

**Foundation Investigation and Design
Proposed MTO Garage and Terminal Building
Deer 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
P7E 6P6

Trow Associates Inc.

Barrie – Brantford – Brampton – Cambridge – Cornwall – Dorval – Hamilton – Iqaluit – Kamloops – Kingston – London – Markham
North Bay – Ottawa – Orillia – Sarnia – Sudbury – Thunder Bay – Vancouver – Victoria – Welland – Windsor – Tallahassee (USA)

Geocres No.: 53F-01
MTO Ref.: GWP 2015-92-00
Trow Ref.: F-03182-A/G
Date: February 4, 2004

1142 Roland Street
Thunder Bay, Ontario
P7B 5M4

Distribution:
Ministry of Transportation (3)
Trow Associates Inc. (1)

Telephone: (807) 623-9495
Facsimile: (807) 623-8070
email: thunderbay@trow.com

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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 Deer Lake Airport in Ontario. The approximate layout of the site is shown on Figure 1, Site Plan.

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 Deer Lake, Ontario.

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 and minor brush. 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 4 included in Appendix B of this report. As shown on the plan, two sites were investigated (noted as Site #1 and Site #2). Site #1 is located on the south side of the apron, adjacent to the MTO garage and MTO house while Site #2 is located just off the east side of the apron, adjacent to the existing terminal building.

Other facilities noted at the site included a diesel powered electrical generating plant and transformers (located about 50 m south of Site #1) and fuel storage tanks and associated pumping equipment (located generally west of Site #1).

3.0 Methodology

3.1 Field Work

The fieldwork was carried out between August 5 and 8, 2003 and consisted of advancing 21 test pits at the locations shown on Figure 2 as TP1 to TP21, inclusive. The test pits were excavated using a CAT 416B loader/backhoe owned and operated by the local First Nation Band Office. The test pits were terminated at depths ranging between 2.5 m and 3.4 m. While in some cases test pits were extended to refusal, maximum test pit depths were generally limited to the capability of the excavator. 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.

In addition to the test pits, two percolation tests were conducted in the area of the proposed septic field (see Figure 2). Percolation Test No. 1 was conducted near TP21 at a depth of about 0.6 m while Percolation Test No. 2 was conducted near TP20 at a depth of about 2.3 m. At each location, a hole was dug (by hand) measuring about 0.2 m in diameter by about 0.6 metres deep. To facilitate the test depth at Percolation Test No. 2, the top 1.7 m of overburden soils were removed prior to the test. The percolation tests were generally done in accordance with the procedures outlined in the Ontario Building Code (1997).

Following the geotechnical investigation, two potential sources for sand and gravel fill were sampled. Source #1 was a natural sand deposit located about 1.5 km from the proposed building site. Source #2 included a local quarry where crushed gravel was being produced. 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. Samples of the sand and gravel were then taken from random locations on the bladed surface to form composite samples of the two sources.

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, grain size analyses and moisture density relationship (standard Proctor) tests were conducted on samples taken from the proposed gravel sources. 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 (SP to GP) fill. The fill was generally described as loose to compact, brown, and damp to moist, containing some cobbles. In some cases, the fill was silty near the surface. This stratum extended to depths ranging between about 0.1 m and 0.6 m.

4.1.2 Clay

Beneath the fill in TP9 through TP21, inclusive, a layer of clay (CH) was encountered. The clay was described as stiff to very stiff, dark grey to brown and damp to moist. The clay was also observed to be fissured (with a blocky structure) and contained traces of organics and rootlets. The clay layer extended to depths ranging between 0.9 m and 1.4 m.

Atterberg limits testing conducted on four samples of clay indicated that the clay is generally of high plasticity. The natural moisture contents of these specimens were generally near the plastic limits. These data are presented on the Plasticity Chart, Figure 4, and summarized in the following Table 1.



Table 1: Summary of Atterberg Limits Testing					
Test Pit/Sample	TP10-S3	TP13-S3	TP16-S3	TP18-S2	TP20-S2
Liquid Limit, w_L	67	64	66	89	56
Plastic Limit, w_P	31	30	30	30	28
Plasticity Index, I_P	36	34	36	59	28
Moisture Content, w	33.0%	31.7%	33.1%	36.8%	29.1%

Based on the results of the percolation test and the Atterberg limit testing, the clay has an estimated hydraulic conductivity less than about 10^{-8} cm/s. This corresponds to a percolation rate (*t-time*) well in excess of 50 min/cm.

4.1.3 Silt

Underlying the clay in TP9 through TP21, inclusive, a compact, grey/brown, moist to wet silt (ML) was encountered. The silt was generally laminated and fissured (with a blocky structure), and often contained traces of clay (ML to CL). This stratum generally extended to depths ranging between 0.5 m and 2.0 m.

Grain size analyses were conducted on one representative sample of sandy silt taken from TP20. The results are presented on Figure 4.

Based on the results of the grain size analysis, the sandy silt has an estimated hydraulic conductivity ranging between 10^{-5} and 10^{-6} cm/s. This corresponds to a percolation rate (*t-time*) ranging between 40 min/cm and 50 min/cm.

4.1.4 Sand

In all of the test pits (TP1 through TP21), fine-grained sand (SP to SM) was encountered underlying the above strata. The sand was generally described as compact, brown, and damp to moist. This layer extended to the termination depth of all test pits.

Grain size analyses were conducted on seven representative samples of the sand. The results are presented on Figure 4.

Based on the results of the grain size analysis, the silty sand encountered in TP21 at a depth of 1.8 m has an estimated hydraulic conductivity ranging between 10^{-4} and 10^{-5} cm/s. This corresponds to a percolation rate (*t-time*) ranging between 25 min/cm and 40 min/cm.

A percolation test conducted in the native sand near TP20 at a depth of 2.3 m indicated a percolation rate of less than 1.0 min/cm.

4.1.5 Refusal

In a number of test pits (TP1, TP3, TP4 and TP5), refusal was encountered at depths of about 2.6 m. It is probable that the refusal is on bedrock; however, the presence of bedrock was not proven by coring and obtaining rock 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

Two potential gravel sources were sampled as part of the current investigation. Laboratory test results for the samples are presented in Appendix B of this report.

Source No. 1 consisted of a local naturally occurring sand and gravel deposit located about 1.5 km from the investigation area (UTM 427,320E and 5,834,401N, NAD 83, Zone 15). Based on the results of the grain size analyses, the 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 2,110 kg/m³ at an optimum water content of 8.5% by dry weight.

Source No. 2 consisted of a local quarry natural where crushed gravel was being produced (UTM 427,550E 5,834,282N, 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 2,100 kg/m³ at an optimum water content of 8.0% 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 most of the test hole locations, extending to depths ranging between about 0.1 m and 0.6 m. Underlying the fill at TP9 to TP21 (with the exception of TP11), high plastic clay was encountered, extending to depths ranging between about 0.9 m and 1.4 m. Beneath the clay at TP9 to TP21 and beneath the fill at TP11, a silt stratum was encountered, extending to depth of 0.5 m at TP11, and depths ranging between about 1.25 m and 2.0 m at the other tests pits noted.

The predominant native mineral soil encountered beneath the fill in TP1 to TP8 and beneath the silt and clay at TP9 to TP21 was compact sand. The native sand generally extended to refusal depths or beyond the termination depths of the test pits (between about 2.5 m and 3.4 m).

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 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 either one of two sites outlined at the subject airport. The proposed buildings will generally consist of single-story 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 capacities and other design and construction recommendations are based on our visual observations at the site, classification testing and our extensive experience with these types of soils.

2.0 Site Selection

As noted previously, two separate sites are being investigated for construction of the proposed buildings (noted as Site #1 and Site #2 on Figure 2).

In general, compact sand with relatively shallow refusal depth were encountered at Site #1 whereas Site #2 generally consisted of silt and clay (extending to depths ranging between 1.25 m and 2.0 m) overlying sand.

Based on the results of the geotechnical investigation, both Site #1 and Site #2 can support the proposed building loads.

The results of the Atterberg Limits testing indicated that the clay present at Site #2 is of high plasticity. Combined with the silt also present in these areas, the subgrade is susceptible to heaving and deformation if subjected to frost. Therefore, if Site #2 is selected, it should be heavily protected from frost using insulation. Alternatively, the clay soils can be removed from Site #2 prior to construction of the proposed buildings.

