

G.I.-30 SEPT. 1976

GEOCRES No. 31E-128DIST. 52 REGION           W.P. No. 409-97-00  
6WP: 290-97-00CONT. No.           W. O. No.           STR. SITE No. 44-384HWY. No. 69LOCATION Raukin Lake Service  
Rd. UnderpassNo of PAGES -           =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.           REMARKS:

FOUNDATION INVESTIGATION REPORT  
FOR  
RANKIN LAKE SERVICE ROAD UNDERPASS  
W.P. 290-97-00, SITE 44-384  
HIGHWAY 69, DISTRICT 52  
HUNTSVILLE, ONTARIO

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Job No. 97TF088A

June, 1998

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## FOUNDATION INVESTIGATION REPORT

For

Rankin Lake Service Road Underpass

W.P. 290-97-00, Site 44-384

Highway 69, District 52, Huntsville

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### INTRODUCTION

This report summarizes the results of the foundation investigation carried out for construction of the Highway 69 underpass at the proposed Rankin Lake Service Road (Station 14+468 Highway 69 chainage).

The report pertains to the proposed bridge structure and approaches within 20 m of the abutments, between approximate stations 9+940 and 10+060, Rankin Lake Service Road chainage.

### SITE DESCRIPTION

The site is located about 25 km north of MacTier and about 150 m southwest of the existing Highway 69 alignment. The proposed interchange will connect the existing Highway 69 (future Highway 169 south) and proposed Rankin Lake Service Road with the proposed new four-lane section of Highway 69. At the underpass, Rankin Lake Service Road will run east-west.

The bridge location is presently a wooded/brush-covered area located behind two residential properties. The ground surface is gently undulating. A low bedrock outcrop is evident to the east and southeast of the bridge site.

The site is located in the Precambrian Laurentian peneplane. The topography is irregular in detail with many small lakes separated by ridges of Precambrian bedrock. The surface in general is relatively flat. The overburden in the region is typically shallow but can vary

substantially in thickness over short distances. Swamp environments have developed in areas of poor drainage.

### **INVESTIGATION PROCEDURES**

The fieldwork was carried out during the period February 11 to 21, 1998 and comprised 10 boreholes drilled at the locations shown on Drawing 1.

Five boreholes at the proposed abutment/pier foundation locations were drilled to refusal on bedrock/inferred bedrock at depths of 9.9 to 14.1 m and a sixth borehole at the abutment was terminated at 8.3 m depth. Three of these boreholes were extended an additional 2.7 to 3.0 m into the bedrock using NQ rock coring equipment. Three boreholes at the approaches were drilled to 5.1 m depth and a fourth approach borehole was terminated on inferred bedrock at 4.4 m depth.

The boreholes were advanced using continuous flight hollow stem augers, powered by a truck-mounted CME-75 drillrig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of our engineering staff.

Representative samples of the overburden were recovered at frequent depth intervals using a conventional split spoon sampler during drilling. Standard penetration tests were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata. Dynamic cone penetration testing was carried out at locations adjacent to selected boreholes to further assess the relative density of the soils. The groundwater conditions in the boreholes were closely monitored during the course of the fieldwork.

All of the recovered samples were returned to our laboratory for detailed visual examination, classification and routine moisture content determinations. Grain size distribution analyses were carried out on selected samples of the overburden. Samples of the recovered rock core were subjected to unconfined compressive strength tests.

## **SUMMARIZED SUBSURFACE CONDITIONS**

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions including soil classifications, inferred stratigraphy, standard penetration test "N" values, dynamic cone penetration test results, rock core descriptions, groundwater observations and the results of laboratory moisture content determinations. Stratigraphic profiles prepared from the borehole data are presented on Drawing 1.

The stratigraphy revealed in the boreholes generally comprised a thin layer of topsoil and/or fill overlying native sand mantling bedrock. The strata encountered are summarized below.

### **Sand and Gravel Fill**

Sand and gravel fill was encountered surficially in boreholes 384-1, 3 and 7. This layer was 100 to 300 mm thick.

### **Topsoil**

Topsoil was encountered surficially in boreholes 384-5, 6 and 8 to 10, as well as below the fill in borehole 384-7. The topsoil layer was 200 to 330 mm thick and comprised silty sand/sandy silt judged to have a low organic content.

### **Sand**

A major sand deposit was encountered surficially in boreholes 384-2 and 4 and below the fill/topsoil in the remaining boreholes. The relative density of the sand ranged from compact to dense, locally very dense. Moisture contents ranged from 4 to 18% (typically 4 to 8%) above observed water levels and from 13 to 26% (typically 17 to 21%) below. The results of grain size analyses conducted on five representative samples of the sand are presented on Figure 1.

