GEOCRES No: 52E-47

TBT Engineering
Consulting Engineers

GEOTECHNICAL DESIGN REPORT

G.W.P. NO. 87-97-00

LOCATION:

Highway 17, from 22.3 km east of Junction 71 easterly 2.04 km

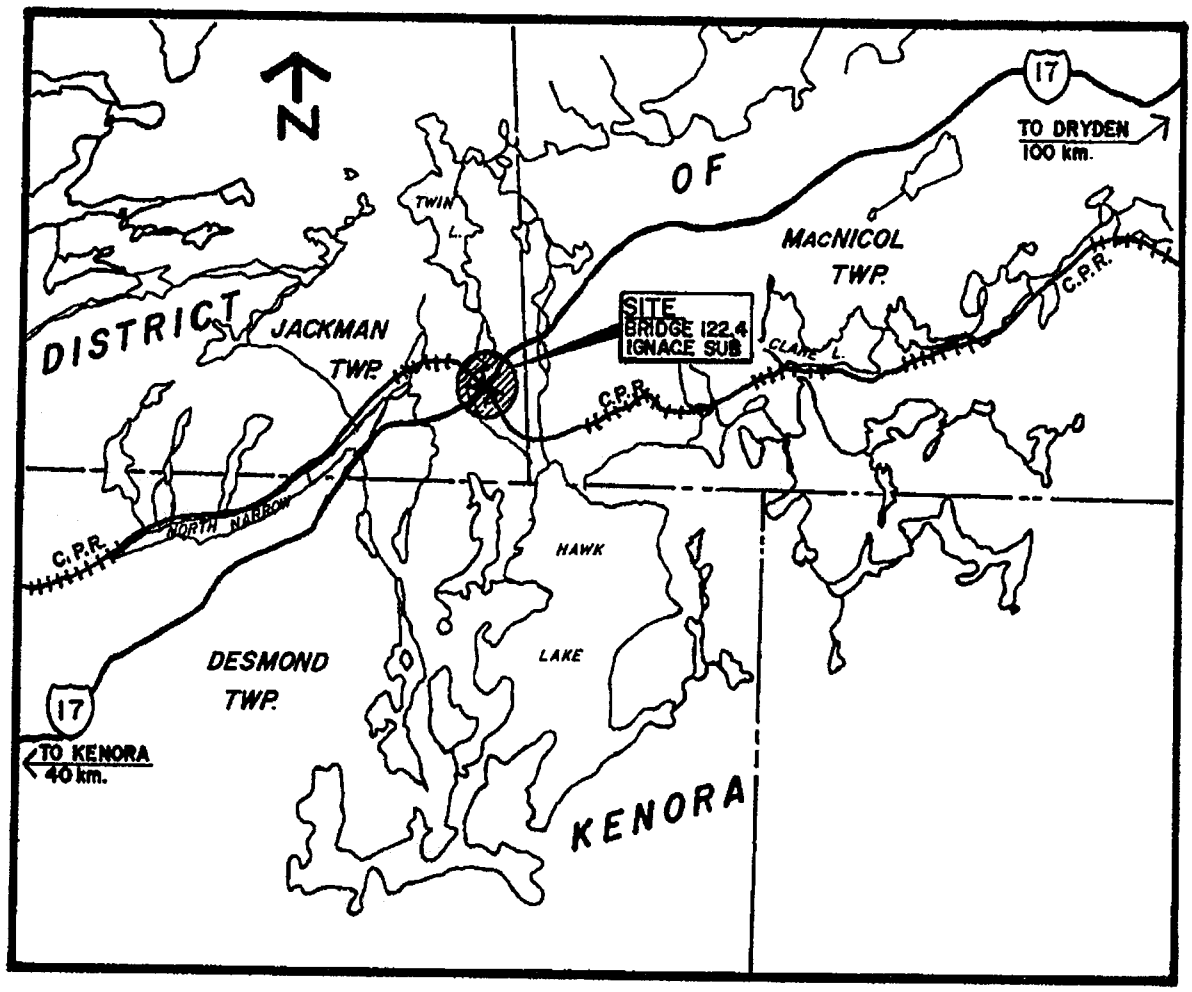
(Hawk Lake Subway Replacement)

TBTE Ref. No. 06-085

May 23, 2007

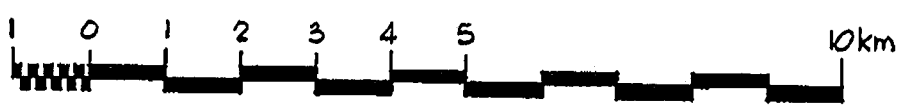
Geocrest No 52E-47

Location Map



Key Plan

Scale



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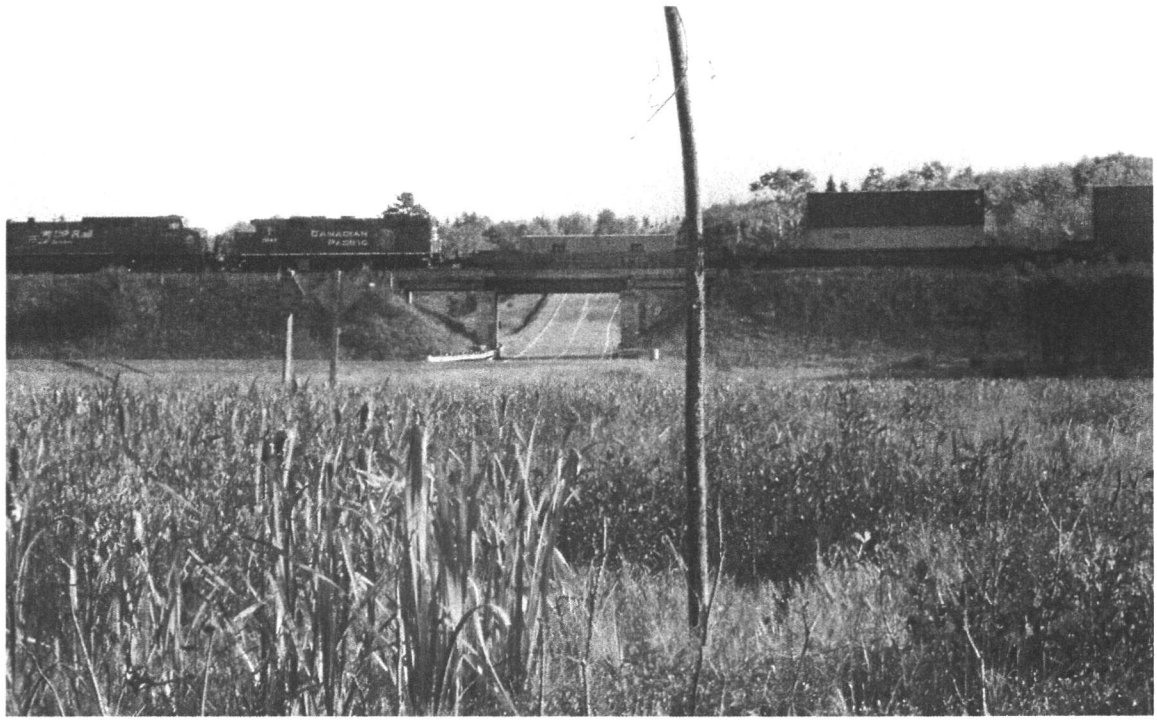
Geotechnical Design Report

GWP 87-97-00 **TBTE # 06-085**

HIGHWAY 17 **MTO DISTRICT # 61, THUNDER BAY**

1.0 INTRODUCTION

TBT Engineering (TBTE) was awarded this "TPM Services" assignment which was advertised under Purchase Order Number 6005-E-0019. This assignment covers the furnishing of all professional and technical services required for the detail design of MTO GWP 87-97-00, the replacement of the Hawk Lake Structure. This report covers the Geotechnical investigation and design component of this assignment, GWP # 87-97-00.



2.0 LOCATION

This project is located on Highway 17 in the Electoral District of Kenora-Rainy River and in the Ministry of Transportation's District 61 (Thunder Bay - Kenora portion).

The project commences approximately 22.3 km east of the intersection of Highway 17 & 71 in the Township of Jackman and terminates in the Township of MacNicol.
The length of the work project is listed as 2.04 km.

Chainages for GWP 87-97-00 are as follows:

Start of Project: Sta. 11+250 Twp. Jackman

Eq'n: Sta. 12+664.434 Twp. Jackman = Sta. 10+000 Twp. MacNicol

End of Project: 10+700.942 (REV) Twp. MacNicol = 10+756.796 (Hwy17) Twp. MacNicol AHD.

3.0 PROJECT DESCRIPTION

The project scope as described in the RFP documentation is Removal of the CPR Subway and construction of a new bridge overpass over the CPR. It will constitute a highway re-alignment for 2.04 km. A portion of the existing alignment will be retained to provide access to twin Lake and a CPR signal and siding facility. Pavement Rehabilitation will include in-place full depth reclamation of existing asphalt and landscaping over a portion of the existing highway to be abandoned. The existing truck climbing lane will be relocated to the new alignment. The existing snow plow turnaround will be relocated to the new highway alignment.

One structure is located within the project limits, CPR Overhead (Site No. 41S-32) at Sta 12+300 Twp. Jackman.

4.0 CONSTRUCTION HISTORY

The CPR subway was originally constructed in 1935.

The CPR subway was originally constructed in 1935 to provide a Canadian route through the communities in the Lake of the Woods area (primarily Kenora and Keewatin). The highway vertical and horizontal alignment was upgraded under Contract 59-331 maintaining the original Hawk Lake subway structure. The structure itself was rehabilitated in the late 1980's under Contract 88-350. The highway grade was lowered and gabions were added to provide additional overhead clearance under MTO Contract 98-230.

The structure has since deteriorated to a state of poor condition requiring remedial repair / replacement.

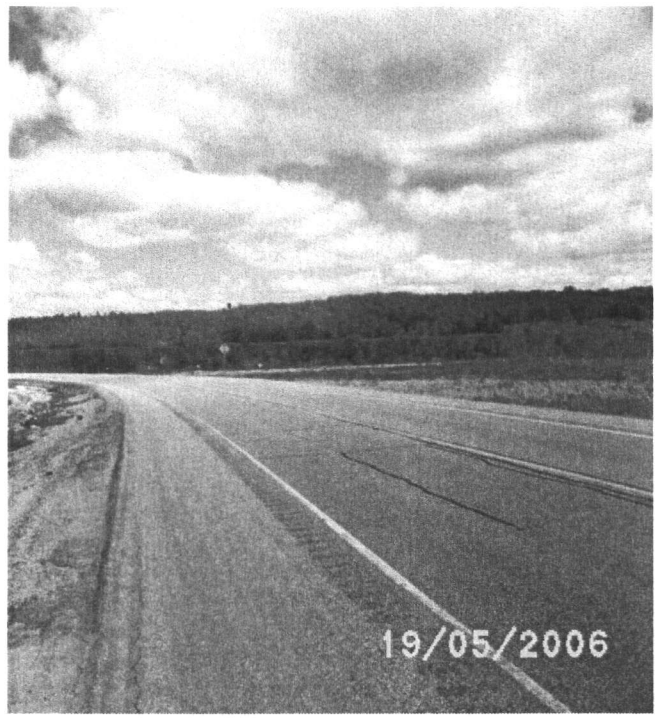
5.0 DESIGN CRITERIA

A Design Criteria covering the assignment area was provided by MTO as part of the assignment documentation. The document was dated July 21, 2006 and subsequently approved and signed on October 6, 2006.

The Design Criteria indicates the following:
The present highway cross-section has 2 x 3.75 m driving lanes, with 2.5 m fully paved shoulders and 1.0 m shoulder rounding. There is a 3.5 m wide Truck Climbing Lane (existing and proposed) located within the project limits.