While the environmental conditions are detailed under separate cover, it is noted that minor contamination was encountered at Site #1. These conditions should also be taken into consideration prior to construction of the proposed buildings.

3.0 Frost Penetration

In the Deer Lake area, the frost penetration in unprotected areas such as roadways and parking areas can be as deep as 3.65 m. Accordingly, 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.

4.0 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, sand and silt soils are classified as Type 3 soil while the clay is 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 and/or otherwise deleterious soils should be removed to expose the native mineral soil. This will likely involve the removal of up to 0.6 m, or more, of soils. Additional excavation will also be required, as outlined in the following Section 5.0.

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 the laboratory testing, it appears that both potential sources of sand and gravel fill are suitable for use as structural fill.

The 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.

5.0 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.

5.1 Conventional Strip and Spread Footings

As discussed in Section 3.0, 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.

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 4.0.

As indicated previously, the subsurface conditions at Site #1 generally consisted of compact sand with relatively shallow refusal depth whereas silt and clay (extending to depths ranging between 1.25 m and 2.0 m) overlying sand was generally encountered at Site #2. The Ultimate Limit States (ULS) bearing resistances for the two potential building sites are given in the following Tables 2 and 3. The ULS bearing resistances are given 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).

Table 2: Factored Bearing Resistance at ULS – Site #1				
		Width of Footing (m)		
		0.6	0.9	1.2
Depth of Footing (m)	1.0	170	190	210
	1.6	250	270	290
	2.4	360	380	400
Notes: 1. Bearing resistances are expressed in kPa.				



Table 3: Factored Bearing Resistance at ULS – Site #2				
		Width of Footing (m)		
		0.6	0.9	1.2
Depth of Footing (m)	1.0	340	325	310
	1.6	250	270	290
	2.4	360	380	400
Notes: 1. Bearing resistances are expressed in kPa.				

For the conventional footings described above, the following Serviceability Limit States (SLS) bearing resistance for both potential building sites 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 4.0. 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/m³ 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 SM*TM, placed at a minimum depth of 600 mm. The following Table 4 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 4: 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.		

5.2 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 4.0.

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 1).

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 5.1, 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/m³ 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.

6.0 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.

7.0 Septic Field

Based on the results of the investigation, the clay at the site of the proposed septic field has a percolation rate well in excess of 50 min/cm. The sand underlying the clay at depth has a percolation rate of less than 1 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.

8.0 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.

9.0 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,

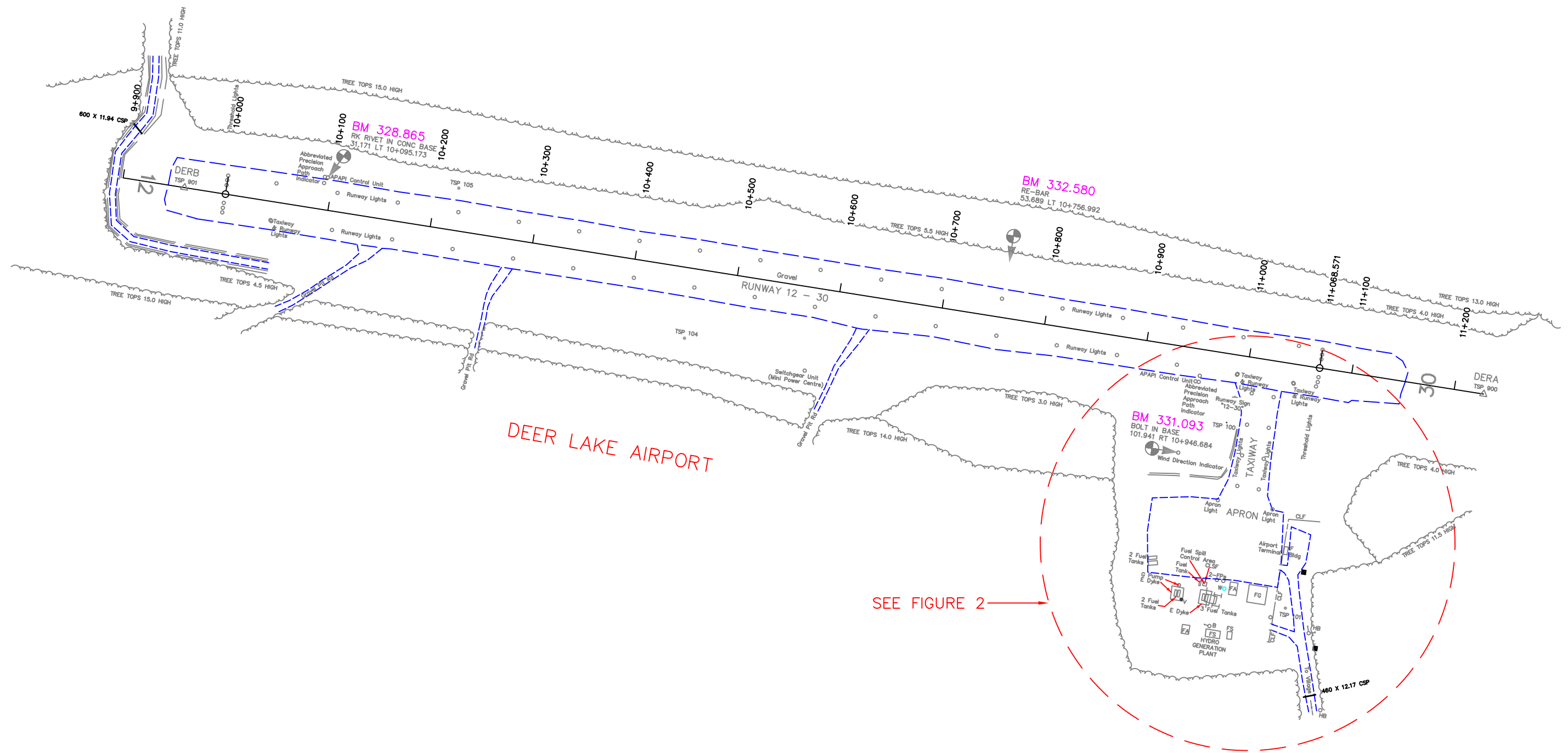
Trow Associates Inc.

John Lobbezoo, B.Eng.