Boreholes 384-1, 2, 4 and 9 were terminated in the sand overburden at depths of 5.1 and 8.3 m. The sand mantled bedrock/inferred bedrock in the remaining boreholes.

#### Bedrock

Bedrock or inferred bedrock was contacted below the sand at depths of 9.9 to 14.1 m (elevation 237.8 to 243.8) in boreholes 384-3 and 5 to 8, and at 4.4 m depth (elevation 249.7) in borehole 384-10. The elevation of the bedrock surface varies by some 2 and 6 m between the central pier and west/east abutments respectively.

A description of the rock cores recovered from/adjacent to boreholes 384-3, 6 and 7 is provided on Table I. In general, the bedrock consists of granitic gneiss and biotite migmatite. Core recovery ranged from 81 to 100% and the RQD ranged from 54 to 92%. The rock was good quality in borehole 384-3, excellent quality in borehole 384-6, and good becoming very poor to poor quality in borehole 384-7.

The unconfined compressive strength of selected core samples were as follows:

Borehole <u>No.</u>	Depth <u>(m)</u>	Unconfined Compressive <u>Strength (MPa)</u>
384-3	11.7-11.8	103.2
384-6	13.3-13.4	108.0
384-7	11.6-11.7	56.5

Groundwater

Free water was observed at depths of 2.3 to 5.6 m (elevation 247.0 to 248.2) in boreholes 384-3 to 8 during drilling and in boreholes 384-1 and 2 upon completion. Observed groundwater levels are subject to seasonal fluctuations and rainfall patterns.

CLOSURE

The fieldwork was carried out under the supervision of M. Rapsey, Senior Drillrig Supervisor. The equipment was supplied by All-Terrain Drilling Limited.

The report was written by M.R. Anderson, Project Engineer and reviewed by D.W. Kerr, Manager of Geotechnical and Geo-Environmental Services, Hamilton.



Yours very truly

Peto MacCallum Ltd.

A handwritten signature of Murray R. Anderson in black ink.

Murray R. Anderson, M.Eng., P.Eng.  
Project Engineer



A handwritten signature of Dennis W. Kerr in black ink.

Dennis W. Kerr, M.Eng., P.Eng.  
Manager Geotechnical and  
Geo-Environmental Services  
Hamilton

MRA:mmm

**TABLE I**

**ROCK CORE DESCRIPTION**  
**WP 290-97-00, Site No. 44-384**

CORE RECOVERY					CORE DESCRIPTION	
BOREHOLE	CORE NO.	DEPTH (m)	RECOVERY (%)	RQD (%)	DEPTH (m)	DESCRIPTION
384-3	8	11.28 - 14.33	95	84	11.28 - 12.20	<b>GRANITIC GNEISS</b> (with occ. layers of black biotite migmatite), pink to grey, fine to coarse crystalline, medium to high strength, slightly to moderately weathered in upper 200 mm becoming unweathered; very close to close spaced partings in upper 200 mm, rough planar, oxidized on parting surface; good quality.
					12.20 - 14.33	<b>BIOTITE MIGMATITE</b> , black, banded, fine to medium crystalline, low to medium strength; close to moderate spaced dipping partings parallel to schistosity, rough planar, tight; good quality.
384-6	8	12.50 - 15.29	100	92	12.50 - 15.29	<b>GRANITIC GNEISS</b> (with occ. thin layers of biotite migmatite), pink, fine to medium crystalline (trace possible uraninite), medium to high strength, unweathered; with vertical parting at 14.0 to 14.3 m depth, rough planar, rust-coloured oxidation stains on parting surfaces; excellent quality.

