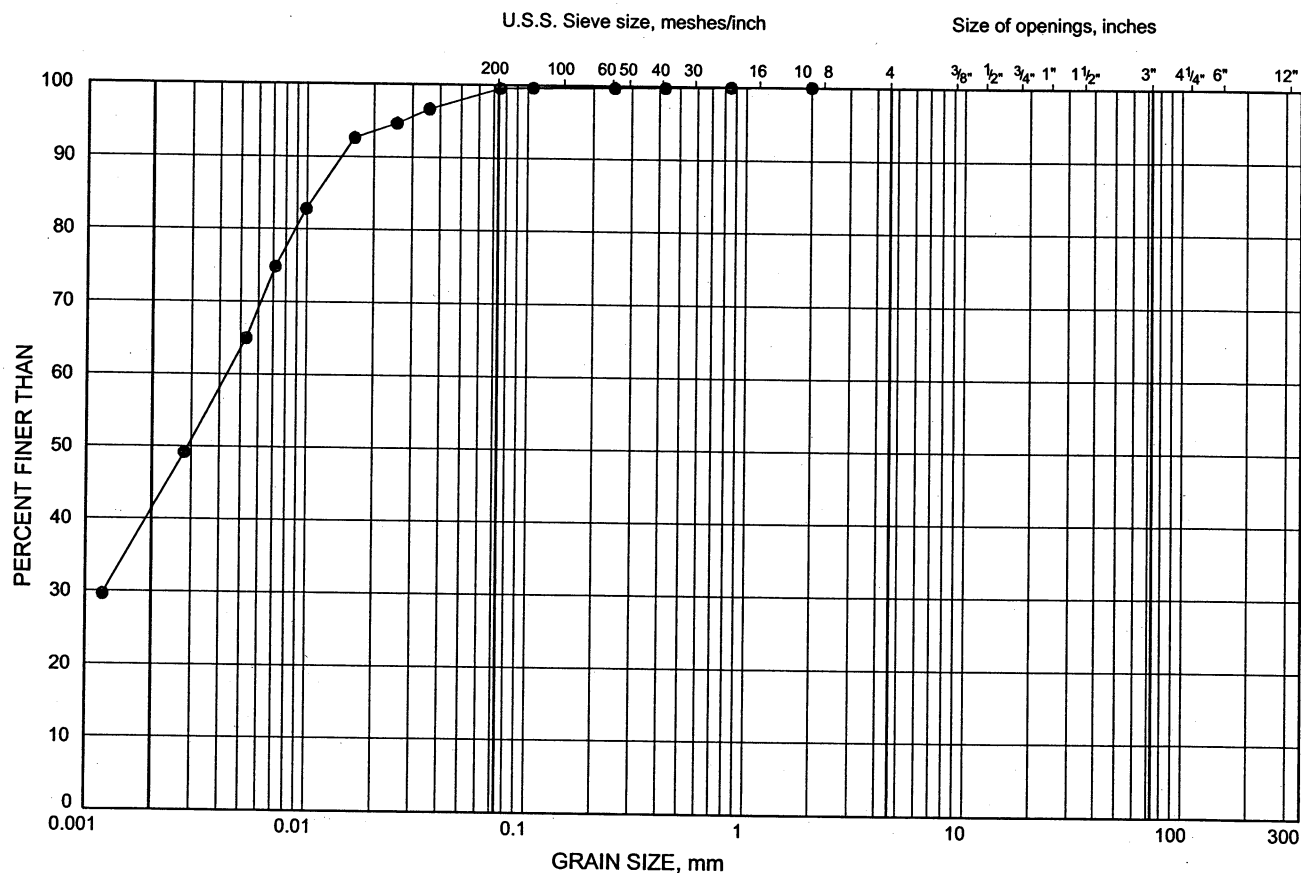
Geodetic Elevation 265.859 metres.