Demetri N. Georgiou, MASc., P.Eng.
Principal Engineer
Thunder Bay Branch Manager

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

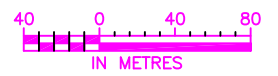
Figures




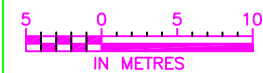
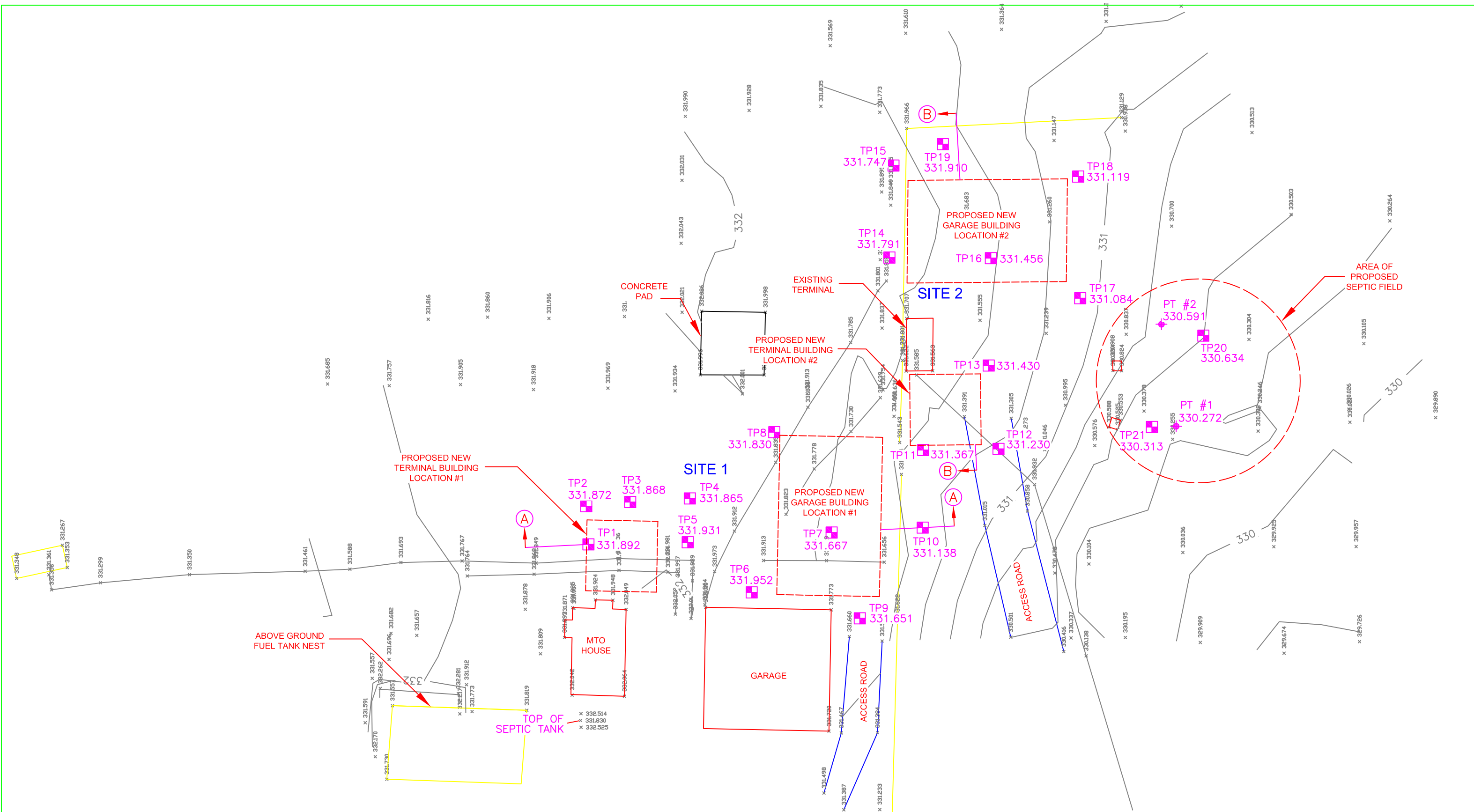
DEER LAKE AIRPORT

SEE FIGURE 2

Notes:
1) Reference: drawing provided by MTO.



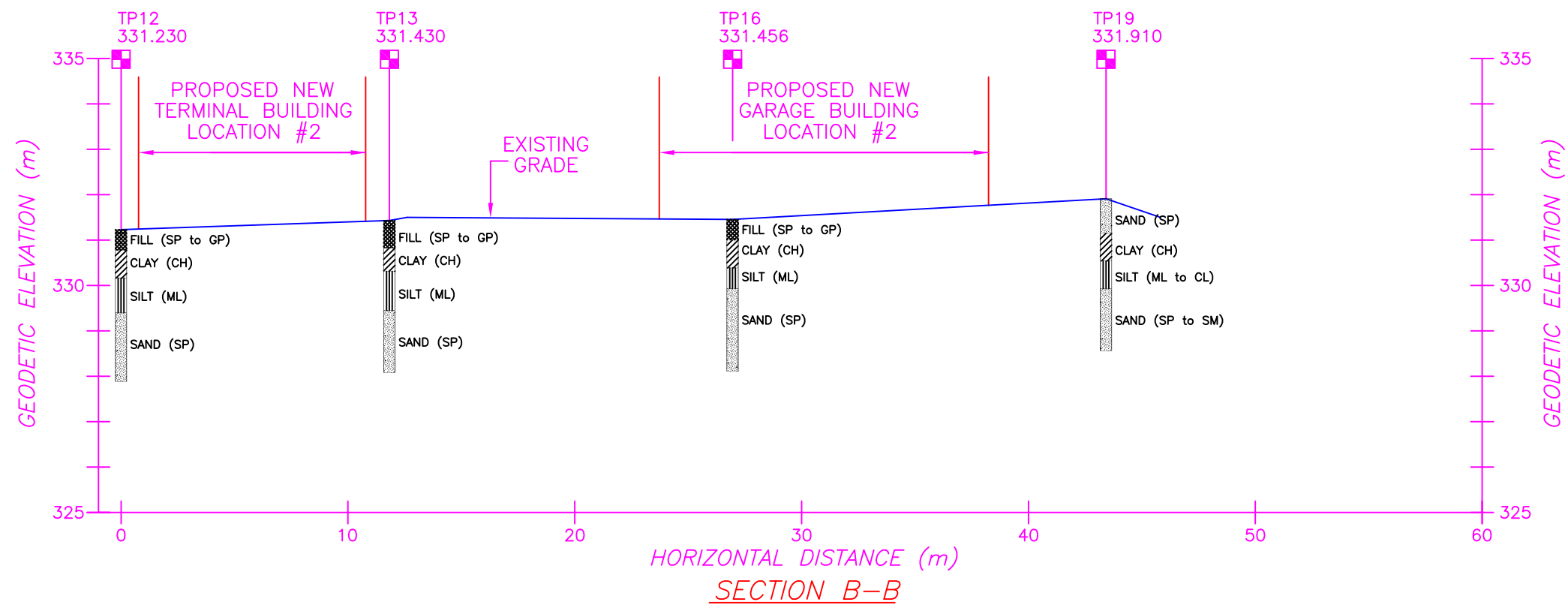
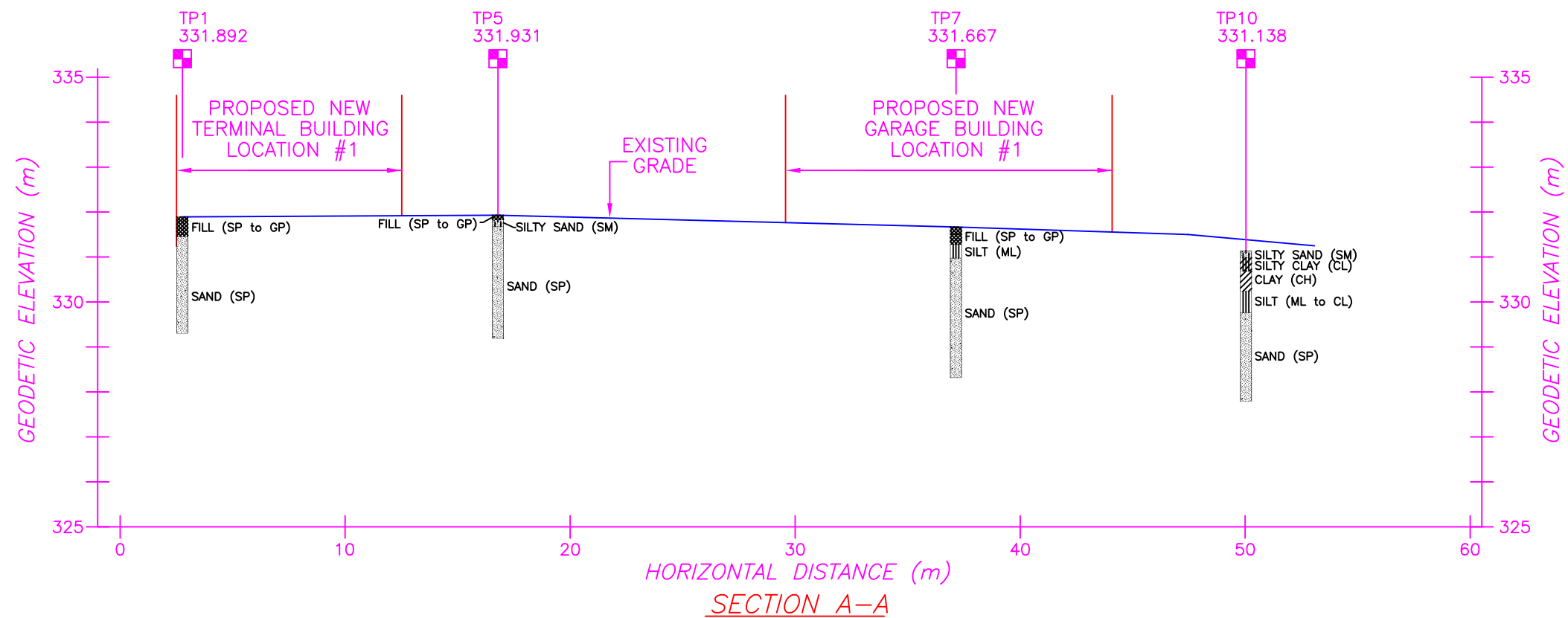
 Trow	Trow Associates Inc. Thunder Bay, Ontario		FIGURE 1
	KEY PLAN New MTO Garage and Terminal Building Deer Lake Airport Ministry of Transportation Ontario Geocres No. 53F-01		PROJECT NO.: F-03182-A/E SCALE: 1:4000 DRAWN BY: DT CHECKED BY: MV DATE: OCT. 2, 2003



- Legend:**
- TP2 244.355 ELEVATION (m)
 - PT #1 244.355 ELEVATION (m)
 - SPOT ELEVATION (m)

- Notes:**
- Reference: base drawing by provided by Delta Survey.
 - Elevations are geodetic and in metres, referenced to BM described as bolt in base of wind direction indicator Geodetic Elevation 331.093 metres (see Figure 1).