RQD = Rock Quality Designation

Logged by J. Wright

**TABLE I Cont'd**

**ROCK CORE DESCRIPTION**  
**WP 290-97-00, Site No. 44-384**

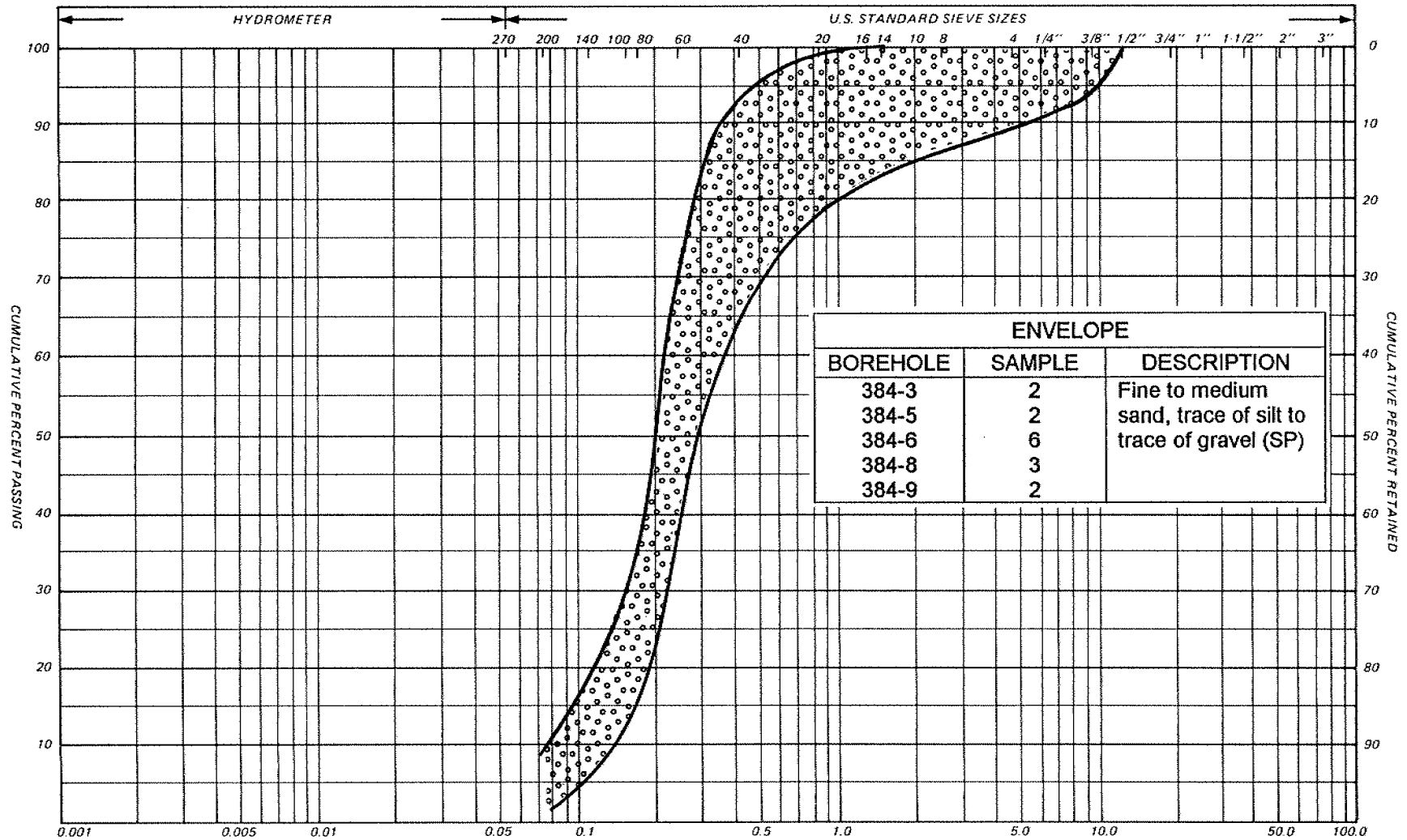
CORE RECOVERY					CORE DESCRIPTION	
BOREHOLE	CORE NO.	DEPTH (m)	RECOVERY (%)	RQD (%)	DEPTH (m)	DESCRIPTION
384-7	8	11.61 - 14.35	81	54	11.61 - 13.00	<b>GRANITIC GNEISS</b> (with layers of black biotite migmatite below 12.2 m), pink, fine crystalline, medium to high strength, unweathered; moderate spaced discontinuities; good quality.
					13.00 - 13.86	<b>BIOTITE MIGMATITE</b> , black, banded to homogeneous, fine to coarse crystalline, medium strength; very close to close spaced dipping to vertical partings, dark green to black alteration and rust coloured oxidation on parting surfaces; very poor quality.
					13.86 - 14.35	<b>GRANITIC GNEISS</b> , pink, fine crystalline, medium to high strength, vertical joint; poor quality.

RQD = Rock Quality Designation

Logged by J. Wright

# PARTICLE SIZE DISTRIBUTION CHART

Figure: 1  
OUR PROJECT NO. 97TF088A



GRAIN SIZE IN MILLIMETERS												UNIFIED				
SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL			COBBLES			
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL	COBBLES	M.I.T.	
	SILT				SAND				GRAVEL							
CLAY		SILT			V. FINE		FINE		MED.		COARSE		SAND		GRAVEL	U.S. BUREAU

REMARKS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## LIST OF ABBREVIATIONS