Trow Thunder Bay Branch

Grain Size Distribution

Figure 4



Unified Soil Classification System

SILT or CLAY				FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE	
				SAND			GRAVEL			
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLE SIZE
	SILT			SAND			GRAVEL			

Modified M.I.T. Classification System

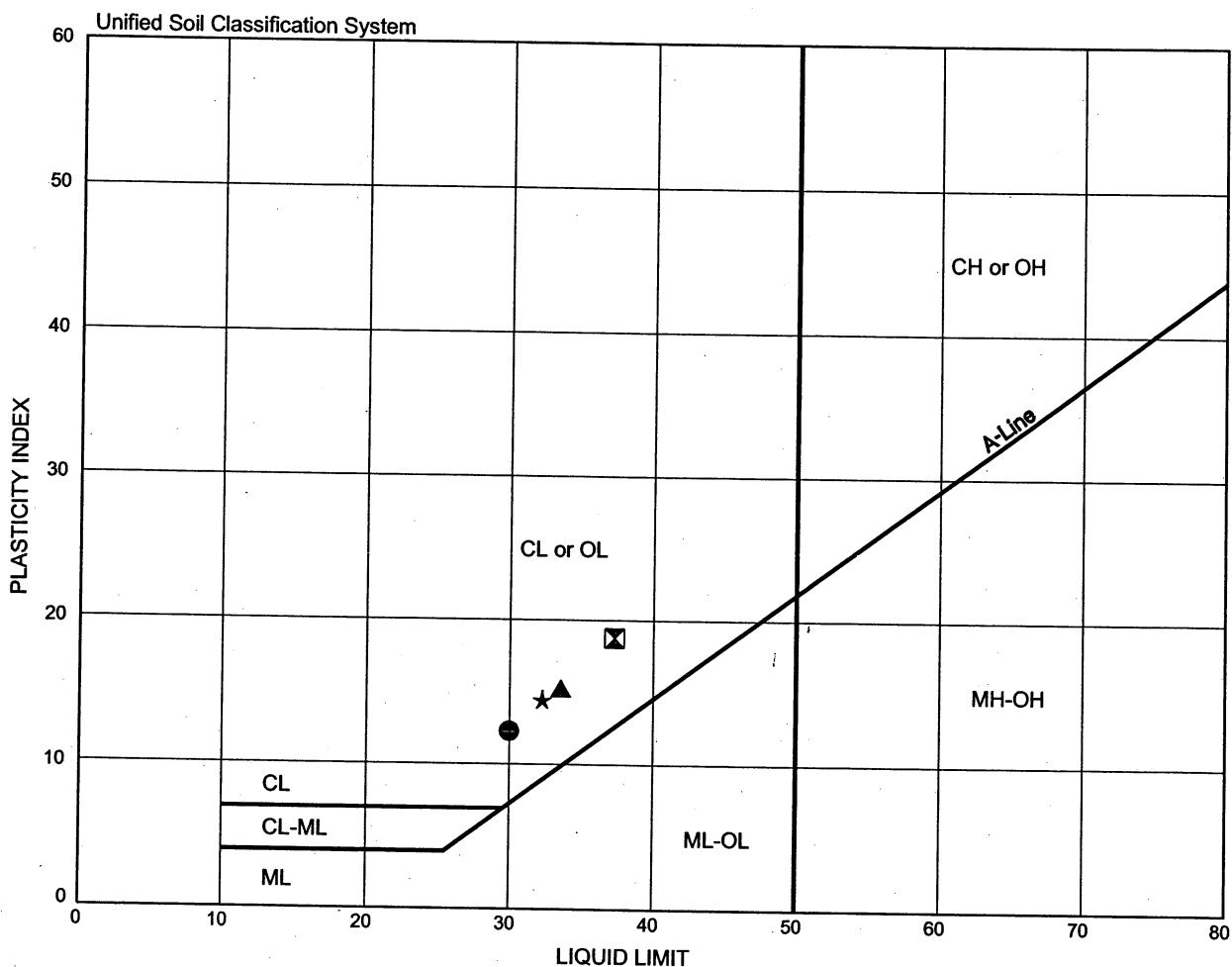
Symbol	Location	Sample No.	Mid-Sample Depth (m)	Elevation (m)	D ₁₀ (mm)	C _u	C _c
•	TP6	3	1.22				



Plasticity Chart

Figure 5

Trow Thunder Bay Branch



Symbol	Location	Sample No.	Depth (m)	Elevation (m)	W	W _p	W _L	PI
●	TP2	3	1.52		19.0	18	30	12
⊠	TP6	3	1.22		26.9	19	37	19
▲	TP7	3	1.07		22.6	18	34	15
★	TP9	3	1.22		21.0	18	32	15