	Trow Associates Inc. Thunder Bay, Ontario		FIGURE 2
	TEST PIT LOCATION PLAN New MTO Garage and Terminal Building Deer Lake Airport Ministry of Transportation Ontario Geocres No. 53F-01		PROJECT NO.: F-03182-A/E SCALE: 1:500 DRAWN BY: DT CHECKED BY: MV DATE: OCT. 2, 2003



Notes:

- 1) Reference: based on plan by Delta Survey.
- 2) Elevations are geodetic and in metres, referenced to BM described as bolt in base of windsock. Geodetic Elevation 243.644 metres (see Figure 1).



Trow Associates Inc.
Thunder Bay, Ontario

FIGURE
3

STRATIGRAPHIC PROFILE
New MTO Garage and Terminal Building
Deer Lake Airport
Ministry of Transportation Ontario
Geocres No. 53F-01

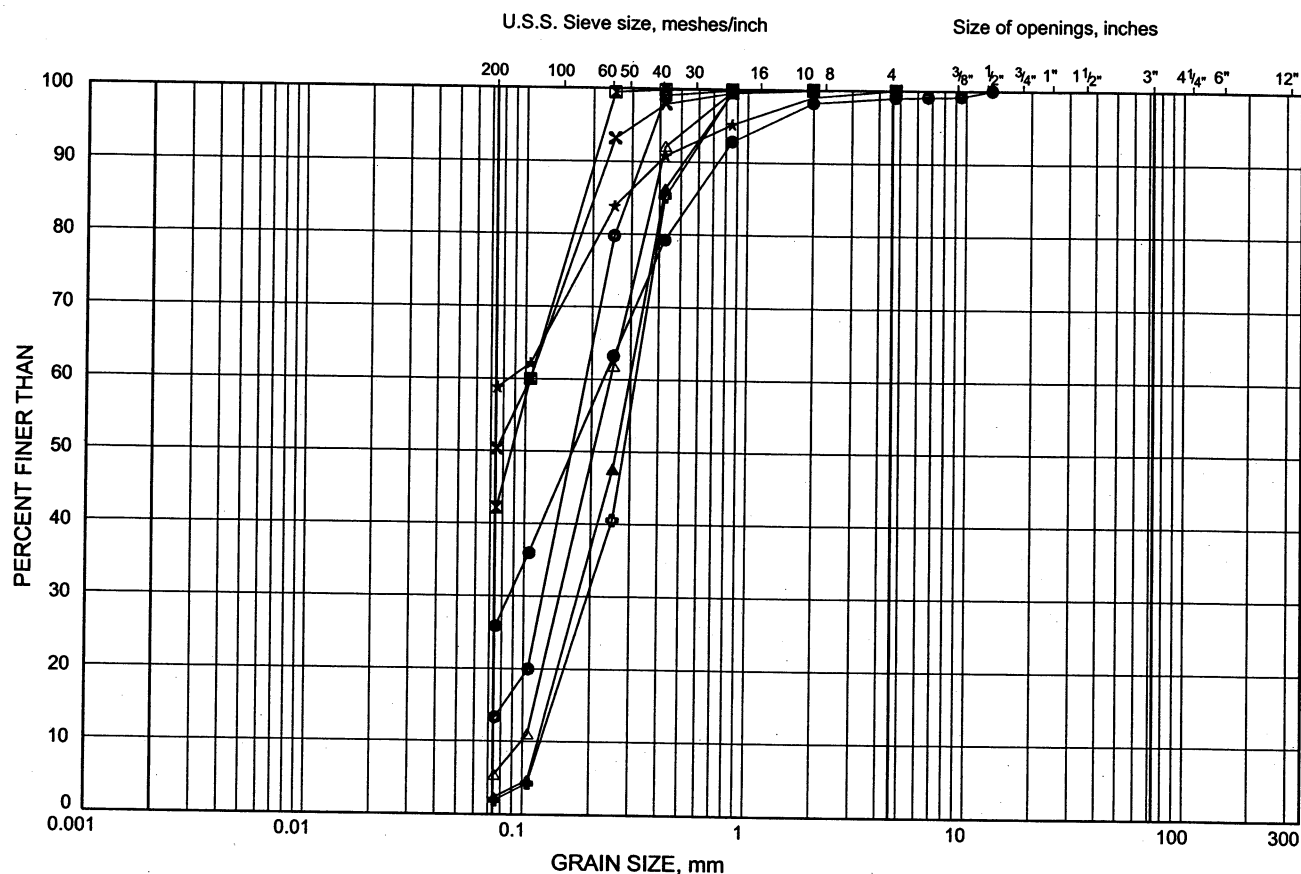
PROJECT NO.:	F-03182-A/G
SCALE:	1:250H/1:125V
DRAWN BY:	DT
CHECKED BY:	MV
DATE:	SEPT. 24, 2003



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

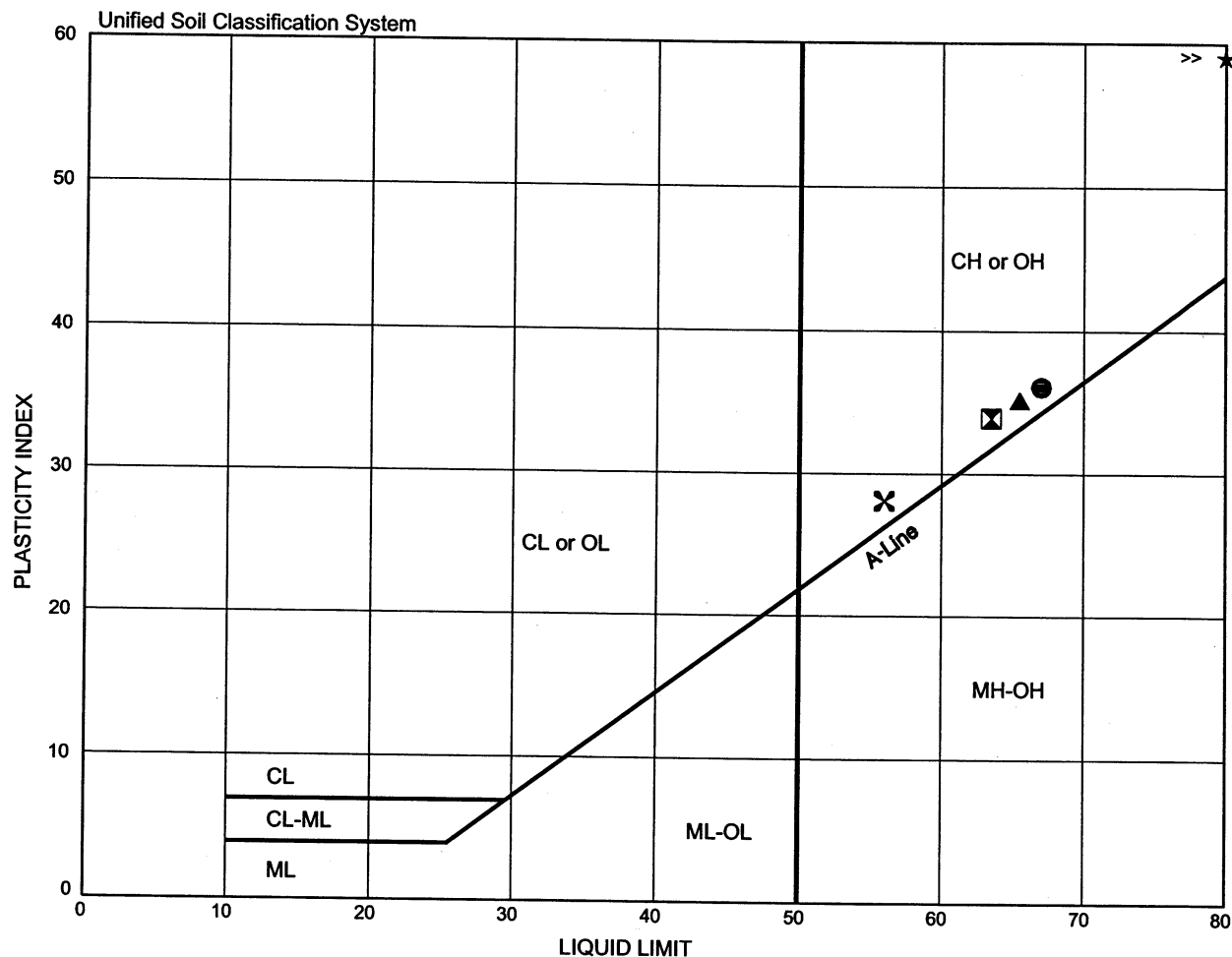
Symbol	Location	Sample No.	Mid-Sample Depth (m)	Elevation (m)	D ₁₀ (mm)	C _u	C _c
●	TP11	3	1.22	330.16	0.118	2.5	0.9
■	TP17	5	1.52	329.56			
▲	TP2	3	0.90	330.97			
*	TP20	3	1.14	329.49			
x	TP21	5	1.83	328.48	0.121	2.6	1.0
⊕	TP5	4	1.07	330.86			
○	TP7	5	1.30	330.37			
△	TP8	3	1.22	330.61			