The posted speed limit for Highway 17 is 90 km/h. Curve widening for WB 17.5 trucks will not be applied. The existing 5.9% highway grade will be improved to a maximum of 3.0% on the new alignment.

Drainage will be improved and culverts replaced and extended as required.



6.0 PAVEMENT PERFORMANCE

The present asphaltic hot mix riding surface is 120 mm recycled hot mix placed under Contract 98-230.

The existing pavement is generally in good condition noting the following:

- Slight coarse aggregate loss throughout
- Slight - moderate transverse cracking throughout
- Few slight meandering & midlane cracking
- Extensive slight random cracking

The rideability is good.

7.0 INVESTIGATIONS

TBT Engineering advanced boreholes and asphalt cores in November of 2006.

Asphalt Coring

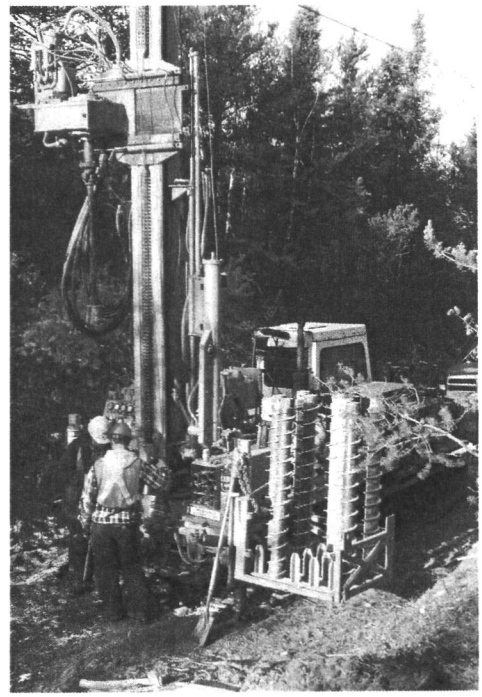
Pavement coring to determine pavement thickness was conducted at the tie-in points and pavement removal areas. Pavement cores to verify thickness were 50 mm in diameter and were reinstated into the hole after measurement. 150 mm diameter cores were taken at each end tie-in point to verify the existing Granular 'A' depths. Asphalt cores were also obtained in fully paved shoulders.

All core locations were documented by chainage and offset distance from existing centerline. References to proposed centerline were adjusted using AutoCad where required. In addition to the total depth of pavement, all discernible layers were documented.

Power Equipment Drilling

All on-road Power Auger holes were completed with a truck-mounted Sterling Auger. This equipment has a solid stem Kelly Bar with a 350 mm diameter auger and is capable of drilling depths of up to 6.0 m. Boreholes were advanced to verify the existing pavement structure.

Off road boreholes were advanced with a tracked Star Drill 100 using hollow stem augers supplemented by dynamic penetration cone testing (DPCT).



Star Drill 100

Pedo Drilling

All areas of proposed drainage improvements, widening, and vertical / horizontal revision were also investigated by hand auger (Pedo Drilling) to verify native soil conditions outside current highway embankment. The vertical / horizontal revision area was investigated in accordance with the NWR Geotechnical Investigation Minimum Requirements.

Sampling

Representative granular samples were obtained for testing purposes.

Typical Granular Sub-base Sample taken from side of Test Hole

Engineering Materials Testing and Evaluation

All pre-engineering material samples obtained during field investigations were returned to TBTE Thunder Bay laboratory for testing. TBTE has a fully qualified materials testing laboratory meeting the specified requirements for performing Engineering Materials Testing and Evaluation for Pavement Design purposes. The TBTE Thunder Bay laboratory is CCIL Type A, B, C, D, E certified.

8.0 EXISTING CONDITIONS

8.1 Pavement Depths

The following data has been derived from the field investigations:

- Total No. of Cores Taken = *(15)*
- Main lanes *(8)* = 121 mm avg. (95 mm min., 130 mm max.)
- Auxiliary Lane *(1)* = 125 mm
- Fully Paved Shoulders (5*)* = 52 mm avg. (35 mm min., 65 mm max.)
- Side roads & Entrances *(1)* = 40 mm

8.2 Granular Materials

Approximately 260 hand and power auger holes were advanced to investigate this project. The depth of existing base course under the existing pavement was verified at the revision tie-in points at 150 mm diameter pavement core locations. The checks showed that the Granular 'A' existing under the present asphaltic pavement was greater than 250 mm in depth. The base course samples were within specifications for Granular 'A' in gradation and percent crushed.

Samples of sub-base materials were taken and analyzed. All of the samples graded within gradation specifications for Granular 'B' Type III. Granular 'B' thickness over rock fills varied between 300 mm and 1.0 m but generally hovered around 600 mm.

8.3 Sub-grade Materials

The existing roadbed sub-grade is rock and shot rock fills.

9.0 DRAINAGE

Recommendations have been developed to ensure drainage over the length of the project. Consultation with the author, during detail design, will be required for geodetic ditching refinements.

10.0 TRAFFIC

The following Traffic Sectional volumes for 2004 and 10 year predictions were supplied by MTO and included in the RFP documentation:

LOCATION	YEAR	AADT	SADT	DHV	% COMM	% LT
From: Highway 71 (Longbow Corners) to Vermilion Bay						
Hwy 17	2004	2680	3900	350	34.0 (1048)	29.5 (905)
	2014	2815	4095	370	34.0 (1048)	29.5 (905)

Table 10.0 : Traffic Volumes

ESAL CALCULATIONS (Equivalent 9 Tonne single Axle Loadings) from Table 10.0:

2004 AADT = 2680
2024 AADT (20 year volumes estimated) = 2950
Percentage Commercial Traffic = 34.0 %
2004 Total Number of Trucks = 2680 x 34.0% = 911
2004 Truck in Design Lane = 911 x 0.5 = 456
2024 Total Number of Trucks = 2950 x 34.0% = 1003
2024 Truck in Design Lane = 1003 x 0.5 = 502
Percentage Long Trucks = 29.5 %
Percentage Long Trucks in Total Truck Population = 29.5 / 34.0 = 86.8%
Truck Factor (extrapolated from Truck Factor Graph*) = 2.0
2004 Equivalent 9 t Axles per Day = 456 x 2.0 = 911
2024 Equivalent 9 t Axles per Day = 502 x 2.0 = 1003
2004 Equivalent 9 t Axles per Year (350 Days/yr) = 911 x 350 = 318,850
2024 Equivalent 9 t Axles per Year (350 Days/yr) = 1003 x 350 = 351,050
Average Equivalent 9 t Axles per Year (350 Days/yr) = (318,850 + 351,050)/2 = 334,950
Equivalent 9 t Axles per 20 Year Period (350 days/yr.) = **6,700,000**

(Note: - Used 350 days per year)
** - Truck Factor Graph, Pavement Design and Rehabilitation Manual, Pg 159)*

The 130 mm pavement thickness (as recommended by MTO Geotechnical Section, NW Region) is consistent with the calculated traffic loadings.

11.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES

11.1 Pavement Rehabilitation

The Ministry of Transportation of Ontario Northwestern Region Geotechnical Section has recommended the pavement design for this project. The Geotechnical Pavement Design provided for this project is to surface with 130 mm (50 mm surface course and 2 x 40 mm binder courses) of Superpave 12.5, 58 – 34 PGAC. Refer to the Pavement Structure Treatment Charts for specific treatment depths and locations.

11.2 Pavement

11.2.1 Pavement Types and Depths

The recommended paving courses are specified by MTO as SUPERPAVE 12.5

a) Highway 17
   - 1 x 50 mm avg. SUPERPAVE 12.5 surface course
   - 2 x 40 mm avg. SUPERPAVE 12.5 binder courses

b) Fully Paved Shoulders
   - 1 x 50 mm avg. SUPERPAVE 12.5 surface course.

c) Snow Plow Turnaround and Access Road
   - 1 x 60 mm avg. SUPERPAVE 12.5 surface course

11.2.2 Pavement Joints

A 'Step' joint is recommended when abutting to multi-lift pavements and a 'butt' joint is recommended when abutting temporary joints. 'Step' joints should be milled for the full thickness of each course for a minimum distance of 3 m. Refer to Pavement Structure Treatment Charts for specific site recommendations.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.3 Existing Pavement Treatment

11.3.1 In-place Processing

The tie-in sections of the project shall be in-place processed or removed full depth. Limits are to be established during detail design. In-place processing shall be in accordance with OPSS 330 and SP 330S01M. The processing width shall be 0.5 m beyond the existing edge of pavement. The processing depth shall be limited to include the underlying Granular 'A' materials to a maximum of 150 mm of Granular 'A'.

11.3.2 Paved Side Road

It is proposed to construct a connection to a section of the by-passed existing highway which will be retained in order to maintain access to Twin Lake and a CPR siding and service area. To tie-in with the existing highway, saw cut and remove pavement full depth, reshape with Granular 'A' as required to provide smooth transition and pave with 60 mm SUPERPAVE 12.5 mm surface course. Butt joint the new asphalt surface to the existing highway.

11.3.3 Abandoned Highway Treatment

It is recommended that the abandoned portions of the existing highway alignment be restored and landscaped to minimize future impacts. Restoration should consist of pulverizing or full depth pickup of the existing asphaltic pavement, reshaping of the old roadbed and removal of existing culverts to restore and protect existing drainage patterns.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.4 Granular Depths

It is recommended that the granular materials required for this project be specified as Granular 'A' and Granular 'B' Type II or Type III (dependant upon availability) and that they be placed full roadway width.

The following minimum granular depths shall apply to this work project, where applicable, and consist of 150 mm of Granular 'A' and the remainder Granular 'B' Type II / III.

(a) Over rock - in cuts and fills – 300 mm.

(b) Over bouldery acceptable materials - in cuts and fills – 300 mm.

(c) Over acceptable granular material - in cuts – 150 mm.
- in fills – 150 mm.

(d) Over sands and gravels containing 10 to 25% passing the 75 um sieve
- in cuts – 450 mm.
- in fills – 300 mm.

(e) Over sands and gravels containing 25 to 40% passing the 75 um sieve
- in cuts – 600 mm.
- in fills – 450 mm.

(f) Over sands and gravels containing 40% plus passing the 75 um sieve
- in cuts – 750 mm.
- in fills – 600 mm.

(g) Over silt and clay (moisture content $\leq$ 5% above optimum)
- in cuts and fills – 750 mm.

(h) Over silt and clay (moisture content > 5% above optimum)
- in cuts – 900 mm.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.5 Recovered Asphaltic Materials

If feasible to use or if a Granular 'A' stockpile is required, it is recommended that all recovered asphaltic materials from the milling and full depth removal areas be crushed and blended with conventional Granular 'A'. Crushing of the asphaltic materials shall ensure that 100% passes through the 26.5 mm screen. Maximum RAP mix proportions, when blending with Granular 'A', shall be 40% by mass reclaimed asphalt to 60% conventional Granular 'A' otherwise it should become the property of the contractor for disposal.

11.6 Transition Points

It is recommended that all transitions be treated as per the appropriate subsection of OPSD 205. For design purposes, the following criteria shall apply:

(a) in silty fine sands, silts and clays
- "t" = 1.5 m
- "H" = 300 mm where applicable

(b) in granular type materials
- "t" = 1.2 m
- "H" = 450 mm where applicable

11.7 Drainage

11.7.1 Culverts

It is recommended that all culverts and extensions to be placed on this project be treated as per the appropriate section of OPSD 802 and 803. Where culverts are required to be placed in organic areas, it is recommended that wherever possible, to place them at the ends of the deposit to keep away from the deep portions of the swamp. In areas of organic material, culverts should be placed in accordance with OPSD 203.06. It is recommended that a frost penetration treatment depth of 2.5 m be used for design of frost tapers where required.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.7.2 Ditching

Since the entire project (with the exception of the tie-in points) is on new alignment, drainage throughout the entire project will be addressed during detail design. It is imperative to ensure that positive drainage of all earth pockets and transition treatments be attained.