Appendix A

Test Pit Logs



Trow Thunder Bay Branch

TEST PIT LOG

TP1

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake AirportPROJECT NO. F-03183-A/GCLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Linkbelt LS 3400DATES: Excavating July 21/03Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture W _p W W _L 20 40 60 80
				TYPE	NUMBER		
0	267.73	SILT/SILTY CLAY- stiff, brown, damp, blocky, roots & rootlets to 0.45m depth, laminated (ML to CL)		BS	1		
				BS	2		
				BS	3		
				BS	4		
	264.07	- becoming mostly silt, very dense, brown, damp, blocky structure, trace clay, occ. boulder to ~0.9m dia. (ML)		BS	5		
	263.61	SAND (TILL)- dense, grey, damp, trace gravel & silt, occ. cobbles & boulders to ~0.9m dia. (SP)		BS	5		
		End of Test Pit					

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP1

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake AirportPROJECT NO. F-03183-A/GCLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Linkbelt LS 3400DATES: Excavating July 21/03Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture W _p W W _L 20 40 60 80
				TYPE	NUMBER		
0	267.73	SILT/SILTY CLAY- stiff, brown, damp, blocky, roots & rootlets to 0.45m depth, laminated (ML to CL)		BS	1		
				BS	2		
				BS	3		
				BS	4		
		- becoming mostly silt, very dense, brown, damp, blocky structure, trace clay, occ. boulder to ~0.9m dia. (ML)					
	264.07						
		SAND (TILL)- dense, grey, damp, trace gravel & silt, occ. cobbles & boulders to ~0.9m dia. (SP)		BS	5		
	263.61						
		End of Test Pit					

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP2

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 21/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane Atterberg Limits and Moisture W _p W W _L
				TYPE	NUMBER		
0	267.79	SILT/SILTY CLAY- stiff becoming very stiff, brown, moist, blocky, laminated, (ML to CL)		BS	1		
				BS	2		
				BS	3		
				BS	4		
				BS	5		
	264.28	End of Test Pit-Refusal on possible large boulder (~1.8m dia.)					
4							
5							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP3

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake AirportPROJECT NO. F-03183-A/GCLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Linkbelt LS 3400DATES: Excavating July 21/03Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH <div> <div> <div>◆ S Field Vane Test</div> <div>▲ Penetrometer</div> <div>■ Torvane</div> </div> <div> <div>100</div> <div>200 kPa</div> </div> <div> <div>Atterberg Limits and Moisture</div> <div> <div>W_P</div> <div>W</div> <div>W_L</div> </div> </div> </div>
				TYPE	NUMBER		
0	267.23						
	267.13	SILTY SAND & GRAVEL (FILL) - loose, brown, dry (SM to GM)		BS	1		
		SILTY CLAY - stiff becoming very stiff, brown, damp, laminated (CL)		BS	2		
1				BS	3		
		- blocky from 1.7m depth		BS	4		
2							
3		- rusty colour from 3.0m depth		BS	5		
	263.57						
		SILTY SAND (TILL) - dense, brown, moist, trace gravel, occ. cobbles & boulders to ~0.9m dia. (SM)		BS	6		
4	263.11						
		End of Test Pit-Refusal on possible boulders					
5							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP4

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 21/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane Atterberg Limits and Moisture W _P W W _L
				TYPE	NUMBER		
0	267.10						
	267.00	SILTY SAND & GRAVEL (FILL)- compact, brown, damp (SM to GM)		BS	1		
		SILTY CLAY- firm to stiff, brown, moist, laminated (CL)		BS	2		
-1				BS	3		
				BS	4		
-2							
				BS	5		
-3		- very stiff, large blocky texture from 2.9m depth					
	263.59						
-4		End of Test Pit-Refusal at 2.2m depth on N side of TP and 3.5m on S side (very large boulder or bedrock)					

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▽ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP5