Plasticity Chart

Figure 5

Trow Thunder Bay Branch



Symbol	Location	Sample No.	Depth (m)	Elevation (m)	W	V_p	V_L	PI
●	TP10	3	0.68	330.46	33.0	31	67	36
⊠	TP13	3	0.85	330.58	31.7	30	64	34
▲	TP16	3	0.76	330.70	33.1	31	66	35
★	TP18	2	0.60	330.52	36.8	30	89	59
✕	TP20	2	0.45	330.18	29.1	28	56	28

Appendix A

Test Pit Logs



Trow Thunder Bay Branch

TEST PIT LOG

TP1

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 6/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W _p W W _L —○— 20 40 60 80
				TYPE	NUMBER		
0	331.89						
	331.82	SAND & GRAVEL (FILL)- compact, brown, damp (SP to GP)		BS	1		
		SAND (FILL)- compact, brown, damp, trace gravel (SP)		BS	2		
	331.46						
		SAND- compact, brown, damp, fine grained (SP)		BS	3		
-1							
				BS	4		
-2							
	329.30	- wet from 2.4m depth		BS	5		
-3		End of Test Pit-Refusal on Assumed Bedrock					
-4							

NOTES

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

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 and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 6/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W _p W W _L ———— 20 40 60 80
				TYPE	NUMBER		
0	331.87	SAND & GRAVEL (FILL) - compact, brown, damp (SP to GP)		BS	1		
	331.74	SAND (FILL) - compact, brown to rusty brown, damp, trace gravel (SP)		BS	2		
	331.42	SAND - compact, brown, damp, fine grained (SP)					
-1				BS	3		
-2		- wet from 2.4m depth		BS	4		
-3		- trace gravel at 3.0m depth		BS	5		
	328.52			BS	6		
		End of Test Pit					
-4							

NOTES

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

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

TP3

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E










CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 6/03

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	
							40 80 kPa Atterberg Limits and Moisture W _p W W _L └─○─┘	
0	331.87							
	331.72	SAND & GRAVEL (FILL)- compact, brown, damp (SP to GP)		BS	1			
		SAND- compact, brown, damp, trace gravel, rust staining (SP)		BS	2			
		- fine grained from 0.45m depth						
-1				BS	3			
								
				BS	4			
-2								
				BS	5			
	329.28	- trace gravel, occ. cobbles & boulders to ~0.4m dia. from 2.4m depth						
		End of Test Pit-Refusal on Assumed Bedrock						
-3								
-4								
-5								

NOTES

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

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 |
| Y 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)

TEST PIT LOG

TP4

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM **Geodetic**

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 6/03

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
							Atterberg Limits and Moisture W_p W W_L	
							40	80 kPa
0	331.87	SAND & GRAVEL (FILL)- compact, brown, damp (SP to GP)		BS	1			
	331.77	SAND (FILL)- compact, brown, damp, trace gravel (SP)		BS	2			
				BS	3			
	331.18	SAND- compact, brown, damp, fine grained (SP)		BS	4			
				BS	5			
	329.33	- wet from 2.4m depth		BS	6			
		End of Test Pit-Refusal on Assumed Bedrock						
3								
4								
5								

NOTES

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

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 |
| Y 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

TP5

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 6/03

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 40 80 kPa Atterberg Limits and Moisture W_P W W_L 	
0	331.93							
	331.83	SAND & GRAVEL (FILL)- compact, brown, damp (SP to GP)	XXXX	BS	1			
	331.68	SILTY SAND- compact, brown, moist, trace gravel (SM)	XXXX	BS	2			
		SAND- compact, brown, moist, fine grained, trace silt to 0.76m depth (SP)		BS	3			
-1				BS	4			
				BS	5			
-2				BS	6			
		- grey/brown, wet, trace silt from 2.4m depth						
	329.19	End of Test Pit-Refusal on Assumed Bedrock						
-3								
-4								
-5								

NOTES

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

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)

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E




CLIENT Ministry of Transportation Ontario

DATUM **Geodetic**

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 6/03

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	
							Atterberg Limits and Moisture W_p W W_L	
0	331.95						40	80 kPa
		SAND (FILL)- compact, brown, moist, trace to some silt, trace gravel, roots & rootlets (SP)		BS	1			
	331.44							
	331.29	SILT- dense, grey, moist, roots & rootlets (ML)		BS	2			
-1		SAND- compact, brown, damp, fine grained (SP)		BS	3			
-2				BS	4			
-3				BS	5			
	328.60	End of Test Pit						
-4								
-5								

NOTES

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

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

TP7

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W _P W W _L 20 40 60 80
				TYPE	NUMBER		
0	331.67						
	331.52	SAND & GRAVEL (FILL)- dense, brown, damp (SP to GP)		BS	1		
	331.29	SAND (FILL)- compact, brown, damp to moist, trace peat, roots & rootlets (SP)		BS	2		
		SILT- compact, grey/brown, moist, trace clay, roots & rootlets (ML)		BS	3		
	330.98						
		SAND- compact, brown, damp, trace silt (SP) - becoming fine grained, rust staining at depth		BS	4		
-1							
				BS	5		
-2							
-3				BS	6		
	328.32	End of Test Pit					
-4							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Some caving in TP below 1.2m depth.