11.8 Frost Heaves and Distortions

No frost heaves or distortion areas at the revision tie-in points were identified for treatment during the Geotechnical design process.

11.9 Benching

It is recommended that, where widening in excess of 1.0 m in width is required, benching as per OPSD 208.01 be used where applicable. Cross sections should be reviewed prior to completion of detail design to verify limits and areas of such application. Existing rock fills need not to be benched but fill widening should be built in layers to ensure some keying to the existing rock fill. End dumping from the top of the existing fill shall not be allowed.

11.10 Stripping

It is recommended that all topsoil and organic debris be stripped in widening and fill construction areas where the proposed fill height is 1.2 m or less. For estimating purposes, assume an average stripping depth of 150 mm. It is further recommended that all ditches, which are to be filled due to widening and where the travelled portion of the roadway extends over the ditch, be cleaned out to firm inorganic foundation regardless of depth. For design purposes, assume stripping commences at inner edge of rounding.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.11 Muskeg on Widening

There are two sections containing organic deposits within the project limits that occur within areas that require widening and alignment revision. In order to minimize future fill settlement and distortion, the organic material should be excavated in its entirety from the foot print of the fill widening and fill construction. For design purposes, widening should conform to OPSD 203.030.

11.12 Existing Geotechnical Structures

There were no known existing Geotechnical structures (i.e. sub-drains, polystyrene locations, geogrid locations, etc.) identified within the project limits that will be impacted by the new construction. Existing gabion baskets at the structure will be removed when the present structure is decommissioned.

11.13 Snow Plow Turnaround

The existing snow plow turnaround located at the west limit of the project will be impacted by the revised horizontal alignment and will require relocation. It is recommended that the existing shoulders which are to be paved to form part of the facility, be excavated to allow for a minimum of 150 mm of Granular 'A' prior to surfacing. On widening, it is recommended that the sub-grade be prepared in accordance with the recommendations contained within this report and pavement structure treatment charts. The shoulder excavation granulars may be used as Granular 'B' on the adjacent widening.

Excavate all organic materials encountered to firm inorganic foundation on widening as per OPSD 203.030.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.14 Seeding and Mulching

It is recommended that seeding and mulching be included as part of this contract. The soils on this project are generally poorly graded silty sand tills over bedrock; therefore, seeding and mulching mixtures and application rates should conform to the requirements of OPSS 572 using a Standard Roadside Mix.

11.15 Slope Flattening

It is recommended that all potential slope-flattening areas be reviewed for drainage and that in all areas of existing and proposed rock fill slope flattening be designed with drainage gaps as per OPSD 202.020 (or a 1.0 m free draining drainage layer at base of fill full width), where required.

It is further recommended that the top of the slope flattening shall not extend above the bottom of granular sub-base within the roadbed. For design purposes, assume this to be 800 mm of granulars at centerline sloped at 3% or S (super-elevation rate), whatever is greater.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

11.16 Associated Work

Subsequent to the initiation of WP 87-97-00 design assignment, work for WP 6072-06-00 was included under Change in Scope # 3. Change in Scope #3, as part of the Hawk Lake Project, requires a complete separate tender package for the removal and stockpile of hazards rock materials that have been identified under GWP 6072-06-00. Change in Scope #3 will mitigate the level of hazardous rock fall and increase sight distances in areas along Hwy 17. In addition, the rock removed will be used to partially address the rock embankment deficiency for the Hawk Lake Project GWP 87-97-00.

There are 10 possible rock hazard sites that have been identified for CIS #3, but due to financial constraints only 3 or 4 sites are anticipated to undergo construction at this time.

Two preferred options to manage the hazard rock removed include stockpiling on a temporary basis (at a site suitable and in the proximity of WP 87-97-00) and actually incorporating the rock into a fill location on the Hawk Lake Project GWP 87-97-00, proposed Sta 12+000 to12+225 +/-.

At the time of issuing this report, both options are under assessment. It is imperative that if the rock is to be directly incorporated into the fill location (Sta 12+000 to12+225 +/-) on the Hawk Lake Project that all of the recommendations contained within this report in conjunction with the recommendations within the foundations report be followed. Access roads constructed under this scenario that will be incorporated into the final fill footprint should be constructed in accordance with the recommendations for the fill construction.

RECOMMENDATIONS AND CONSTRUCTION FEATURES (cont'd)

12.0 Limitations

Some of the factual soils data contained within this report were supplied by the owner for use in the design of the project. This data has been included within the borehole logs and is in italic font. TBTE does not guarantee the accuracy of this data.

Conclusions and recommendations presented in this report are based on the information determined at the borehole locations and are intended for the use of the design team only. The design recommendations provided in this report are based on the project described in the text and then only if constructed substantially in accordance with the details stated in this report and in conjunction with the separate foundations report completed for this project.

Conditions may become apparent during construction that were not detected and could not be anticipated at the time of the site investigation. Subsurface and groundwater conditions between and beyond test locations may differ from those encountered.

The information contained within this report in no way reflects any environmental aspect of the site or soil.

TBT Engineering

prepared this report to address the Geotechnical component of a

Detail Design Project assignment for the

Ministry of Transportation of Ontario's Work Project 87-97-00.

Prepared by:

A. Clements, Manager Geotechnical Services — May 23, 2007

TBT Engineering — Date

Reviewed by:

W. Hurley, P. Eng., Vice-President Engineering — May 23, 2007

TBT Engineering — Date

TBT Engineering
Consulting Engineers

PAVEMENT STRUCTURE TREATMENT CHARTS

G.W.P. NO. 87-97-00

TBTE Ref. No. 06-085

Pavement Structure Treatment Charts			
Location	**Feature**	**Recommended Treatment**	**Comments / Rationale**
11+250	***Project WP 87-97-00 Proposed West Limit***	***Limit of Paving***	Precise limits to be determined during detail design
11+250 - 11+475	Proposed Roadbed widening transition to revision alignment. Muskeg on widening Rt.	Mill to provide a 3m Step joint @11+250 – 11+253. Sta 11+253 - 11+247 - In-place process existing asphaltic pavement and reshape & remove &/or place Granular 'A' to provide a smooth transition (as per GDR). Excavate muskeg on widening Right as per OPSD 203.030	Match with current project treatment design. On widening, Boreholes indicate variable depths organics (max 1.8 m) over F Sa.
11+425 – 11+475	Proposed Snow plough Turn around Rt.	Excavate muskeg on widening Rt. as per OPSD 203.030	Boreholes indicate 450 – 550 mm organics over F Sa.
11+475 – 11+700	Proposed Fill (~ 3m) Muskeg	Excavate muskeg as per OPSD 203.010	Boreholes indicate variable depths organics (max 1.8 m) over F Sa.
11+700 – 11+860	Proposed Fill (~3m)	Strip/Grub and allow a minimum of 900 mm granulars over parent materials.	Boreholes indicate shallow topsoil over fine sands and silts over boulders and /or bedrock.
11+860 – 11+915	Proposed Cut (0 – 2m)	Rock: Excavate as per OPSD 201.010. Treat rock / earth transitions as per the appropriate section of OPSD 205 Treat boulders as per OPSD 204.010 For design purposes assume earth overburden to be waste.	Boreholes indicate shallow topsoil and fine sands and silts over boulders and /or bedrock.
11+915 – 12+280	Proposed Fill (0 – 18m) Muskeg	Refer to foundations report for recommendations. Excavate muskeg as per OPSD 203.010	Boreholes indicate variable depths organics (max 3.6 m) over F Sa.
12+280 – 12+320	Proposed Overpass & Approaches	As per Structural and Foundations recommendations.	CPR Tracks – Existing 7 m embankment
12+320 – 12+595	Proposed Fill (0 – 15m)	As per Foundations Report recommendations. Apply best construction practices. Construct fill in layers.	Boreholes indicate shallow topsoil and variable depths of fine sands and silts over boulders and /or bedrock.

Pavement Structure Treatment Charts			
Location	**Feature**	**Recommended Treatment**	**Comments / Rationale**
12+595 (Jackman) – 10+345 (MacNicol)	Proposed Cut (0 – 12m)	Rock: Excavate as per OPSD 201.010 Treat rock / earth transitions as per the appropriate section of OPSD 205 Treat boulders as per OPSD 204.010 For design purposes assume earth overburden to be waste.	Boreholes indicate shallow topsoil and fine sands and silts over boulders and /or bedrock.
10+345 – 10+450	Proposed Fill (0 – 7m)	As per Foundations Report recommendations. Apply best construction practices. Construct fill in layers. Sta 10+450 - 10+698.942 – Remove or In-place process existing asphaltic pavement and reshape prior to placing Granular 'A' to provide a smooth transition (as per GDR). Excavate as required to provide a minimum of 150 mm Granular 'A'.	Old Hwy. at toe of existing rock fill slope with wooden box culvert @ Sta 10+463
10+450 – 10+697.942	Proposed Fill Widening Rt. Proposed Roadbed widening transition to revision alignment.		
	10+463 Old Wooden box culvert Right	Remove and replace to match with existing concrete box culvert to ensure adequate drainage.	
10+697.942 – 10+700.942	Step Joint Treatment	Mill and Provide a 3m Step joint	Precise limits to be determined during detail design
10+700.942 = 10+756.796 Ah'd	***End Project WP 87-97-00 East Limit***	***Limit of Paving***	

TBT Engineering
Consulting Engineers

Geotechnical Design Report

WP 87-97-00

Borehole Data

Jackman Twp.

TBT Engineering
TBTE Ref. No. 06-085

HIGHWAY 17 – Jackman Twp.

Station 11+250 4.3 Rt

0	-	60	Asph
60	-	550	Cr Gr
550	-	1.0	Br M-Co Sa with Gr Occ Cob (Moist)
1.0	-	1.4	Dk Gry Sh Rk Fill
		1.4	NFP Sh Rk Fill

Station 11+250 4.3 Rt
Sample No. 06-TD-288 (60 – 250)
% Passing 4.75 mm 51.5 %
% Passing 75 um 3.6 %
% Crushed 95.6 %
Acceptable in gradation as Gran 'A'

Station 11+250 4.3 Rt
Sample No. 06-TD-289 (600 – 800)
% Passing 4.75 mm 74.5 %
% Passing 75 um 7.5 %
FMC @ 800 4.3 %
Acceptable in gradation as Gran 'B' Type III

Station 11+320 10.0 Rt
1.8 Blk Orgs (Soft & Wet) to F Sa

Station 11+350 10.0 Rt
1.5 Blk Orgs (Soft & Wet) to F Sa

Station 11+350 4.2 Rt

0	-	60	Asph
60	-	550	Cr Gr
550	-	1.1	Br M-Co Sa with Gr Occ Cob (Moist)
1.1	-	1.3	Dk Gry Sh Rk Fill
		1.3	NFP Sh Rk Fill

Station 11+380 10.0 Rt
1.2 Blk Orgs (Soft & Wet) to F Sa

Station 11+410 10.0 Rt
900 Blk Orgs (Soft & Wet) to F Sa

Station 11+440 10.0 Rt
450 Blk Orgs (Soft & Wet) to Bld (Poss B/R)

Station 11+466 4.0 Rt

0	-	40	Asph
40	-	200	Cr Gr
200	-	600	Br M-Co Sa with Gr Occ Cob (Moist)
		600	NFP Bld / Sh Rk Fill

Station 11+470 10.0 Rt
550 Blk Orgs (Soft & Wet) to F Sa

11+498		*CL*	*D+000*
0	-	*600*	*Br F-Med Sa Tr Si Tr Org w = 24%*
600	-	*1.5*	*Br-Gry Sa Tr Si Wet*
		1.5	*NFP Poss Blds or BR*