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 21/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH <div> <div> <div>◆ S Field Vane Test</div> <div>▲ Penetrometer</div> <div>■ Torvane</div> </div> <div> <div>100</div> <div>200 kPa</div> </div> <div> <div>Atterberg Limits and Moisture</div> <div> <div>W_P</div> <div>W</div> <div>W_L</div> </div> </div> </div>
				TYPE	NUMBER		
0	267.29						
	267.14	SILT- brown, damp, roots & rootlets, trace organics (ML)		BS	1		
		SILTY CLAY- stiff, brown, moist, laminated (CL)		BS	2		
1				BS	3		
2		- becoming mostly dense silt, trace clay at 7.1m depth (ML to CL)		BS	4		
3		- very moist from 2.7m depth		BS	5		
	263.94	End of Test Pit-Refusal on possible large boulder or bedrock					
4							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP6

Sheet 1 of 1

PROJECT **New MTO Garage & Terminal Building, Sachigo Lake Airport**

PROJECT NO. **F-03183-A/G**

CLIENT **Ministry of Transportation Ontario**

DATUM **Geodetic**

EXCAVATOR **Linkbelt LS 3400**

DATES: Excavating **July 21/03**

Water Level **N/A**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH <div> <div> <div>◆ S Field Vane Test</div> <div>▲ Penetrometer</div> <div>■ Torvane</div> </div> <div> <div>100</div> <div>200 kPa</div> </div> <div> <div>Atterberg Limits and Moisture</div> <div>W_P W W_L</div> <div> <div>20</div> <div>40</div> <div>60</div> <div>80</div> </div> </div> </div>
				TYPE	NUMBER		
0	267.24	SAND & GRAVEL (FILL)- compact to dense, brown, damp (SP to GP)		BS	1	S&H	
	267.04	SILTY CLAY- stiff, brown, moist (CL to CI), laminated from 0.9m depth		BS	2		
1				BS	3		
2		- frozen soil, visible ice crystals from 1.8m to 2.4m depth		BS	4		
3	264.50	SILT- dense, brown, moist, laminated (ML)		BS	5		
4	263.43	SILTY SAND (TILL)- dense, brown, damp to moist, trace gravel, occ. cobbles & bouldrs to ~0.8m dia. (SP)		BS	6		
	263.12	End of Test Pit-Refusal on possible boulders or bedrock					

NOTES

- For definition of symbols & terms used on logs, see sheets prior to logs.
- Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▽ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP7

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake AirportPROJECT NO. F-03183-A/GCLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Linkbelt LS 3400DATES: Excavating July 21/03Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH * S Field Vane Test ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture W _P W W _L 20 40 60 80
				TYPE	NUMBER		
0	267.45	SANDY SILT (FILL) - dense, brown, damp, trace gravel (SM)		BS	1		
	267.35	SILTY CLAY - stiff, brown, damp (CL)		BS	2		
-1				BS	3		
-2		- frozen from 1.7-2.9m depth - laminated from 1.7m depth		BS	4		
				BS	5		
-3	264.25	SILT - dense, brown, moist to very moist, rust coloured fissures (ML)		BS	6		
-4	263.33	End of Test Pit					

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

- ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▽ Measured
- ▲ Artesian (see Notes)

TEST PIT LOG

TP8

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G











CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating **July 21/03**

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH	
				TYPE	NUMBER		◆ S Field Vane Test ▲ Penetrometer ■ Torvane	
							100 200 kPa	
							Atterberg Limits and Moisture W _P W W _L	
							20 40 60 80	
0	267.55	SAND (FILL)- dense, brown, damp, med. to coarse grained, trace gravel (SP)		BS	1			
	267.25	SILTY CLAY- stiff, brown, moist (CL)		BS	2			
-1								
		- blocky texture, laminated from 1.4m depth		BS	3			
								
-2		- frozen from 1.8-3.4m depth		BS	4			
								
-3				BS	5			
								
		- becoming silt, dense, brown, blocky rusty coloured fissures at 3.5m depth (ML to CL)		BS	6			
-4	263.43	End of Test Pit						
-5								

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
☒ BL Block Sample

- ST Shelby Tube

OTHER TESTS

- | | |
|----------------------|--------------------------------------|
| G Specific Gravity | C Consolidation |
| H Hydrometer | CD Consolidated Drained Triaxial |
| S Sieve Analysis | CU Consolidated Undrained Triaxial |
| γ Unit Weight | UU Unconsolidated Undrained Triaxial |
| P Field Permeability | UC Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS

- ▽ Apparent ▼ Measured ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP9

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 22/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane Atterberg Limits and Moisture W _P W W _L
				TYPE	NUMBER		
0	267.33	SAND & GRAVEL (FILL)- compact, brown, damp, occ. cobbles, pieces of wood (SP to GP)		BS	1		
	267.03	SILTY CLAY- stiff, brown, moist, trace organics, trace gravel, blocky texture (CL)		BS	2		
-1		- laminated from 0.9m depth		BS	3		
-2				BS	4		
-3	264.28	SILT- dense, brown, moist, blocky, rust coloured seams & fissures (ML)		BS	5		
-4	263.21			BS	6		
		End of Test Pit					

NOTES

- For definition of symbols & terms used on logs, see sheets prior to logs.
- Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP9

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 22/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane Atterberg Limits and Moisture W _P W W _L
				TYPE	NUMBER		
0	267.33	SAND & GRAVEL (FILL)- compact, brown, damp, occ. cobbles, pieces of wood (SP to GP)		BS	1		
	267.03	SILTY CLAY- stiff, brown, moist, trace organics, trace gravel, blocky texture (CL)		BS	2		
-1		- laminated from 0.9m depth		BS	3		
-2				BS	4		
-3	264.28	SILT- dense, brown, moist, blocky, rust coloured seams & fissures (ML)		BS	5		
-4	263.21			BS	6		
		End of Test Pit					

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

- ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP10

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-A/G

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 22/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH * S Field Vane Test ▲ Penetrometer ■ Torvane 100 200 kPa Atterberg Limits and Moisture W _P W W _L 20 40 60 80
				TYPE	NUMBER		
0	267.15						
	267.00	SAND & GRAVEL (FILL)- dense, brown, damp (SP to GP)		BS	1		
		SILTY CLAY- stiff, brown, blocky, roots & rootlets, trace organics (CL)		BS	2		
		- laminated from 0.45m depth					
-1				BS	3		
				BS	4		
-2		- frozen from 2.1-3.7m depth		BS	5		
				BS	6		
-3							
	263.49			BS	7		
		SILT- dense, brown, moist to very moist (ML)					
-4							
	263.03						
		End of Test Pit					

NOTES

- For definition of symbols & terms used on logs, see sheets prior to logs.
- Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▽ Measured
- ▲ Artesian (see Notes)



Trow Thunder Bay Branch

TEST PIT LOG

TP11

Sheet 1 of 1

PROJECT New MTO Garage & Terminal Building, Sachigo Lake Airport

PROJECT NO. F-03183-AG

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Linkbelt LS 3400

DATES: Excavating July 22/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH <div> <div> <div>◆ S Field Vane Test</div> <div>▲ Penetrometer</div> <div>■ Torvane</div> </div> <div> <div>100</div> <div>200 kPa</div> </div> <div> <div>Atterberg Limits and Moisture</div> <div>W_P W W_L</div> </div> </div>
				TYPE	NUMBER		
0	267.25	SAND (FILL) - dense, brown, damp, trace gravel (SP)		BS	1		
	267.05	SILTY CLAY - stiff, brown, moist, blocky (CL) - roots & rootlets to 0.76m depth		BS	2		
1		- laminated from 0.76m depth		BS	3		
2				BS	4		
3				BS	5		
	263.59	SILT - dense, brown, moist to very moist, laminated, rusty coloured seams (ML)		BS			
4	263.29	End of Test Pit on Boulders & Cobbles					

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown is based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No caving. No groundwater encountered.

SAMPLE LEGEND

- ☒ BS Bulk Sample
- ☒ BL Block Sample

■ ST Shelby Tube

OTHER TESTS

- G Specific Gravity
- H Hydrometer
- S Sieve Analysis
- γ Unit Weight
- P Field Permeability
- K Lab Permeability
- C Consolidation
- CD Consolidated Drained Triaxial
- CU Consolidated Undrained Triaxial
- UU Unconsolidated Undrained Triaxial
- UC Unconfined Compression
- DS Direct Shear

WATER LEVELS

- ▽ Apparent
- ▼ Measured
- ▲ Artesian (see Notes)

Appendix B

Site Photographs



Photo 1: Looking west at the investigation area. Note existing security building (blue) and existing terminal building (brown).