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

TP8

Sheet 1 of 1

PROJECT New MTO Garage and Terminal BuildingsPROJECT NO. F-03182-A/ECLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Cat 416B Loader/BackhoeDATES: Excavating Aug. 7/03Water 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	331.83	SAND & GRAVEL (FILL)- dense, brown, damp (SP to GP)		BS	1		
	331.53	SAND- compact, brown, damp, trace gravel, rust staining (SP)		BS	2		
-1		- fine grained from 0.7m depth		BS	3		
-2	329.39			BS	4		
	329.24	SILTY SAND- compact, grey, moist, trace gravel (SM)		BS	4		
-3		End of Test Pit-Refusal on Assumed Bedrock					
-4							

NOTES

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

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 and Terminal BuildingsPROJECT NO. F-03182-A/ECLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Cat 416B Loader/BackhoeDATES: Excavating Aug. 6/03Water 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	331.65						40 80 kPa 20 40 60 80
	331.55	SAND- loose, brown, damp, fine grained (SP)		BS	1		
	331.45	SAND & GRAVEL- loose to compact, brown, damp (SP to GP)		BS	2		
		CLAY- very stiff, dark grey, damp, roots & rootlets (CH)		BS	3		
				BS	4		
1	330.75			BS	5		
		SILT- compact, brown, damp, blocky, rootlets, rust staining (ML) - becoming moist to wet from 1.37m depth		BS	6		
				BS	7		
2	329.97			BS	8		
		SAND- compact, brown, damp to moist, fine grained (SP)					
3							
	328.30	End of Test Pit					
4							
5							

NOTES

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

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 and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

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>40</div> <div>80 kPa</div> </div> </div> <div> <div>Atterberg Limits and Moisture</div> <div> <div>W_p</div> <div>W</div> <div>W_L</div> </div> </div> <div> <div>20</div> <div>40</div> <div>60</div> <div>80</div> </div>
				TYPE	NUMBER		
0	331.14						
	330.99	SILTY SAND- loose to compact, brown, damp, trace gravel (SM)		BS	1		
	330.69	SILTY CLAY- stiff, rusty brown, moist, blocky, trace organics (CL)		BS	2		
	330.24	CLAY- stiff, brown, moist, blocky, trace organics (CH)		BS	3		
1		SILT- compact, brown, moist, blocky, trace clay, laminated (ML to CL)		BS	4		
	329.77	SAND- compact, brown, damp, fine grained (SP)		BS	5		
2							
3							
	327.79	End of Test Pit					
4							
5							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Slight caving in TP below 1.5m depth.

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 and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

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	331.38						40 80 kPa
		SAND & GRAVEL- dense, brown, damp, some crushed rock, cobbles (SP to GP)		BS	1		
	331.02						
	330.85	SILT- compact, grey/brown, moist, trace sand & clay, roots (ML)		BS	2		
		SAND- compact, brown, damp, some silt (SP)					
-1				BS	3		
-2							
-3				BS	4		
	328.03	End of Test Pit					
-4							

NOTES

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

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

TP12

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

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	331.23						
	331.16	SAND & GRAVEL (FILL)- dense, brown, damp (SP to GP)		BS	1		
		SAND (FILL)- compact, brown, damp, trace gravel, occ. boulder (SP)		BS	2		
	330.78						
		CLAY- very stiff, brown, moist, roots & rootlets, trace organics (CH)		BS	3		
1	330.16						
		SILT- compact, brown, moist, trace clay (ML)		BS	4		
	329.40						
2		SAND- compact, brown, damp, fine grained (SP)		BS	5		
				BS	6		
	327.88	End of Test Pit					
4							
5							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Slight caving in TP below 1.8m depth.

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

TP13

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W _P W W _L 20 40 60 80
				TYPE	NUMBER		
0	331.43	SAND & GRAVEL (FILL) - dense, brown, damp (SP to GP)		BS	1		
	331.28	SAND (FILL) - compact, brown, damp, trace gravel, occ. cobbles (SP)		BS	2		
	330.83	CLAY - stiff to very stiff, brown, moist, blocky, stumps, branches (CH)		BS	3		
-1	330.31	SILT - compact, grey/brown, moist, laminated, trace rootlets (ML)		BS	4		
	329.45	SAND - compact, brown, damp, fine grained (SP)		BS	5		
-2							
-3							
	328.08	End of Test Pit					
-4							

NOTES

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

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

TP14

Sheet 1 of 1

PROJECT New MTO Garage and Terminal BuildingsPROJECT NO. F-03182-A/ECLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Cat 416B Loader/BackhoeDATES: Excavating Aug. 7/03Water 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	331.79						
	331.49	SAND- loose, brown, damp, fine grained, trace silt & gravel, roots & rootlets (SP)		BS	1		
		CLAY- very stiff, grey, moist, rust staining, trace organics (CH) - becoming stiff, brown, blocky at depth		BS	2		
	330.89			BS	3		
1		SILT- compact, grey/brown, moist, trace clay (ML to CL)		BS	4		
	330.27						
		SAND- compact, brown, damp, fine grained (SP)		BS	5		
2							
3				BS	6		
	328.44	End of Test Pit					
4							
5							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Some caving in TP below 1.5m depth.

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

TP15

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 8/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ♦ S Field Vane Test ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W _P W W _L 20 40 60 80
				TYPE	NUMBER		
0	331.75	SAND- loose, brown, damp, trace gravel & silt, occ. cobbles, roots & rootlets (SP)		BS	1		
	331.32	SILTY CLAY- stiff, grey, moist, blocky, rootlets, rust staining (CL)		BS	2		
	331.04	CLAY- stiff, brown, moist, blocky (CH)		BS	3		
-1	330.73	SILT- compact, brown, moist, trace clay, blocky (ML to CL)		BS	4		
	330.23	SAND- compact, brown, damp, fine grained (SP)		BS	5		
-2							
-3							
	328.40	End of Test Pit					
-4							
-5							

NOTES

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

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)

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH	
				TYPE	NUMBER		Atterberg Limits and Moisture	
							W _p	W _L
0	331.46						40	80 kPa
	331.36	SAND & GRAVEL (FILL)- compact, brown, damp (SP to GP)		BS	1			
		SAND (FILL)- compact, brown, damp, trace gravel, occ. cobbles (SP)		BS	2			
	331.01	CLAY- stiff, brown/grey, moist, trace silt, roots & rootlets (CH)		BS	3			
-1	330.39	SILT- compact, brown, moist, blocky, rootlets (ML)		BS	4			
	329.94	SAND- compact, brown, damp, fine grained, occ. boulder (SP)		BS	5			
-2				BS	6			
-3	328.11	End of Test Pit						
-4								
-5								

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Slight caving in TP below 1.5m depth.

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 | UU Unconfined Compression |
| K Lab Permeability | DS Direct Shear |

WATER LEVELS

- ▽ Apparent ▼ Measured ▲ Artesian (see Notes)

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM **Geodetic**

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating **Aug. 7/03**

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	
							Atterberg Limits and Moisture W_P W W_L	
0	331.08						40	80 kPa
	330.93	SAND & GRAVEL (FILL)- compact, brown, damp (SP to GP)		BS	1			
	330.78	SAND- compact, brown, damp, trace gravel (SP)		BS	2			
		CLAY- stiff, brown, moist, blocky, trace silt, roots & rootlets, rust staining (CH)		BS	3			
-1	330.18							
		SILT- compact, grey/brown, moist, laminated, trace rootlets (ML)		BS	4			
	329.86	SAND- compact, brown, damp, silty (SM)		BS	5			
-2		- large boulders from 1.8-2.7m depth						
-3								
	327.73			BS	6			
		End of Test Pit						
-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 groundwater encountered.
- 4) Slight caving in TP below 1.2m depth.

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 |
| Y 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

TP18

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

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	331.12						
	330.97	SAND & GRAVEL (FILL)- loose, brown, damp, roots & rootlets (SP to GP) CLAY- stiff, brown, moist, fissured, trace silt, roots & rootlets (CH)		BS	1		
				BS	2		
1	330.05						
	329.75	SILT- compact, grey/brown, moist, blocky, trace clay (ML to CL)		BS	3		
		SAND- compact, brown, damp, some silt (SP to SM)		BS	4		
2							
3							
	327.77			BS	5		
		End of Test Pit					
4							
5							

NOTES

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

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

TP19

Sheet 1 of 1

PROJECT New MTO Garage and Terminal BuildingsPROJECT NO. F-03182-A/ECLIENT Ministry of Transportation OntarioDATUM GeodeticEXCAVATOR Cat 416B Loader/BackhoeDATES: Excavating Aug. 7/03Water Level N/A

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	SAMPLES		OTHER TESTS	SHEAR STRENGTH ◆ S Field Vane Test ▲ Penetrometer ■ Torvane 40 80 kPa Atterberg Limits and Moisture W _p W W _L 20 40 60 80
				TYPE	NUMBER		
0	331.91	SAND- loose, brown, damp, fine grained, trace gravel, rootlets (SP)		BS	1		
1	331.15	CLAY- stiff, brown/grey, moist, roots & rootlets, blocky, rust staining (CH)		BS	2		
	330.54	SILT- compact, grey/brown, moist, blocky, trace clay, laminated, rootlets (ML to CL)		BS	3		
2	329.93	SAND- compact, brown, damp, some silt (SP to SM)		BS	4		
3	328.56	End of Test Pit					
4							

NOTES

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

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

TP20

Sheet 1 of 1

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM Geodetic

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

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	330.63						
	330.48	SILTY SAND- loose, brown, damp, roots & rootlets, trace gravel, occ. boulder to ~0.5m dia. (SM)		BS	1		
		CLAY- very stiff, brown, moist, trace silt, roots & rootlets, blocky (CH)		BS	2		
1	329.73						
	329.26	SILT- compact, grey/brown, moist, blocky, laminated, sandy, trace clay (ML to SM)		BS	3		
2		SAND- compact, brown, damp to moist, trace silt (SP)		BS	4		
3				BS	5		
	327.28	End of Test Pit					
4							

NOTES

- 1) For definition of symbols & terms used on logs, see sheets prior to logs.
- 2) Compactness/consistency of soils as shown in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Slight to some caving in TP below 1.5m depth.