Station 11+500 11.0 Lt
B/R on Surf

Station 11+500 15.0 Rt (D+300)

0	-	1.2	Dk Br Org (wet)
1.2	-	2.1	Lt Br Si with Sa (wet)
		2.1	NFP Hole Sloughing

Station 11+515 CL
1.8 Blk Orgs (Soft & Wet) to F Sa

Station 11+530 11.0 Lt
750 Blk Orgs (Soft & Wet) to F Sa

Station 11+530 11.0 Rt
1.3 Blk Orgs (Soft & Wet) to F Sa

Station 11+530 CL
1.6 Blk Orgs (Soft & Wet) to F Sa

11+550		*CL*	*D+000*
0	-	*1.2*	*Br Fib Peat w = 407%*
1.2	-	*3.0*	*Gry Si(y) Sa Wet w = 18%*
3.0	-	*3.5*	*Gry F Sa Some Si* Wet w = 18%*
			Fr Wat @ 1.2
			N = 13 @ 1.8
			N = 13 @ 3.3

** % Passing*	*1.18 mm*	*= 100*
	300 μm	*= 89*
	75 μm	*= 17*
	'K' Factor	*= 0.1*
	LSFH	

11+550 8.0 RT D+000

0 - 1.5 Br Fib Peat w = 437%
1.5 - 2.5 Gry F-Med Sa Tr Si Wet
w = 16%
2.5 - 3.5 Gry Sa Tr Si Wet w = 18%
Fr Wat @ 1.5
N = 10 @ 1.8
N = 8 @ 3.3

Station 11+560 11.0 Lt
1.5 Blk Orgs (Soft & Wet) to F Sa

Station 11+560 11.0 Rt
0 - 750 Blk Orgs (Soft & Wet)
750 - 1.0 Br F Sa (Wet)

Station 11+560 CL
900 Blk Orgs (Soft & Wet) to F Sa

Station 11+575 CL
900 Blk Orgs (Soft & Wet) to F Sa

11+600 9.0 LT D+000
0 - 900 Br Fib Peat w = 422%
900 - 2.4 Gry Si(y) Sa Wet w = 20%
2.4 NFP Poss Blds or BR
Fr Wat @ 1.5
N = 12 @ 1.8

11+600 CL D+000
0 - 1.0 Br Fib Peat w = 440%
1.0 - 3.5 Br Med Sa Tr Gr Wet*
w = 16% @ 1.8
w = 17% @ 3.3
Fr Wat @ 1.5
N = 10 @ 1.8
N = 20 @ 3.3
** % Passing 9.5 mm = 100*
4.75 mm= 99
1.18 mm= 94
300 µm= 24 'K' Factor = 0.1
75 µm= 3 LSFH

Station 11+600 12.0 Rt
900 Blk Orgs (Soft & Wet) to F Sa

Station 11+615 CL
900 Blk Orgs (Soft & Wet) to F Sa

Station 11+630 12.0 Rt
0 - 150 Blk Orgs (Soft & Wet)
150 - 1.2 Br F Sa with Gr(Wet)

Station 11+630 12.0 Rt
0 - 600 Blk Orgs (Soft & Wet)
600 NFP B/R

Station 11+630 CL
1.2 Blk Orgs (Soft & Wet) to F Sa

Station 11+645 CL
0 - 150 Blk Orgs (Soft & Wet)
150 - 500 Br Si Cl (Wet)

Station 11+650 16.3 Rt (D-400)
0 - 50 Tps
50 - 1.5 Br Si Tr Sa Occ Gr (moist)
(Wet @ 1.0)
1.5 NFP Cobbles / Bld

11+650 CL D+000
0 - 900 Br Fib Peat w = 74%
*900 - 3.2 BrGry Sa Tr Si- Si(y) Some Gr**
Wet w = 24% @ 1.8
w = 25% @ 3.2
3.2 NFP Poss Blds or BR
Fr Wat @ 1.5
N = 10 @ 1.8
N = 50/150 @ 3.1
** % Passing 19 mm= 100*
4.75 mm= 88
1.18 mm= 85
300 µm= 63 'K' Factor = 0.3
75 µm= 40 LSFH-MSFH

Station 11+660 11.0 Lt
Br F Sa Tr Gr on Surf (Old Dump Road)

Station 11+660 11.0 Rt
Br F Sa Tr Gr on Surf (Old Dump Road)

Station 11+660 CL
Br F Sa Tr Gr on Surf (Old Dump Road)

Station 11+675 CL
0 - 150 Tps (Soft & Wet)
150 NFP Bld

11+700 CL D+000
0 - 2.1 Br Sa Si Wet
w = 20% @ 600
w = 20% @ 1.8
2.1 NFP Poss Blds or BR
Fr Wat @ 1.5
N = 22 @ 1.8

Station 11+700 16.2 Rt (D+600)
0 - 25 Tps
25 - 550 Br Si(y) Cl Tr Sa (moist)
550 NFP Bld / Dense Mat'l

Station 11+700 16.3 Rt (D+600)
0 - 25 Tps
25 - 200 Br Si(y) Cl Tr Sa (moist)
200 - 450 Br Si Tr Sa Tr Cl (moist)
450 NFP Bld / Dense Mat'l

Station 11+749 CL
0 - 250 Br F Sa Tr Tps
250 NFP Bld

Station 11+750 17.7 Rt (D+2.2)
0 - 25 Tps
25 - 250 Br F Sa
250 NFP Cob / Bld

Station 11+750 17.8 Lt (D-300)
0 - 25 Tps
25 - 650 Br Si Tr Cl & Sa (Moist)
650 - 1.1 Lt Br Si Tr Sa (Moist)
(Wet @ 900)
1.1 NFP Cob / Bld

Station 11+750 17.8 Rt (D+2.3)
0 - 25 Tps
25 - 250 Br F Sa
250 NFP Bld

Station 11+750 CL
0 - 200 Br F Sa Tr Tps
200 NFP Bld

Station 11+751 CL
0 - 300 Br F Sa Tr Tps
300 NFP Bld

11+800 CL D+000
0 - 100 Br Sa Tr Si Tr Org w = 24%
100 NFP Poss Blds or BR

Station 11+800 16.3 Rt (D-400)
Cob / Blds on surf

Station 11+825 3.6 Lt (D+1.7)
0 - 50 Tps
50 - 750 Br Si with Sa Tr Gr Occ Cob
(moist)
750 NFP Prob B/R

11+850 8.0 LT D-1.4
0 - 075 Br Sa Tr Si Tr Org
075 NFP Poss Blds or BR

11+850 CL D+000
0 - 050 Org M
050 NFP Poss Blds or BR

11+850 8.3 RT D+0.4
0 NFP BR

Station 11+860 12.8 Lt (D-1.0)
B/R on surf

Station 11+860 12.8 Rt (D-400)
0 - 250 Tps
250 NFP B/R

Station 11+860 CL
0 - 75 Tps
75 NFP B/R

Station 11+870 12.8 Lt (D-1.9)
0 - 200 Tps (Moss)
200 NFP B/R

Station 11+870 12.8 Rt (D+600)
B/R on surf

Station 11+870 CL
B/R on surf

Station 11+885 CL
0 - 50 Tps
50 - 300 Lt Br Si with Sa Occ Cob (moist)
300 - .400 Rd Br Si with Sa Occ Cob (moist)
400 NFP B/R

Station 11+895 12.8 Lt (D+100)
B/R on surf

Station 11+895 12.8 Rt (D+1.5)
0 - 250 Tps (Moss)
250 NFP B/R

Station 11+895 CL
0 - 150 Tps (Moss)
150 - 400 Rd Br Si with Sa Tr Gr (Moist)
400 NFP B/R

11+900 CL D+000

0 - 1.8 Br Sa Tr Cl Tr Si Tr Org
1.8 NFP Poss Blds or BR

Station 11+905 12.8 Rt (D-1.6)
0 - 250 Tps (Moss)
250 NFP B/R

Station 11+905 12.8 Rt (D-1.6)
0 - 250 Tps (Moss)
250 NFP B/R

Station 11+905 CL
0 - 250 Tps (Moss)
250 NFP B/R

Station 11+915 12.8 Lt (D-2.8)
0 - 400 Tps (Moss)
400 NFP B/R

Station 11+915 12.8 Rt (D+2.7)
0 - 100 Tps (Moss)
100 - 500 Rd Br Si with Sa Tr Gr (wet)
500 NFP B/R

Station 11+915 CL
0 - 50 Tps (Moss)
50 NFP B/R

Station 11+925 12.8 Lt (D-1.6)
B/R on surf

Station 11+925 12.8 Rt (D+2.5)
0 - 300 Tps (Moss)
300 - 400 Rd Br Si with Sa Tr Gr (Moist)
400 NFP B/R

Station 11+925 12.8 Rt (D+2.5)
0 - 300 Tps (Moss)
300 - 400 Rd Br Si with Sa Tr Gr (Moist)
400 NFP B/R

Station 11+925 CL
B/R on surf

Station 11+940 7.0 Rt (D+2.3)
B/R on surf

Station 11+940 CL
0 - 300 Tps (Moss)
300 NFP B/R

11+950 CL D+000
0 - 150 Org M
150 NFP BR

Station 11+961.8 0.5 Lt (Elev 383.7)
B/R on surf

Station 11+970 18.0 Lt
0 - 200 Tps (Wet)
200 NFP B/R

Station 11+985 CL
200 Tps over Br F Sa

12+000 20 LT D+000
0 - 600 Br Fib Peat w = 151%
600 NFP Poss RF or BR
Fr Wat @ 150

12+000 CL D+000
0 - 600 Br Fib Peat w = 449%
600 NFP Poss RF or BR
Fr Wat @ 300

12+000 20 RT D+000
0 - 450 Br Fib Peat W Sa w = 254%
450 NFP Poss RF or BR
Fr Wat @ 200

Station 12+015 CL
900 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+030.3 22.5 Lt (Elev 380.5)(DCPT)
0 - 3.5 Prob Peat (wet)
3.5 NFP Refusal Prob B/R

Station 12+031.8 CL (Elev 380.7)
0 - 3.0 Peat (wet)
3.0 - 6.4 Gry Sa with Si (loose)
6.4 NFP Refusal Prob B/R

Station 12+032.6 21.5 Rt (Elev 380.6) (DCPT)
0 - 2.7 Prob Peat (wet)
2.7 - 5.9 Prob Gry Sa with Si (loose)
5.9 NFP Refusal Prob B/R

Station 12+045 26.0 Lt
2.3 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

12+050 CL D+000
0 - 2.1 Br Fib Peat
2.1 - 2.7 Gry F-Med Sa
Fr Wat @ 300

12+050 15 RT D+000
0 - 2.4 Br Fib Peat Occ Wd w = 493%
2.4 - 3.0 Br Sa Tr Si Tr Org Wet
w = 75% Fr Wat @ 230

Station 12+060 CL
2.8 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+075 27.0 Lt
1.0 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+075 27.0 Rt
2.0 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+075 CL
2.8 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+081 23.3 Lt (Elev 380.3)
0 - 2.4 Peat (wet)
2.4 - 2.5 Gry Sa (v dense)
2.5 NFP Refusal Prob B/R

Station 12+081.1 0.5 Lt (Elev 380.6)
0 - 3.1 Peat (wet)
3.1 - 3.2 Gry Sa (v dense)
3.2 NFP Refusal Prob B/R

Station 12+081.7 22.3 Rt (Elev 380.6)
0 - 3.2 Peat (wet)
3.2 - 9.4 Gry Si(y) Sa (Loose to Comp)
9.4 NFP Refusal Prob B/R