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N', - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 0.3m INTO THE SUBSOIL. DRIVEN BY MEANS OF A 63.5kg HAMMER FALLING FREELY A DISTANCE OF 0.76m.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 51mm, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS. 0.3m INTO THE SUBSOIL. THE DRIVING ENERGY BEING 475 J PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS/0.3 m</u>	<u>c kPa</u>	<u>DENSENESS</u>	<u>'N' BLOWS/0.3 m</u>
VERY SOFT	0 - 2	0 - 12	VERY LOOSE	0 - 4
SOFT	2 - 4	12 - 25	LOOSE	4 - 10
FIRM	4 - 8	25 - 50	COMPACT	10 - 30
STIFF	8 - 15	50 - 100	DENSE	30 - 50
VERY STIFF	15 - 30	100 - 200	VERY DENSE	> 50
HARD	> 30	> 200		
W.T.P.L. WETTER THAN PLASTIC LIMIT		D.T.P.L. DRIER THAN PLASTIC LIMIT		
A.P.L. ABOUT PLASTIC LIMIT				

### TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

### SOIL TESTS

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL		

▲, Δ - Undisturbed and remoulded shear strength determined from in situ vane test.

■ - Undrained shear strength determined from pocket penetrometer test.

## LOG OF BOREHOLE NO. 384-1

N 5 017 130  
E 276 236

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE  
SITE Rankin Lake Service Road Underpass, Site 44-384  
LOCATION Station 9+939 (Rankin Lake Service Road) 6.4m Lt. BC  
BORING METHOD Continuous Flight Hollow Stem Augers

OUR PROJECT 97HF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH $C_u$		LIQUID LIMIT $W_L$			GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST		WATER CONTENT %			
							BLOWS/0.3M		WATER CONTENT %			
							20	40	60	80	10	
0	GROUND ELEVATION 252.08											
0.30	<b>SAND AND GRAVEL FILL</b> : Crushed stone	XXXX										
	<b>SAND</b> : Compact, brown, fine sand, trace of silt and gravel, damp		251									
1.5				1	SS	6	150mm & bouncing*					* Probable boulder
2.40	becoming light greyish brown		250									
3.0			249									
3.90	becoming dense, saturated		248	2	SS	29						
4.5												
5.05	BOREHOLE TERMINATED AT 5.05m		247	3	SS	50						Upon completion of augering, free water at 3.90m.
6.0												

NOTES:

CHECKED BY: *mont*

N 5 017 117  
E 276 241

OUR PROJECT 97HF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey

Upon completion of augering, free water and cave at 2.30m.

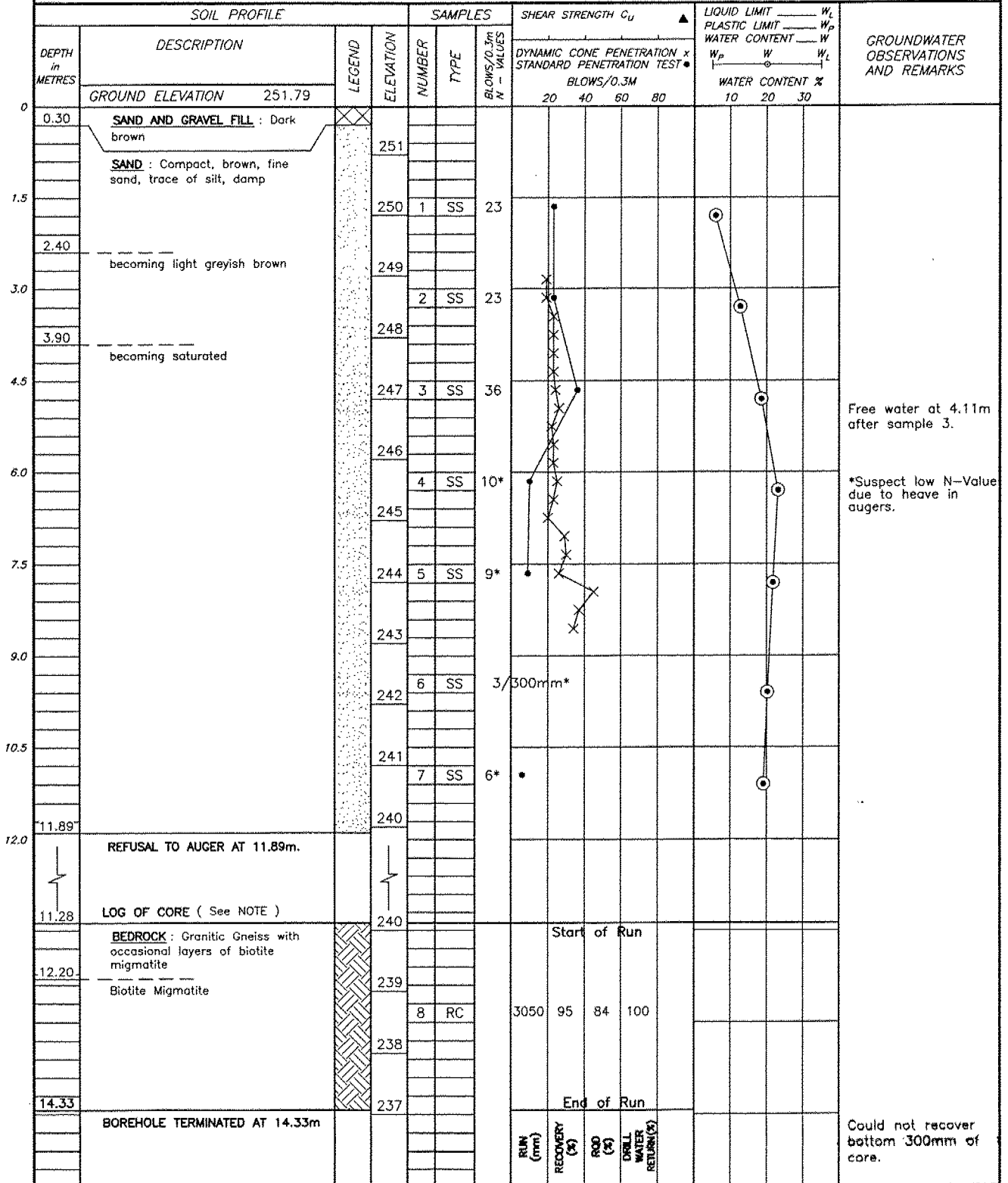
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## LOG OF BOREHOLE NO. 384-3