Photo 2: Looking north at the investigation area. Gravel surfaced apron in background. Note temporary brush pile at immediate right.



Photo 3: Looking east at the investigation area.



Photo 4: Looking southeast at the investigation area.



Photo 5: Looking at TP8. Note the heating oil tank alongside the terminal building. Note also the maintenance complex in background.



Photo 6: Sampling of the gravel source from large esker deposit.

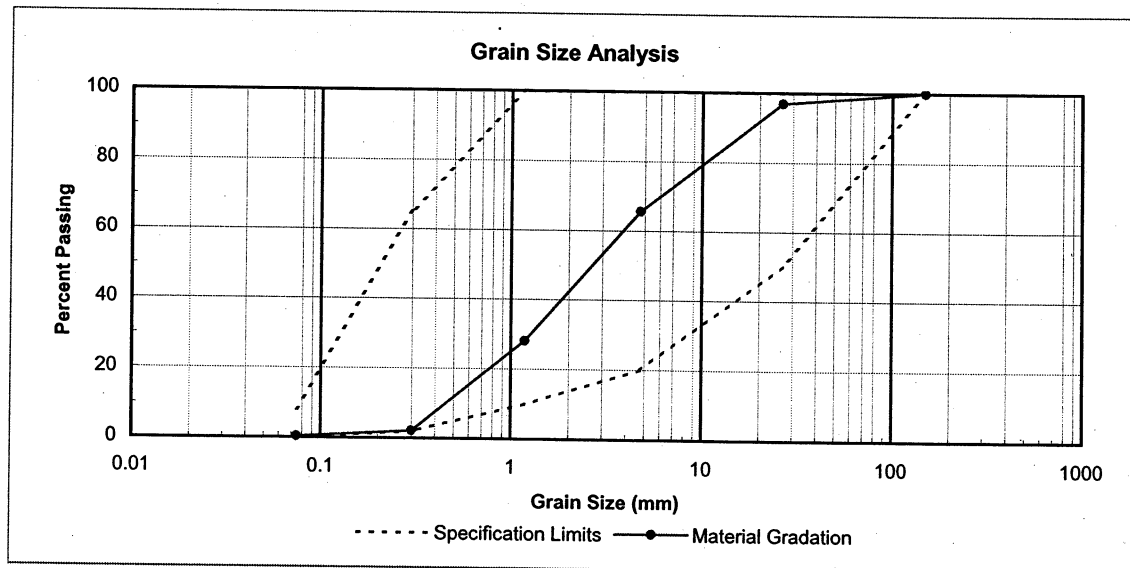
Appendix C

Laboratory Results for Proposed Gravel Source

Washed Sieve Analysis Test Report - Granular B Type I

Client: <u>M.T.O.</u>	Trow Project No.: <u>F-03183-A/G</u>
Client Project No.: <u>GWP 2012-03-00 - Sachigo</u>	Lab. No.: <u>173</u>
Project Description: <u>New MTO Garage and Terminal Buildings</u>	Contractor: <u>n/a</u>
Report To: <u>J.L.</u>	Sampled By/Date: <u>E.F. / 22-Jul-03</u>
Source of Material: <u>UTM 545 293E, 5 975 255N</u>	Date Tested: <u>06-Aug-03</u>
<u>(NAD83, Zone 15)</u>	

MTO Sieve Designation LS 602 - Figure 1	Cumulative Mass Retained	Percent Passing	Specifications: OPSS: 1010 Table 2
150 mm	0	100	100
106 mm			
75 mm			
53 mm			
37.5 mm			
26.5 mm	343.4	96.9	50 - 100
19 mm	877.3	92.1	
13.2 mm	1413.2	87.2	
9.5 mm	2123.9	80.8	
6.7 mm			
4.75 mm	3826.2	65.5	20 - 100
1.18 mm	117.9	28.1	10 - 100
0.3 mm	199.9	2.1	2 - 65
0.075 mm	205.2	0.4	0 - 8



Total Sample		[x] Washed [] Not Washed		Wash Pass 4.75 mm	
Wt. of dry sample + container		Wt. of dry sample + container		Wt. of dry sample + container	
Wt. of container		Wt. of container		Wt. of container	
Wt. of dry sample	11073.6	Wt. of dry sample		Wt. of dry sample	206.6
Remarks:					
Prepared By:					





Trow Associates Inc.