Station 12+090 CL
3.6 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

12+100 CL D+000
0 - 2.9 Br Fib Peat w = 564%
2.9 - 3.7 Gry F-Med Sa Wet w = 74%
Fr Wat @ 300

12+100 20 RT D+000
0 - 2.6 Br Fib Peat
2.6 - 3.4 Gry F-Med Sa Wet
Fr Wat @ 230

Station 12+100 28.0 Lt
3.6 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+115 CL
3.3 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+129.9 21.6 Rt (Elev 380.4) (DCPT)
0 - 3.4 Prob Peat (wet)
3.4 - 12.5 Prob Gry Sa with Si (loose)
12.5 NFP Refusal Prob B/R

Station 12+130 20.0 Lt
2.6 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+130 30.0 Rt
3.4 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+132 22.4 Lt (Elev 380.3) (DCPT)
0 - 3.0 Prob Peat (wet)
3.0 - 9.8 Prob Gry Sa with Si (loose)
9.8 NFP Refusal Prob B/R

Station 12+145 31.0 Rt
3.3 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

12+150 25 LT D+000
0 - 600 Br Sa Tr Org Wet w = 24%
600 NFP Poss RF or BR
Fr Wat @ 300

12+150 CL D+000
0 - 2.7 Br Fib Peat w= 473%
2.7 - 3.4 Gry Sa Tr Si Wet w = 34%
Fr Wat @ 150

Station 12+160 CL
3.2 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+175 10.0 Rt
2.1 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+175 10.0 Rt
3.4 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+175 CL
3.2 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+180 25.7 Rt (Elev 380.2)
0 - 2.8 Peat (wet)
2.8 - 24.0 Gry Sa (Loose to comp) (wet)
24.0 - 26.5 Gry Sa (Tr Si) (Comp to dense) (wet)
26.5 NFP Refusal Prob B/R

Station 12+180.9 0.1 Lt (Elev 380.3)
0 - 3.0 Peat (wet)
3.0 - 6.1 Gry Sa (Loose to comp) (wet)
6.1 - 26.2 Gry Sa (Tr Si) (Loose to comp) (wet)
26.2 NFP Refusal Prob B/R

Station 12+181.8 28.8 Rt (Elev 380.2)
0 - 2.9 Peat (wet)
2.9 - 17.9 Gry Sa (Loose to comp)(wet)
17.9 NFP Refusal Prob B/R

Station 12+190 CL
3.5 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

12+200 27 LT D+000
0 - 900 Br Sa W Peat Tr Gr Wet
w = 32%
900 - 1.8 Br Fib Peat w = 149%
1.8 - 3.0 Gry F-Med Sa Wet
Fr Wat @ 270

12+200 CL D+000
0 - 3.0 Br Fib Peat w = 566%
3.0 - 3.7 Gry F-Med Sa Wet
Fr Wat @ 300

12+200 27 RT D+000
0 - 3.0 Br Fib Peat w = 227%
3.0 - 3.7 Gry F-Med Sa Wet w = 42%
Fr Wat @ 300

Station 12+223.9 0.3 Rt (Elev 380.3)
0 - 2.7 Peat (wet)
2.7 - 11.7 Gry Sa (Loose to comp) (wet)
11.7 NFP Refusal Prob B/R

Station 12+224.1 29.7 Rt (Elev 380.3) (DCPT)
0 - 2.4 Prob Peat (wet)
2.4 - 17.4 Prob Gry Sa with Si (loose)
17.4 NFP Refusal Prob B/R

12+225 CL D+000
0 - 2.0 Br Fib Peat
2.0 - 2.7 Br-Gry Sa Tr Si Wet
Fr Wat @ 270

Station 12+235 32.0 Lt
2.1 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+235 35.0 Rt
1.2 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

Station 12+235 CL
1.8 Blk Orgs (Soft & Wet) over Br F Sa (Wet)

12+250 CL D+000
0 - 1.4 Br-Gry F-Med Sa Tr Org Wet
w = 21%
1.4 - 3.7 Gry F-Med Sa Wet*
w = 16% @ 1.8
w = 17% @ 3.3
3.7 NFP Poss BR
Fr Wat @ 300
N = 8 @ 300
N = 16 @ 1.8
N = 27 @ 3.3
** % Passing 4.75 mm= 100*
1.18 mm= 92
300 µm= 33 'K' Factor = 0.1
75 µm= 3 LSFH

Station 12+250 10.0 Rt
Lt Br F Si(y) Sa on Surf

Station 12+250 42.3 Rt (D+600)
0 - 250 Tps (Moss)
250 - 1.3 Gry Si(y) F -M Sa (wet)
1.3 NFP Bld Poss B/R

Station 12+250 43.3 Rt (D+600)
0 - 250 Tps (Moss)
250 - 1.8 Gry Si(y) F -M Sa (wet)
1.8 NFP Bld Poss B/R

Station 12+266.5 0.1 Rt (Elev 382.9)
0 - 3.0 Sa Fill
3.0 - 5.5 Br Sa (Loose to v dense) (wet)
5.5 NFP Refusal Prob B/R

Station 12+289.8 6.0 Rt (Elev 386.0)
0 - 1.5 Br F Sa (Fill)
1.5 - 5.5 Gry Si(y) Sa & Gr (wet)
5.5 NFP Prob BR

Station 12+289.8 6.0 Lt (Elev 386.1)
0 - 1.4 Br F Sa (Fill)
1.4 - 6.9 Gry Si(y) Sa & Gr (wet)
6.9 NFP BR

Station 12+318.5 6.0 Lt (Elev 384.5)
0 - 5.1 Br F Sa Tr Si Tr Gr
5.1 - 6.2 Gry Si(y) Sa & Gr (wet)
6.2 NFP Prob BR

Station 12+318.5 6.0 Rt (Elev 384.8)
0 - 4.8 Br F Sa Tr Si Tr Gr (wet @ 4.0)
4.8 NFP BR

Station 12+330.2 0.3 Rt (Elev 387.4)
0 - 150 Tps
150 - 5.7 Gry Sa with Si Tr Gr (comp)
5.7 NFP Refusal Poss B/R

Station 12+369.1 0.3 Rt (Elev 387.2)
0 - 2.9 Gry Sa with Si (occ cob)
(loose - dense) (wet @ 2.8)
2.9 NFP Refusal Prob B/R

Station 12+369.3 26.2 Rt (Elev 389.3)
B/R on Surf

Station 12+396 25.6 Lt (Elev 385.6) (DCPT)
0 - 5.3 Prob Gry Sa with Si (loose)
5.3 NFP Refusal Prob B/R

12+325 35 LT D-0.1
0 - 3.0 Br F-Med Sa w = 4%
3.0 - 4.6 Br F-Co Sa* Wet w = 5%
4.6 - 10.0 Br F-Med Sa** Wet
w = 17% @ 4.9
w = 17% @ 6.4
w = 21% @ 7.9
w = 21% @ 9.4
10.0 NFP Poss Blds or BR
Fr Wat @ 3.4
N = 17 @ 1.8
N = 18 @ 3.3
N = 18 @ 4.9
N = 17 @ 6.4
N = 14 @ 7.9
N = 31 @ 9.4
* % Passing 19 mm = 100
4.75 mm= 99
1.18 mm= 83
300 µm= 25 'K' Factor = 0.1
75 µm= 3 LSFH
** % Passing 4.75 mm= 100
1.18 mm= 97
300 µm= 48 'K' Factor = 0.1
75 µm= 1 LSFH

12+325 30 RT D+1.5
0 - 050 Tps
050 - 600 Br Sa Tr Gr
600 NFP Poss Blds or BR

12+325 50 RT D+4.0
0 - 025 Tps
025 - 100 Br F-Med Sa
100 NFP Poss Blds or BR

12+350 24 LT D+000
0 - 1.5 Br F Sa w = 3%
1.5 - 4.6 Br F Sa* Some Si
w = 3% @ 1.8
w = 12% @ 3.3
4.6 - 6.1 Br F-Med Sa** w = 4%
6.1 - 7.3 Br Med-Co Sa Tr Gr w = 3%
7.3 NFP Poss Blds or BR
N = 14 @ 1.8
N = 12 @ 3.3
N = 17 @ 4.9
N = 28 @ 6.4
* % Passing 1.18 mm= 100
300 µm= 97 'K' Factor = 0.1
75 µm= 14 LSFH
** % Passing 19 mm = 100
4.75 mm= 99
1.18 mm= 95
300 µm= 27 'K' Factor = 0.1
75 µm= 5 LSFH

12+350 CL D+000
0 - 4.1 Br F Sa* W Si
w = 3% @ 600
w = 4% @ 1.8
w = 5% @ 3.3
4.1 NFP Poss Blds or BR
N = 13 @ 1.8
N = 12 @ 3.3
* % Passing 1.18 mm= 100
300 µm= 99 'K' Factor = 0.2
75 µm= 24 LSFH

12+350 24 RT D+0.3
0 - 3.0 Br F-Med Sa
w = 2% @ 600
w = 4% @ 1.8
3.0 NFP Poss Blds or BR
N = 6 @ 1.8

12+400 CL D+000
0 - 900 Br Sa Si w = 16%
900 NFP Poss Blds or BR

Station 12+433.3 14.9 Lt (Elev 391.5)
0 - 1.1 Br Si(y) Sa
1.1 NFP Refusal Prob B/R

Station 12+433.5 17.8 Rt (Elev 394.9)
0 - 500 Br Si(y) Sa with Gr
500 NFP Refusal Prob B/R

Station 12+449.1 0.7 Rt (Elev 392.6)
0 - 1.3 Br Sa with Si (dense)
1.3 NFP Refusal Prob B/R

12+450 CL D+000
0 - 025 Tps
25 - 900 Br Sa Si Tr Gr w = 14%
900 NFP Poss Blds or BR

Station 12+450 11.8 Lt (D-500)
0 - 25 Tps (Moss)
25 - 650 Br M-Co Sa Tr Si Occ Gr
650 NFP Bld Poss B/R

Station 12+450 CL
0 - 950 Br M-Co Sa Tr Si Occ Gr
950 NFP Bld Poss B/R

Station 12+475 CL
0 - 200 Br M-Co Sa Tr Si Occ Gr
200 NFP Cob / Bld

Station 12+475.5 CL
0 - 900 Br M-Co Sa Tr Si Occ Gr & Cob
900 NFP Bld Poss B/R

Station 12+476 CL
0 - 150 Br M-Co Sa Tr Si Occ Gr & Cob
150 NFP Cob / Bld

Station 12+492 1.0 Rt (D+/-0)
0 - 400 Br M-Co Sa Tr Si Occ Gr & Cob
400 NFP Bld Poss B/R

Station 12+492 CL
0 - 250 Br M-Co Sa Tr Si Occ Gr & Cob
250 NFP Bld Poss B/R

Station 12+493 CL
0 - 300 Br M-Co Sa Tr Si Occ Gr & Cob
300 NFP Bld Poss B/R

12+502 CL D+000
0 - 025 Tps
25 - 750 Br Sa Tr Si Tr Gr w = 14%
750 NFP Poss Blds or BR