N 5 017 129  
E 276 258

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE, ONTARIO  
SITE Rankin Lake service Road Underpass, Site 44-384  
LOCATION Station 9+961 (Rankin Lake Service Road) 6.4m Lt.  
BORING METHOD Continuous Flight Hollow Stem Augers & NQ Rock Coring

OUR PROJECT 97TF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey



NOTES: Could not set casing in bedrock at initial borehole location due to excessive auger deflection. Moved 1.7m east and 3.4m south; augered to refusal at 11.28m depth (elevation 240.21) and began coring.

CHECKED BY: *[Signature]*

## LOG OF BOREHOLE NO. 384-4

N 5 017 116  
E 276 262

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE, ONTARIO

OUR PROJECT 97TF088A

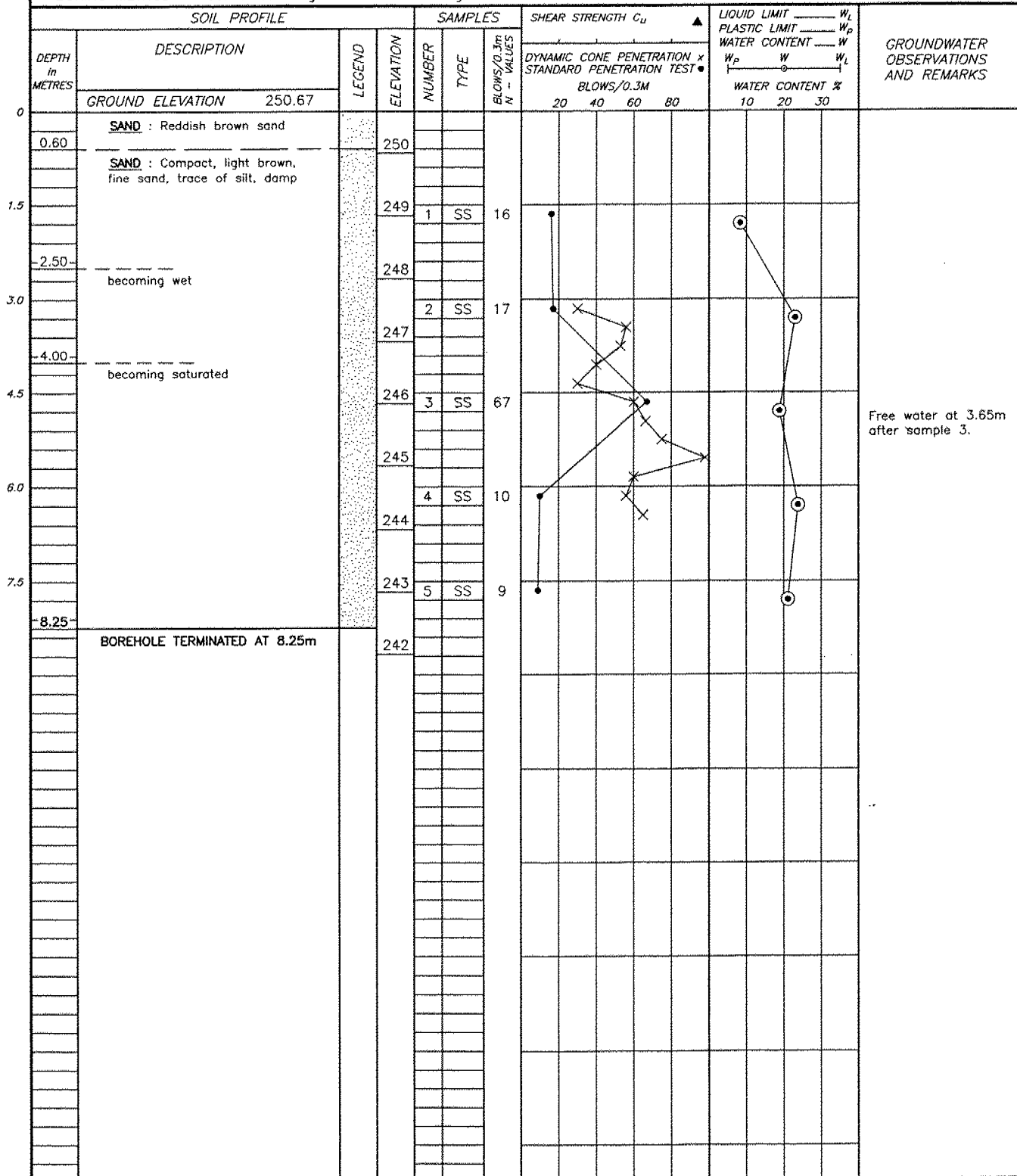
SITE Rankin Lake Service Road Underpass, Site 44-384