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e-mail: thunderbay@trow.com

Laboratory Test for Soil Compaction - Standard Proctor Method

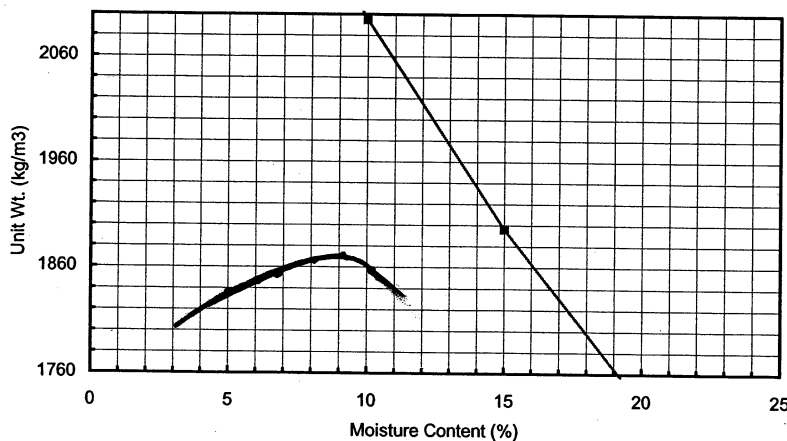
Client: MTO Trow Project No.: F-03183-A/G
Client Project No.: GWP 2012-03-00 - Sachigo Lab No.: 173
Project Description: New MTO Garage and Terminal Buildings Contractor: n/a
Report To: J.L. Sampled By/Date: E.F. / 22-Jul-03
Source of Material: UTM 545 293E, 5 975 255N, Tested By/Date: 06-Aug-03
(NAD83, Zone 15)

Test No.	1	2	3	4	5	6				
Water Added mL	508.5	102.1	97.6	92.7	88.8	82.2				
Mold + Wet Soil	10667.4	10722.1	10782.2	10848.1	10897.1	10913.3				
Tare (2.124) (.944)	6565.9	6565.9	6565.9	6565.9	6565.9	6565.9				
Wet Soil Mass	4101.5	4156.2	4216.3	4282.2	4331.2	4347.4				
Wet Density g/cm ³	1931.0	1956.8	1985.1	2016.1	2039.2	2046.8				

Moisture Content Determinations

Tin No.	CC	12	H	101	9	X				
Tin + Wet Soil	563.5	711.9	708.9	769.3	728.2	793.5				
Tin + Dry Soil	542.4	678.6	674.1	723.1	678.9	733.7				
Moisture Loss	21.1	33.3	34.8	46.2	49.3	59.8				
Tare	122.9	129.9	169.6	152.6	130.8	141.6				
Dry Soil Mass	419.5	548.7	504.5	570.5	548.1	592.1				
% Moist	5.0	6.1	6.9	8.1	9.0	10.1				
Dry Density g/cm ³	1839	1845	1857	1865	1871	1859				

Max. Wet Density g/cm³ 2039 Oversize Sieve 19 mm (% Ret'd) 7.9%
Ma. Dry Density g/cm³ 1870 MDD Corrected for Oversize: 1931
Optimum Moisture 9.0% Moisture Corrected for Oversize: 8.3%



Zero Air Voids

	Specific Gravity	
M.C.	2.65	2.7
5%	2340	2379
10%	2095	2126
15%	1896	1922
20%	1732	1753
25%	1594	1612

Moisture Content

(Moisture Loss/Dry Soil Mass) x 100

Wet Density (g/cm³)

(Wet Soil Mass/Vol. Mold)

Dry Density (g/cm³)

(Wet Density/(100 + %Moisture) x 100)

Remarks:

Date: Sept 11/03

Field Technician:

Appr. by: [Signature]

Ken Mosley, E.E.T.
Lab & Field Supervisor



Member of the Canadian Council
of Independent Laboratories



Certified Concrete
Testing Laboratory