Station 12+525 CL
0 - 25 Tps
25 NFP B/R

12+550 CL D+000
0 - 050 Tps
50 - 750 Br Sa Tr Si Tr Gr
750 NFP Poss Blds or BR

Station 12+550 12.8 Lt (D-100)
0 - 25 Tps
25 NFP B/R

Station 12+575 CL
B/R on Surf

Station 12+590 12.8 Lt (D+700)
0 - 200 Tps (Moss)
200 NFP B/R

Station 12+590 12.8 Rt (D+1.5)
0 - 250 Tps (Moss)
250 NFP B/R

Station 12+590 CL
0 - 25 Tps
25 - 200 Br M-Co Sa Tr Si Occ Gr
200 NFP B/R

12+600 10 LT D-0.3
0 - 100 Br Sa Tr Si
100 NFP Poss Blds or BR

12+600 CL D+000
0 - 125 Br Sa Tr Si Tr Org w = 14%
125 NFP BR

12+600 10 RT D+0.3
0 - 125 Br Sa Tr Si Tr Org
125 NFP Poss Blds or BR

Station 12+610 CL
0 - 75 Tps (Moss)
75 - 250 Br M-Co Sa Tr Si Occ Gr
250 NFP B/R

Station 12+620 12.8 Lt (D-500)
0 - 75 Tps (Moss)
75 - 200 Br F-M Sa Tr Si Occ Gr (moist)
200 NFP B/R

Station 12+620 12.8 Rt (D+400)
0 - 50 Tps (Moss)
50 - 300 Br F-M Sa Tr Si Occ Gr (moist)
300 NFP B/R

Station 12+620 CL
0 - 50 Tps (Moss)
50 - 350 Br F-M Sa Tr Si Occ Gr (moist)
350 NFP B/R

Station 12+630 CL
B/R on Surf

Station 12+640 12.8 Lt (D+200)
0 - 50 Tps
50 - 300 Br F-M Sa Tr Si Occ Gr (moist)
300 NFP B/R

Station 12+640 12.8 Rt (D+900)
0 - 50 Tps
50 - 300 Br F-M Sa Tr Si Occ Gr (moist)
300 NFP B/R

Station 12+640 CL
0 - 75 Tps
75 NFP B/R

Station 12+650 CL
0 - 50 Tps
50 - 200 Br F-M Sa Tr Si Occ Gr (moist)
200 NFP B/R

Station 12+660 12.8 Lt (D+200)
B/R on surf

Station 12+660 12.8 Rt (D+1.1)
B/R on surf

Station 12+660 CL
0 - 75 Tps 10.0 Rt
75- 500 Br F-M Sa Tr Si Occ Gr (moist)
500 NFP B/R

12+664.434 TWP. JACKMAN =
10+000.000 TWP. MACNICOL AHD.

TBT Engineering
Consulting Engineers

Geotechnical Design Report

WP 87-97-00

Borehole Data

MacNicol Twp.

TBT Engineering
TBTE Ref. No. 06-085

HIGHWAY 17 –
MacNicol Twp.

Station 10+010 CL
0 - 50 Tps (Moss)
50 - 300 Br Si Tr Sa Occ Gr (wet)
300 NFP Prob B/R

Station 10+020 12.8 Lt (D-700)
0 - 25 Tps (Moss)
25 - 200 Br Si Tr Sa Occ Gr (wet)
200 NFP B/R

Station 10+020 CL
0 - 50 Tps (Moss)
50 - 200 Br Si Tr Sa Occ Gr (wet)
200 NFP B/R

Station 10+020 CL
B/R on surf

Station 10+030 CL
B/R on surf

Station 10+040 12.8 Lt (D+400)
0 - 100 Tps
100 - 200 Br F-M Sa Tr Si Occ Gr (moist)
200 NFP B/R

Station 10+040 12.8 Rt (D+2.6)
B/R on surf

Station 10+040 8.5 Rt (D+300)
0 - 50 Tps
50 - 200 Br F-M Sa Tr Si Occ Gr (moist)
200 NFP Prob B/R

Station 10+040 CL
0 - 50 Tps
50 - 350 Br F-M Sa Tr Si Occ Gr (moist)
350 NFP Prob B/R

Station 10+045 CL
0 - 75 Tps
75 - 200 Br F-M Sa Tr Si Occ Gr (moist)
200 NFP B/R

Station 10+054 CL
B/R on surf

Station 10+060 12.8 Lt (D-700)
0 - 100 Tps
100 - 300 Br F-M Sa Tr Si Occ Gr (moist)
300 NFP B/R

Station 10+060 12.8 Rt (D-100)
0 - 75 Tps
75 NFP B/R

Station 10+060 CL
B/R on surf

Station 10+070 CL
0 - 100 Tps
100 - 250 Br F-M Sa Tr Si Occ Gr (moist)
250 NFP B/R

Station 10+080 12.8 Lt (D+200)
B/R on surf

Station 10+080 12.8 Rt (D+1.4)
B/R on surf

Station 10+080 CL
0 - 75 Tps
75 - 300 Br F-M Sa Tr Si Occ Gr (moist)
300 NFP B/R

Station 10+090 CL
B/R on surf

10+100 CL D+000
0 - 025 Org M
025 NFP BR

Station 10+100 12.8 Lt (D-2.1)
B/R on surf

Station 10+100 12.8 Rt (D-300)
B/R on surf

Station 10+108 11.0 Lt (D-300)
B/R on surf

Station 10+108 17.0 Lt (D-3.8)
0 - 300 Tps (Moss)
300 NFP B/R

Station 10+108 CL
B/R on surf

Station 10+110 CL
B/R on surf

Station 10+120 12.8 Lt (D-100)
B/R on surf

Station 10+120 12.8 Rt (D+900)
0 - 200 Tps
200 NFP B/R

Station 10+120 CL
0 - 75 Tps
75 - 400 Br F-M Sa Tr Si
400 NFP B/R

Station 10+130 CL
B/R on surf

Station 10+140 11.2 Lt (D-500)
B/R on surf

Station 10+140 12.8 Rt (D-100)
B/R on surf

Station 10+140 CL
B/R on surf

Station 10+150 CL
B/R on surf

Station 10+160 12.8 Lt (D-900)
0 - 75 Tps
75 - 200 Br F Sa with Si Tr Gr (moist)
200 NFP B/R

Station 10+160 12.8 Rt (D+400)
0 - 100 Tps
100 NFP B/R

Station 10+160 17.0 Lt (D-3.8)
0 - 100 Tps
100 NFP B/R

Station 10+170 CL
0 - 25 Tps (moss)
25 NFP B/R

Station 10+180 12.8 Lt (D-300)
0 - 200 Tps
200 NFP B/R

Station 10+180 12.8 Rt (D+600)
0 - 100 Tps
100 NFP B/R

Station 10+180 CL
0 - 150 Tps
150 NFP B/R

Station 10+190 CL
0 - 50 Tps (moss)
50 NFP B/R

10+200 10 LT D-1.5
0 - 050 Org M
050 NFP BR

10+200 CL D+000
0 NFP BR

10+200 10 RT D-450
0 NFP BR

Station 10+200 12.8 Lt (D-1.5)
0 - 300 Tps
300 NFP B/R

Station 10+200 12.8 Rt (D+1.0)
B/R on surf

Station 10+200 CL
B/R on surf

Station 10+210 CL
0 - 50 Tps (moss)
50 NFP B/R

Station 10+220 12.7 Rt (D-1.3)
0 - 250 Tps
250 - 550 Br F Sa with Si Tr Gr (moist)
550 NFP B/R

Station 10+220 12.8 Lt (D-1.3)
0 - 50 Tps (moss)
50 NFP B/R

Station 10+220 12.8 Rt (D-1.3)
0 - 200 Tps (moss)
200 NFP Bld Poss B/R

Station 10+220 CL
B/R on surf

Station 10+230 7.0 Rt (D+1.4)
B/R on surf

Station 10+230 CL
0 - 25 Tps (moss)
25 NFP B/R

Station 10+240 12.8 Lt (D-600)
0 - 250 Tps
250 NFP B/R

Station 10+240 12.8 Rt (D+1.2)
B/R on surf

Station 10+240 CL
0 - 250 Tps (moss)
250 NFP B/R

Station 10+250 CL
0 - 350 Tps
350 NFP B/R

Station 10+260 12.8 Rt (D-100)
B/R on surf

Station 10+260 17.0 Lt (D-3.3)
0 - 250 Tps (moss)
250 NFP B/R

Station 10+260 9.5 Lt (D+100)
B/R on surf

Station 10+260 CL
B/R on surf

Station 10+270 CL
B/R on surf

Station 10+280 12.8 Lt (D+200)
0 - 50 Tps (moss)
50 NFP B/R

Station 10+280 12.8 Rt (D-2.3)
0 - 350 Tps (moss)
350 NFP B/R

Station 10+280 4.0 Rt (D-1.9)
0 - 150 Tps (moss)
150 NFP B/R

Station 10+280 7.5 Lt (D+900)
0 - 50 Tps (moss)
50 NFP B/R

Station 10+280 CL
0 - 75 Tps (moss)
75 NFP B/R

Station 10+290 CL
0 - 350 Tps (moss)
350 NFP B/R

Station 10+294.303 CL
0 - 25 Tps (moss)
25 NFP B/R

10+300 CL D+000
0 - 100 Br Si Tr Sa Tr Gr Tr Org
(w = 21%)
100 NFP Poss Blds or BR

Station 10+300 12.8 Lt (D+500)
0 - 50 Tps (moss)
50 NFP B/R

Station 10+300 12.8 Rt (D-300)
0 - 250 Tps (moss)
250 NFP B/R

Station 10+300 3.5 Rt (D+700)
B/R on surf

Station 10+310 CL
0 - 25 Tps (moss)
25 NFP B/R

Station 10+320 12.8 Lt (D+200)
B/R on surf

Station 10+320 12.8 Rt (D-2.4)
0 - 150 Tps
150 - 550 Br F Sa with Si Tr Gr (wet)
550 NFP B/R

Station 10+320 5.5 Rt (D-1.2)
0 - 100 Tps (moss)
100 NFP B/R

Station 10+320 CL
B/R on surf

Station 10+330 CL
0 - 50 Tps (moss)
50 NFP B/R

Station 10+345 1.6 Rt (D-1.4)
0 - 150 Tps (moss)
150 NFP B/R

Station 10+345 12.8 Lt (D+1.7)
B/R on surf

Station 10+345 12.8 Rt (D-300)
B/R on surf

Station 10+345 3.5 Lt (D+1.2)
B/R on surf

Station 10+345 8.3 Rt (D-1.2)
0 - 200 Tps (moss)
200 NFP B/R

Station 10+345 CL
B/R on surf

Station 10+355 12.8 Lt (D+/-0)
0 - 150 Tps (moss)
150 NFP B/R

Station 10+355 5.3 Rt (D+500)
0 - 50 Tps (moss)
50 NFP B/R

Station 10+355 CL
0 - 150 Tps (moss)
150 NFP B/R

10+400 10 LT D-1.5
0 - 025 Org M
025 NFP Poss Blds or BR

10+400 CL D+000
0 NFP BR

10+400 10 RT D-4.5
0 NFP BR

Station 10+425 5.0 Rt (Elev 408.9)
B/R on surf

10+450 CL D+000
0 NFP RF

Station 10+458 8.0 Lt (Elev 411.9)
B/R on Surf

Station 10+460 11.0 Lt
0 - 700 Wat
700 NFP Prob B/R

Station 10+463 CL
0 - 70 Wat
70 - 400 Blk Org (Wet)
400 NFP Sh Rk Fill Poss B/R

Station 10+493 20.0 Rt (Elev 407.2)
B/R on Surf

Station 10+495 11.0 Lt
0 - 130 Asph
130 - 400 Cr Gr
400 - 900 Br M Sa with Gr Occ Cob (Moist)

900 NFP Sh Rk Fill

Station 10+495 8.0 Rt (Elev 411.5)
B/R on surf

Station 10+500 CL
Sh Rk Fill on surf
(Existing Hwy Embankment)

10+550 CL D+000
0 NFP RF

10+550 14.9 RT D-2.5
0 - 150 Br Sa Gr
150 NFP RF

Station 10+594 3.5 Rt
0 - 130 Asph
130 - 450 Cr Gr
450 - 900 Br M Sa with Gr Occ Cob (Moist)
900 NFP Sh Rk Fill

10+600 CL D+000
0 NFP RF W Br Sa Gr

Station 10+696 7.4 Rt
0 - 130 Asph
130 - 450 Cr Gr
450 - 900 Br M Sa with Gr Occ Cob (Moist)
900 NFP Sh Rk Fill

Station 10+696 7.4 Rt
Sample No. 06-TD-290 (150 – 300)
% Passing 4.75 mm 45.9 %
% Passing 75 um 3.8 %
% Crushed 94.9 %
Acceptable in gradation as Gran 'A'

Station 10+696 7.4 Rt
Sample No. 06-TD-291 (600 – 800)
% Passing 4.75 mm 62.9 %
% Passing 75 um 4.5 %
FMC @ 800 2.6 %
Acceptable in gradation as Gran 'B' Type III

10+700.942 (REV) TWP. MacNICOL =
10+756.796 (Hwy17) TWP. MacNICOL AHD.