LOCATION Station 9+965 (Rankin Lake Service Road) 6.4m Rt

BORING DATE Feb. 11, 1998 ENGINEER M. R. Anderson

BORING METHOD Continuous Flight Hollow Stem Augers

TECHNICIAN M. Rapsey



NOTES:

CHECKED BY: *MRP*

## LOG OF BOREHOLE NO. 384-5

N 5 017 129  
E 276 294

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE, ONTARIO  
SITE Rankin Lake Service Road Underpass, Site 44-384  
LOCATION Station 9+997 (Rankin Lake Service Road) 6.4m Lt.  
BORING METHOD Continuous Flight Hollow Stem Augers

OUR PROJECT 97TF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES			SHEAR STRENGTH $C_u$ ▲		LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ $W$ $W_L$			GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •		WATER CONTENT %					
						BLOWS/0.3M							
0	GROUND ELEVATION 252.33					20	40	60	80	10	20	30	
0.25	TOPSOIL : Dark brown silty fine sand, low organic		252										
	SAND : Compact, light brownish grey, fine sand, trace of silt, damp		251										
1.5				1	SS	29							
			250										
3.0				2	SS	27							
			249										
4.00	becoming saturated		248										
4.5				3	SS	12							
5.20	DROVE DYNAMIC CONE		247										
6.0			246										
7.30			245										
7.5	POWER AUGERED WITH DRILLING MUD		244										
9.0			243										
10.5			242										
			241										
12.0			240										
12.30	occasional boulders		239										
13.5			238										
14.07	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 14.07m BEDROCK ASSUMED.												
15.0													

NOTES:

CHECKED BY: *MDP*

## LOG OF BOREHOLE NO. 384-6

N 5 017 116  
E 276 300

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE

OUR PROJECT 97TF088A

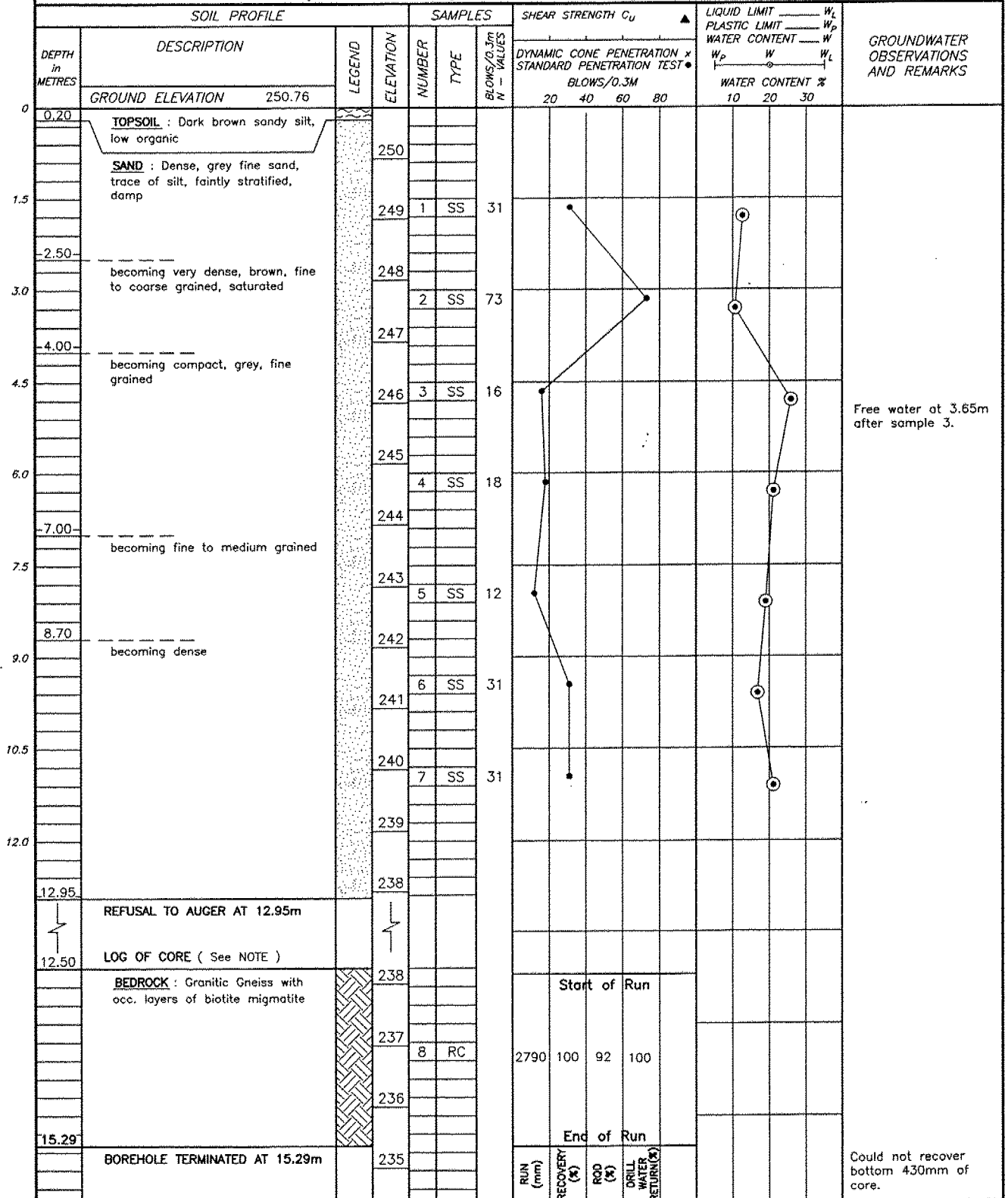
SITE Rankin Lake Service Road Underpass, Site 44-384

BORING DATE Feb. 12, 1998 ENGINEER M. R. Anderson

LOCATION 10+003 (Rankin Lake Service Road) 6.9m Rt

BORING METHOD Continuous Flight Hollow Stem Augers & NQ Rock Coring

TECHNICIAN M. Ropsey



NOTES: Could not set casing at initial borehole location due to excessive auger deflection. Moved 1.5m north and 1.5m east; augered to refusal at 12.50m depth (elevation 238.26) and began coring.

CHECKED BY: *[Signature]*

## LOG OF BOREHOLE NO. 384-7

**N 5 017 129**  
**E 276 332**

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE, ONTARIO  
SITE Rankin Lake Service Road Underpass, Site 44-384  
LOCATION Station 10+035 (Rankin Lake Service Road) 6.4m Lt. BORING DATE Feb. 17, 1998  
BORING METHOD Continuous Flight Hollow Stem Augers & NQ Rock Core

OUR PROJECT 97TF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES		SHEAR STRENGTH $C_u$		LIQUID LIMIT $W_L$		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST * BLOWS/0.3M	PLASTIC LIMIT $W_P$	WATER CONTENT $W$	
	GROUND ELEVATION 253.52						20 40 60 80			
0.10	<b>SAND FILL</b> : Dark brown silty sand		253							Free water at 5.42m after sample 4.
0.40	<b>TOPSOIL</b> : Dark brown silty sand, low organic		252							
1.5	<b>SAND</b> : Dense, brownish grey, fine sand, some silt, damp		251	1	SS	39				
2.40	becoming fine to medium grained, trace of silt; boulder at 2.40m.		250	2	SS	34				
3.0			249	3	SS	35				
3.90	becoming light greyish brown, fine grained, dry to damp		248							
4.5	becoming saturated		247	4	SS	32				
5.60			246	5	SS	52				
6.0			245							
7.10	becoming brownish grey, fine to medium grained		244	6	SS	30				
7.5			243							
9.0			242	7	SS	32				
10.20	becoming grey, fine to coarse grained		241	8	RC					
10.5			240							
11.61	<b>BEDROCK</b> : Granitic Gneiss with layers of biotite migmatite		239							
12.0										
13.5										
14.35	BOREHOLE TERMINATED AT 14.35m									
15.0										
16.5										