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)

PROJECT New MTO Garage and Terminal Buildings

PROJECT NO. F-03182-A/E

CLIENT Ministry of Transportation Ontario

DATUM **Geodetic**

EXCAVATOR Cat 416B Loader/Backhoe

DATES: Excavating Aug. 7/03

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	
							40	80 kPa
0	330.31						Atterberg Limits and Moisture	
	330.24	SANDY SILT - loose, brown, damp, roots & rootlets (SM)		BS	1		W _P	W _L
	329.93	SILTY CLAY - stiff, grey/brown, damp, blocky, roots & rootlets (CL)		BS	2			
	329.41	CLAY - very stiff, brown, moist, blocky, rootlets, trace organics (CH)		BS	3			
1	328.94	SILT - compact, grey/brown, moist, blocky, laminated (ML)		BS	4			
2		SAND - compact, brown, damp, silty (SM)		BS	5			
3	326.96			BS	6			
4		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 in based on a visual assessment of the test pit excavation and our experience with these soil types.
- 3) No groundwater encountered.
- 4) Slight to some caving in TP below 1.5m depth.

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)

Appendix B

Site Photographs



Photo 1: Looking southwest at Site #1. Note the existing MTO garage building (left), the MTO house (center-right) and the electrical generating station (brown building in right-background)



Photo 2: Looking south at the MTO house and garage facilities.



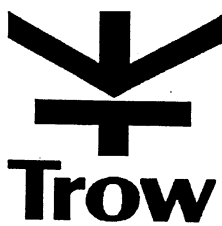
Photo 3: Looking northeast at Site #2. Note the existing terminal building (center-right).



Photo 4: Looking southeast at Site #2. Note existing terminal building (center).

Appendix C

Laboratory Results for Proposed Gravel Sources



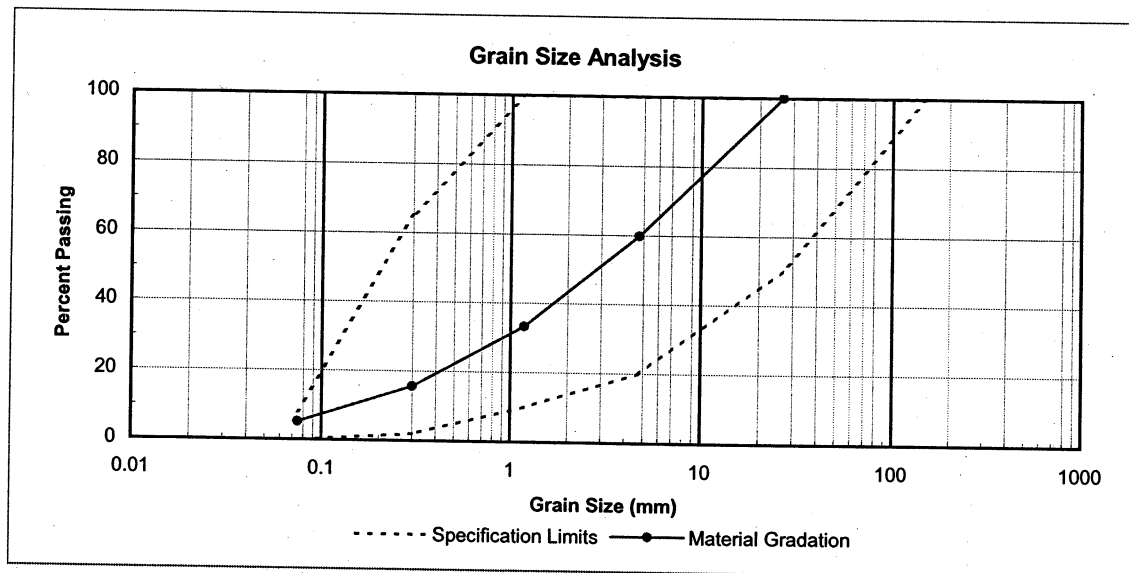
Trow Associates Inc.

1142 Roland Street
Thunder Bay, Ontario P7B 5M4
Telephone (807) 623-9495
Facsimile (807) 623-8070
E-mail: thunderbay@trow.com

Washed Sieve Analysis Test Report - Granular B Type I

Client:	Ministry of Transportation Ontario	Trow Project No.:	F-03182
Client Project No.:	New MTO Garage & Terminal Buildings	Lab. No.:	248
Project Description:	GWP-2015-92-00-Deer Lake	Contractor:	n/a
Report To:	J.L.	Sampled By/Date:	E.F. / 08-Aug-03
Source of Material:	Source #1 - UTM 427,320E & 5,834,401N (NAD83, Zone 15)	Date Tested:	28-Aug-03

MTO Sieve Designation LS 602 - Figure 1	Cumulative Mass Retained	Percent Passing	Specifications: OPSS: 1010 Table 2
150 mm			100
106 mm			
75 mm			
53 mm			
37.5 mm			
26.5 mm	0	100	50
19 mm	0	100	
13.2 mm	726.6	93.4	
9.5 mm	2152.2	80.4	
6.7 mm			
4.75 mm	4427.4	59.8	20 - 100
1.18 mm	102.8	33.2	10 - 100
0.3 mm	170.7	15.6	2 - 65
0.075 mm	211.2	5.1	0 - 8



Total Sample		Wash Pass 4.75 mm	
Wt. of dry sample + container	12721.6	Wt. of dry sample + container	
Wt. of container	1717.4	Wt. of container	
Wt. of dry sample	11004.2	Wt. of dry sample	231.0

Remarks:

Prepared By:



Member of the Canadian Council
of Independent Laboratories



Certified Concrete
Testing Laboratory





Trow Associates Inc.

1142 Roland Street
Thunder Bay, Ontario P7B 5M4
Telephone (807) 623-9495
Facsimile (807) 623-8070
E-mail: thunderbay@trow.com

Laboratory Test for Soil Compaction - Standard Proctor Method

Client: Ministry of Transportation Ontario
Client Project No.: New MTO Garage & Terminal Buildings
Project Description: GWP-2015-92-00-Deer Lake
Report To: J.L.
Source of Material: Source #1, UTM 427,320E & 5,834,401N (NAD83, Zone 15)

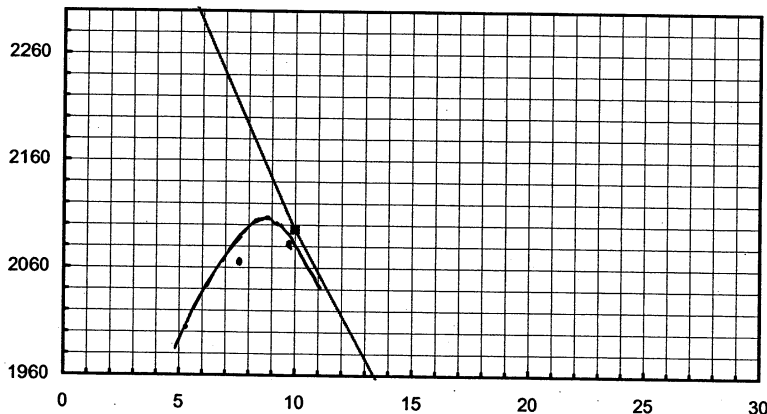
Trow Project No.: F-03182
Lab No.: 248
Contractor: n/a
Sampled By/Date: E.F./08-Aug-03
Tested By/Date: D.K./28-Aug-03