Access Road

Sta 10+294.303 Rev Hwy 17 =
Sta 10+000.000 Conn Access Road

Station 10+000 CL
0 - 25 Tps (moss)
25 NFP B/R

Station 9+990 CL
B/R on surf

Station 9+990 10.0 Rt (D+500)
B/R on surf

Station 9+990 10.0 Lt (D-2.0)
0 - 300 Tps (moss)
300 NFP B/R

Station 9+980 CL
0 - 50 Tps (moss)
50 NFP B/R

Station 9+970 CL
0 - 75 Tps (moss)
75 NFP B/R

Station 9+970 10.0 Lt (D+1.6)
B/R on surf

Station 9+970 10.0 Rt (D-1.8)
0 - 150 Tps
150 - 700 Dk Br Si with Sa Tr Gr (wet)
700 - 950 Lt Br Si(y) F Sa Tr Gr (wet)
950 NFP B/R

Station 9+960 CL
0 - 200 Tps (moss)
200 NFP B/R

Station 9+950 CL
0 - 150 Tps (moss)
150 NFP B/R

Station 9+950 10.0 Lt (D+900)
0 - 200 Tps (moss)
200 NFP B/R

Station 9+950 10.0 Rt (D+1.9)
0 - 25 Tps (moss)
25 NFP B/R

Station 9+950 2.5 Rt (D-100)
0 - 200 Tps (moss)
200 NFP B/R

Station 9+950 3.7 Rt (D+2.0)
B/R on surf

Station 9+940 CL
0 - 25 Tps (moss)
25 NFP B/R

TBT Engineering
Consulting Engineers

Geotechnical Design Report

WP 87-97-00

Asphalt Core Data

TBT Engineering
TBTE Ref. No. 06-085

Station	Offset	Main Lanes	Auxiliary Lane	Sideroads Entrances	Paved Shld	Remarks
Jackman Twp.						
11+336	1.0 Rt	130				250+ Cr Gr (Original Hwy Alignment)
11+395	4.8 Lt				65	(Original Hwy Alignment)
11+496	4.0 Rt			40		SPTA
11+586	3.0 Lt	125				(Original Hwy Alignment)
11+797	0.6 Rt	115				(Original Hwy Alignment)
11+898	1.2 Lt	95				(Original Hwy Alignment)
12+080	4.5 Lt				50	(Original Hwy Alignment)
12+157	4.5 Rt				35	(Original Hwy Alignment)
12+232	1.7 Rt	125				(Original Hwy Alignment)
MacNicol Twp.						
10+338	0.6 Rt	125				(Original Hwy Alignment)
10+430	4.3 Rt				60	(Original Hwy Alignment)
10+566	0.4 Rt	130				(Original Hwy Alignment)
10+571	4.7 Lt				50	(Original Hwy Alignment)
10+615	5.1 Rt		125			270 mm Cr Gr (Original Hwy Alignment)
10+739	1.8 Lt	125				(Original Hwy Alignment)

# cores	8	1	1	5
Minimum	95	125	40	35
Maximum	130	125	40	65
Average	121.3	125.0	40.0	52.0
Average	121.7			

TBT Engineering
Consulting Engineers

Geotechnical Design Report

WP 87-97-00

Laboratory Data

TBT Engineering
TBTE Ref. No. 06-085

TBT ENGINEERING

Thunder Bay Testing & Engineering Limited
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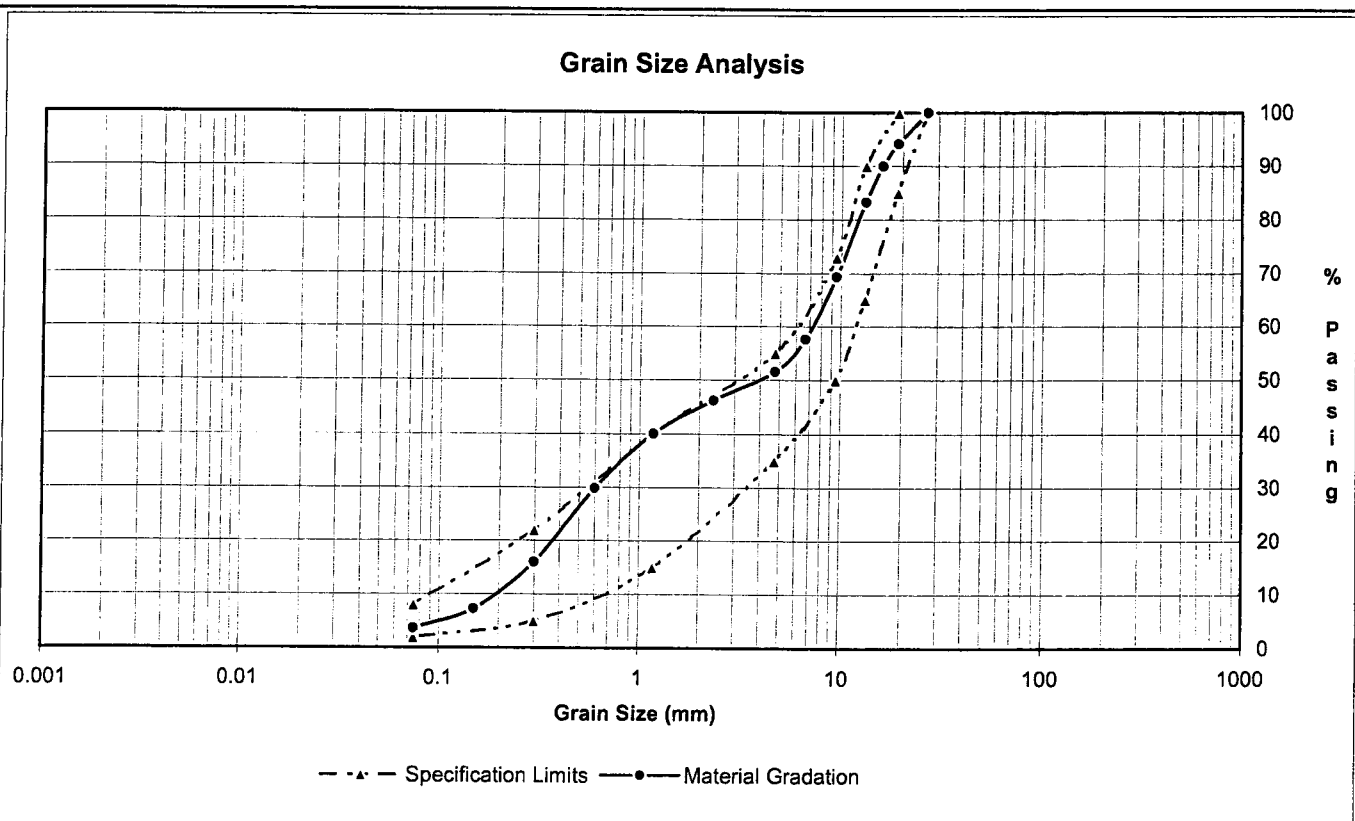
711 Harold Cres.,Thunder Bay, ON P7C 5H8
PH: (807) 624-5162 FAX: (807) 624-5163
E-Mail: tbte@tbt-engineering.on.ca

Grain Size Analysis - Granular 'A'

Client:	Ministry of Transportation	TBTE Project No.:	06-085
MTO Project No.:		Lab No.:	06-908
Location:	Hwy 17-Hawk Lake	Field No.:	06-TD-288
	Kenora	Station:	11+250
Twp	Jackman	Offset:	4.3m Rt
Reported To:	Al Clements	Depth:	60 mm - 250 mm
Sampled By/Date:	Terry Dupuis/Nov. 7, 2006	Tested By/Date:	Forch Valela/Dec.1, 2006
Reported By:	Forch Valela	Reviewed By:	Tim Fummerton

Sieve Size	Percent Passing	OPSS 1010 Specifications
26.5 mm	100.0	100
19.0 mm	94.2	85 - 100
16.0 mm	90.0	
13.2 mm	83.3	65 - 90
9.5 mm	69.3	50 - 73
6.7 mm	57.6	
4.75 mm	51.5	35 - 55
2.36 mm	46.1	
1.18 mm	40.0	15 - 40
600 um	29.8	
300 um	15.9	5 - 22
150 um	7.2	
75 um	3.6	2 - 8



Remarks: Test Method LS 602,607/ ASTM C136, D5821
Crushed Particles - 95.6%

TBT ENGINEERING

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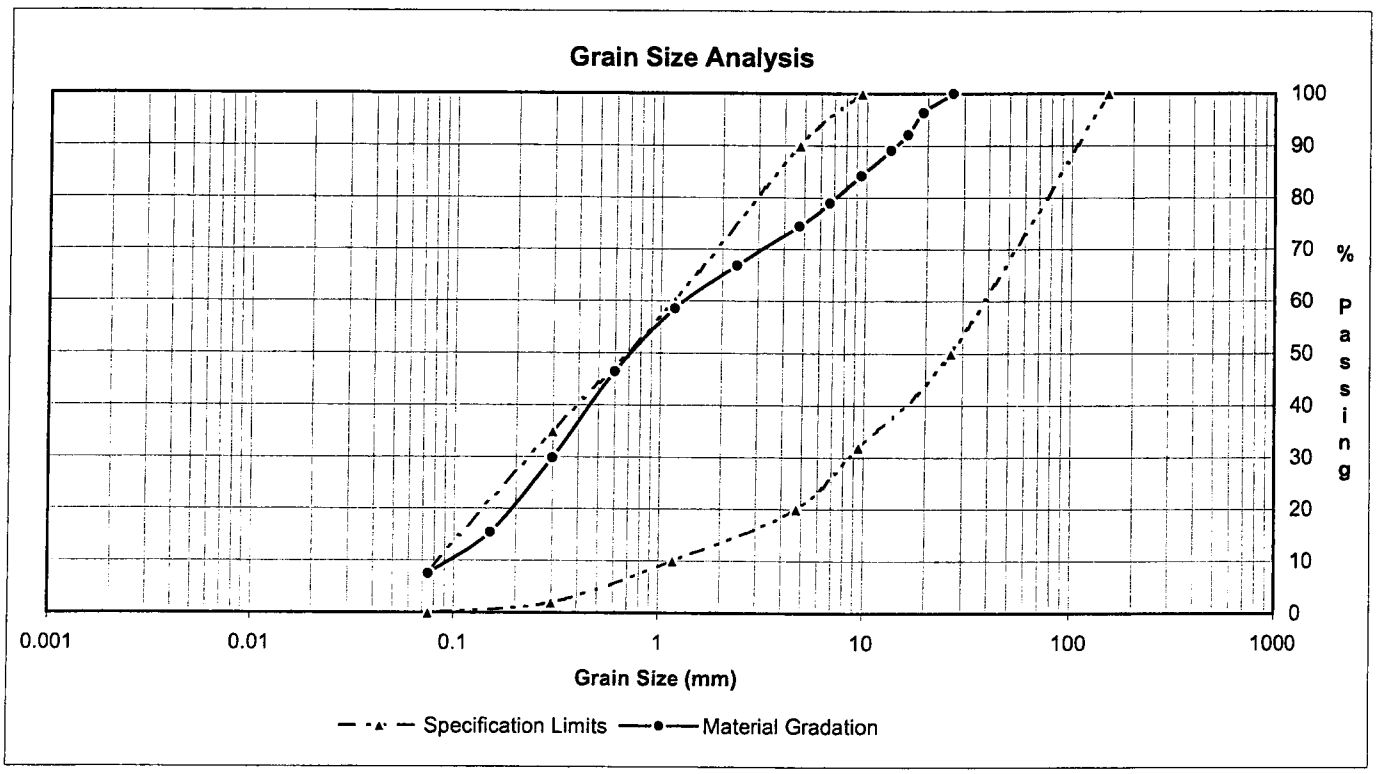
Grain Size Analysis - Granular 'B' Type III

Client:	Ministry of Transportation	TBTE Project No.:	06-085
MTO Project No.:		Lab No.:	06-909
Location:	Hwy 17-Hawk Lake	Field No.:	06-TD-289
	Kenora	Station:	11+250
Twp	Jackman	Offset:	4.3m Rt
Reported To:	Al Clements	Depth:	600 mm - 800 mm
Sampled By/Date:	Terry Dupuis/Nov 7, 2006	Tested By/Date:	F. Valela/P.Burbeck/Dec. 1, 2006
Reported By:	Forch Valela	Reviewed By:	Tim Fummerton

Sieve Size	Percent Passing	SP110F13
150 mm		100
26.5 mm	100.0	50-100
19.0 mm	96.3	
16.0 mm	92.1	
13.2 mm	89.0	
9.5 mm	84.1	32-100
6.7 mm	78.9	
4.75 mm	74.5	20-90
2.36 mm	66.8	
1.18 mm	58.4	10-60
600 um	46.4	
300 um	29.8	2-35
150 um	15.4	
75 um	7.5	0-8



Remarks: Test Method LS 602, 701/ASTM C136, D2216
Natural Moisture Content: 4.3 % @ 800 mm Depth

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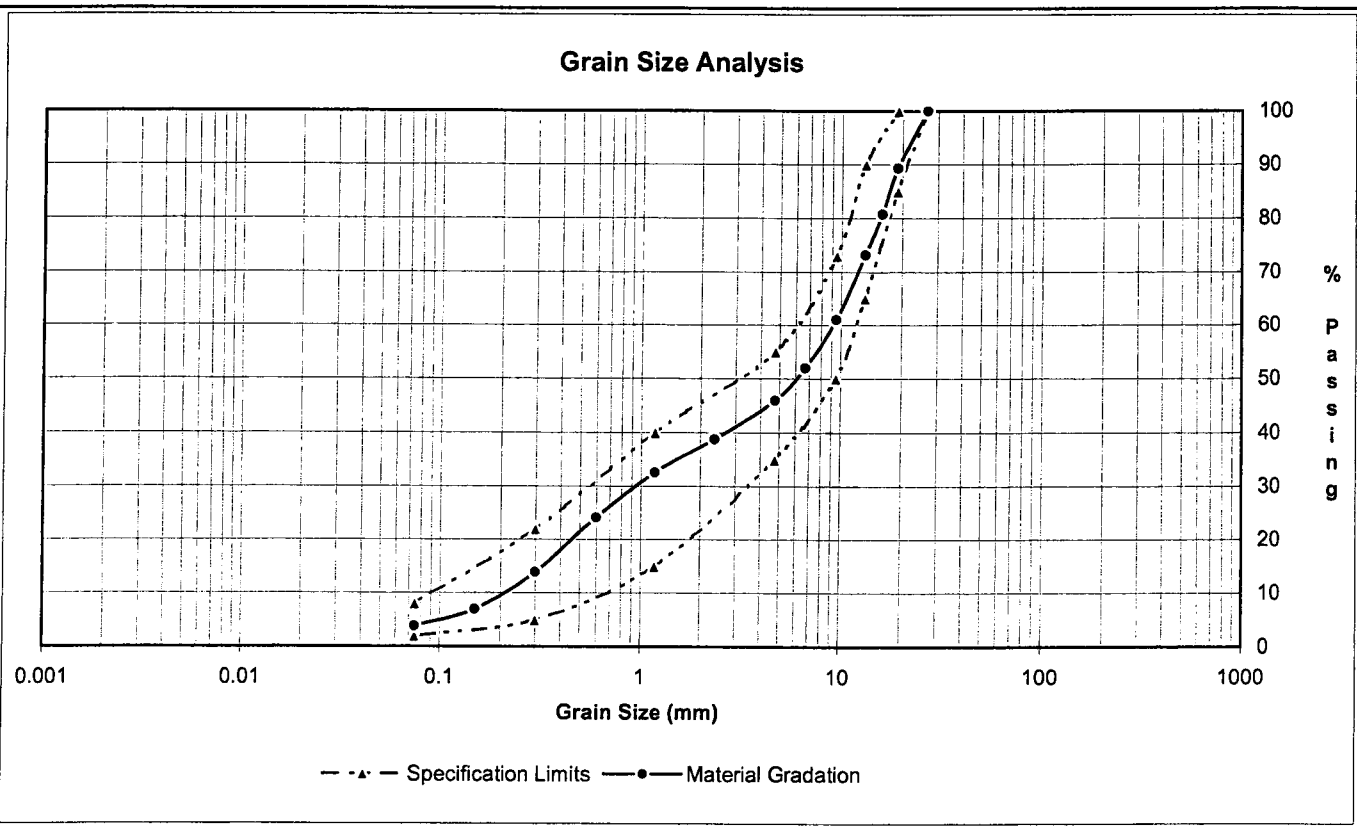
Grain Size Analysis - Granular 'A'

Client:	Ministry of Transportation	TBTE Project No.:	06-085
MTO Project No.:		Lab No.:	06-910
Location:	Hwy 17-Hawk Lake	Field No.:	06-TD-290
	Kenora	Station:	10+696
Twp	MacNichol	Offset:	7.4m Rt
Reported To:	Al Clements	Depth:	150 mm - 300 mm
Sampled By/Date:	Terry Dupuis/Nov. 8, 2006	Tested By/Date:	Forch Valela/Dec.1, 2006
Reported By:	Forch Valela	Reviewed By:	Tim Fummerton

Sieve Size	Percent Passing	OPSS 1010 Specifications
26.5 mm	100.0	100
19.0 mm	89.3	85 - 100
16.0 mm	80.7	
13.2 mm	73.1	65 - 90
9.5 mm	61.0	50 - 73
6.7 mm	51.9	
4.75 mm	45.9	35 - 55
2.36 mm	38.8	
1.18 mm	32.5	15 - 40
600 um	24.1	
300 um	13.8	5 - 22
150 um	6.9	
75 um	3.8	2 - 8



Remarks: Test Method LS 602,607/ ASTM C136, D5821
Crushed Particles - 94.9%

TBT ENGINEERING

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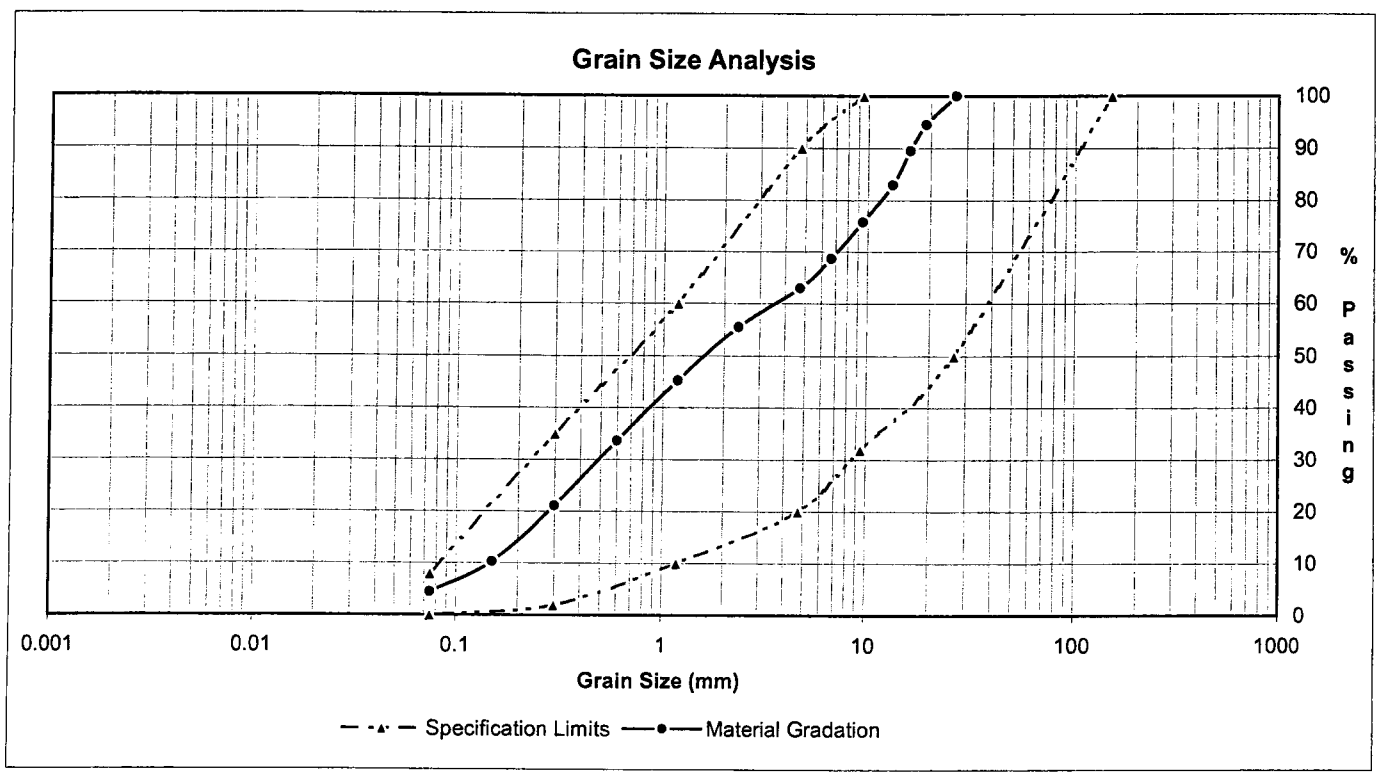
Grain Size Analysis - Granular 'B' Type III

Client:	Ministry of Transportation	TBTE Project No.:	06-085
MTO Project No.:		Lab No.:	06-911
Location:	Hwy 17-Hawk Lake	Field No.:	06-TD-291
	Kenora	Station:	10+696
Twp	MacNichol	Offset:	7.4m Rt
Reported To:	Al Clements	Depth:	600 mm - 800 mm
Sampled By/Date:	Terry Dupuis/Nov 8, 2006	Tested By/Date:	F. Valela/P.Burbeck/Dec. 1, 2006
Reported By:	Forch Valela	Reviewed By:	Tim Fummerton

Sieve Size	Percent Passing	SP110F13
150 mm		100
26.5 mm	100.0	50-100
19.0 mm	94.5	
16.0 mm	89.5	
13.2 mm	82.9	
9.5 mm	75.7	32-100
6.7 mm	68.6	
4.75 mm	62.9	20-90
2.36 mm	55.5	
1.18 mm	45.2	10-60
600 um	33.6	
300 um	21.1	2-35
150 um	10.3	
75 um	4.5	0-8



Remarks: Test Method LS 602, 701/ASTM C136, D2216
Natural Moisture Content: 2.6 % @ 800 mm Depth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SECTION