Test No.	1	2	3	4						
WaterAdded mL	432.7	202.6	97.3	91.5						
Mold + Wet Soil	11051.1	11295.7	11429.5	11407.9						
Tare (2.124) (.944)	6563.3	6563.3	6563.3	6563.3						
Wet Soil Mass	4487.8	4732.4	4866.2	4844.6						
Wet Density g/cm ³	2112.9	2228.1	2291.1	2280.9						

Moisture Content Determinations

Tin No.	10	6	2	X						
Tin + Wet Soil	509.2	566.2	588.8	584.6						
Tin + Dry Soil	490.54	481.1	555.2	546.3						
Moisture Loss	18.66	25.1	33.6	38.3						
Tare	132.5	145.8	164.3	143.6						
Dry Soil Mass	358.04	335.33	390.9	402.7						
% Moist	5.2	7.5	8.6	9.5						
Dry Density g/cm ³	2008	2073	2110	2083						

Max. Wet Density g/cm³ 2291 Oversize Sieve 19 mm (% Ret'd) 0.0%
Ma. Dry Density g/cm³ 2110 MDD Corrected for Oversize: _____
Optimum Moisture 8.5% Moisture Corrected for Oversize _____



Zero Air Voids

M.C.	Specific Gravity	
	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)

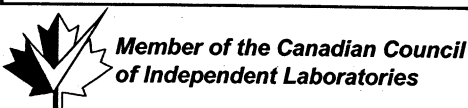
Remarks:

Date: _____

Field Technician:

Approved by: _____

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



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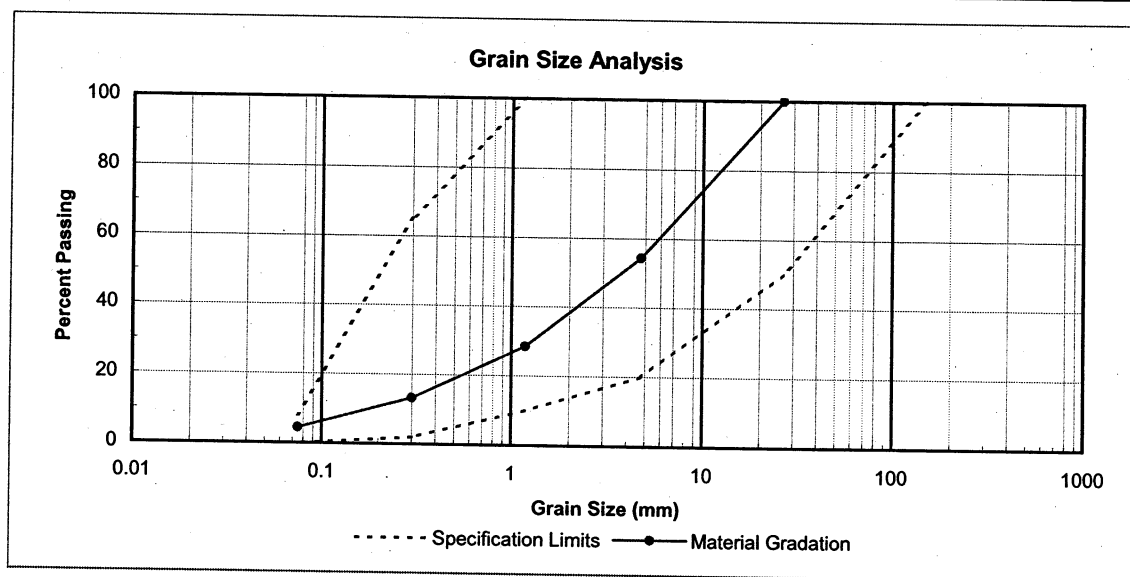
Trow Associates Inc.

1142 Roland Street
Thunder Bay, Ontario P7B 5M4
Telephone (807) 623-9495
Facsimile (807) 623-8070
E-mail: thunderbay@trow.com

Washed Sieve Analysis Test Report - Granular B Type I

Client:	Ministry of Transportation Ontario	Trow Project No.:	F-03182
Client Project No.:	New MTO Garage & Terminal Buildings	Lab. No.:	248
Project Description:	GWP-2015-92-00-Deer Lake	Contractor:	n/a
Report To:	J.L.	Sampled By/Date:	E.F. / 08-Aug-03
Source of Material:	Source #2 - UTM 427,550E & 5,834,282N (NAD83, Zone 15)	Date Tested:	D.K. /28-Aug-03

MTO Sieve Designation LS 602 - Figure 1	Cumulative Mass Retained	Percent Passing	Specifications: OPSS: 1010 Table 2
150 mm			100
106 mm			
75 mm			
53 mm			
37.5 mm			
26.5 mm	0	100	50
19 mm	0	100	
13.2 mm	839	92	
9.5 mm	2388.3	77.3	
6.7 mm			
4.75 mm	4792.5	54.4	20 - 100
1.18 mm	88	28.5	10 - 100
0.3 mm	139.9	13.2	2 - 65
0.075 mm	170	4.4	0 - 8



Total Sample		[x] Washed [] Not Washed	Wash Pass 4.75 mm	
Wt. of dry sample + container	12199.6	Wt. of dry sample + container		
Wt. of container	1699.7	Wt. of container		
Wt. of dry sample	10499.9	Wt. of dry sample	184.9	

Remarks:

Prepared By:

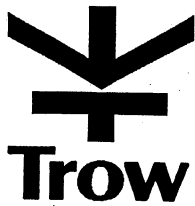


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Laboratory Test for Soil Compaction - Standard Proctor Method

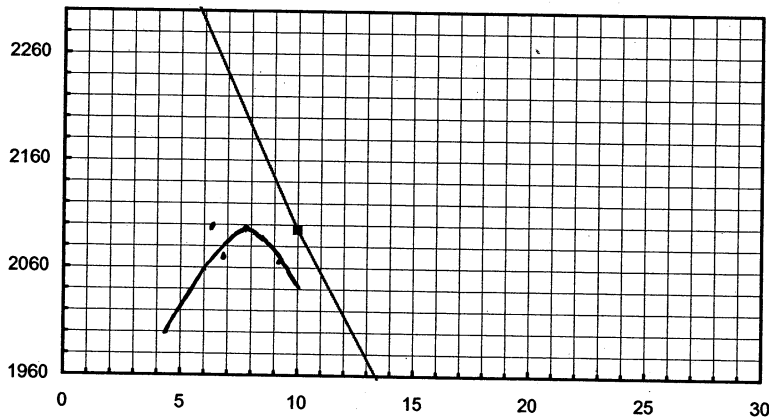
Client: Ministry of Transportation Ontario Trow Project No.: F-03182
Client Project No.: New MTO Garage & Terminal Buildings Lab No.: 248
Project Description: GWP-2015-92-00-Deer Lake Contractor: n/a
Report To: J.L. Sampled By/Date: E.F./08-Aug-03
Source of Material: Source #2, UTM 427,550E & 5,834,282N (NAD83, Zone 15) Tested By/Date: D.K./28-Aug-03

Test No.	1	2	3	4	5						
Water Added mL	479.0	202.6	90.4	85.3	80.7						
Mold + Wet Soil	11018.1	11295.7	11267.9	11365.5	11353.0						
Tare (2.124) (.944)	6563.2	6563.2	6563.2	6563.2	6563.2						
Wet Soil Mass	4454.9	4732.5	4704.7	4802.3	4789.8						
Wet Density g/cm ³	2097.4	2228.1	2215.0	2261.0	2255.1						

Moisture Content Determinations

Tin No.	B	X	I	G	Q						
Tin + Wet Soil	702.8	708.3	710.3	742.9	694.8						
Tin + Dry Soil	678.1	677.7	675.3	700.7	649.0						
Moisture Loss	24.7	30.6	35.0	42.2	45.8						
Tare	173.1	174.9	154.6	156.6	146.3						
Dry Soil Mass	505.0	502.8	520.7	544.1	502.7						
% Moist	4.9	6.1	6.7	7.8	9.1						
Dry Density g/cm ³	2000	2100	2076	2098	2067						

Max. Wet Density g/cm³ 2261 Oversize Sieve 19 mm (% Ret'd) 0.0%
Ma. Dry Density g/cm³ 2100 MDD Corrected for Oversize:
Optimum Moisture 8.0% Moisture Corrected for Oversize



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: _____

Field Technician:

Approved by: _____

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