NOTES:

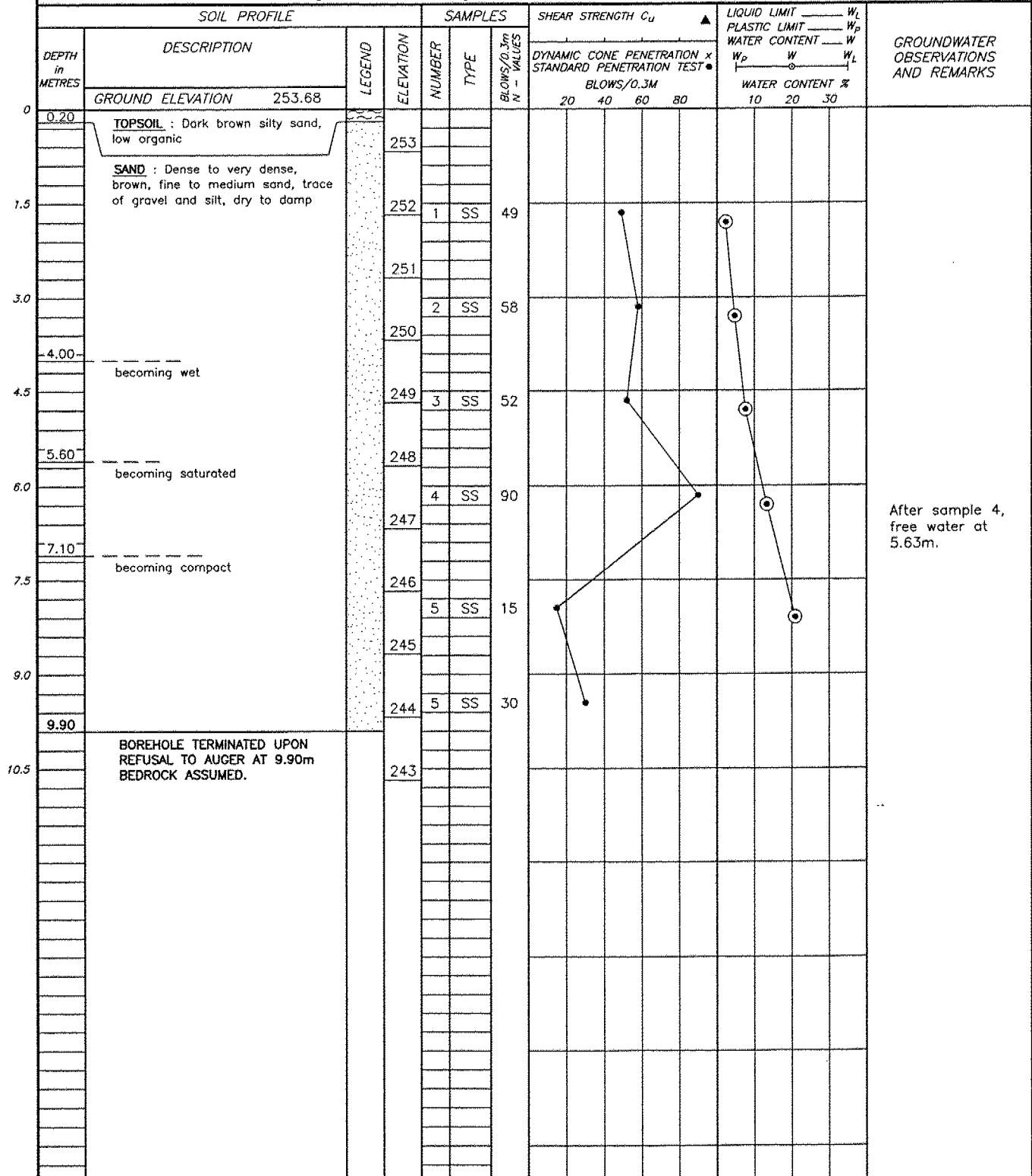
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## LOG OF BOREHOLE NO. 384-8

N 5 017 116  
E 276 338

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE  
SITE Rankin Lake Service Road Underpass, Site 44-384  
LOCATION Station 10+041 (Rankin Lake Service Road) 6.4m Rt.  
BORING METHOD Continuous Flight Hollow Stem Augers

OUR PROJECT 97HF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey



After sample 4, free water at 5.63m.

NOTES:

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## LOG OF BOREHOLE NO. 384-9

N 5 017 129  
E 276 352

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE  
SITE Rankin Lake Service Road Underpass, Site 44-384  
LOCATION Station 10+055 (Rankin Lake Service Road) 6.4m Lt.  
BORING METHOD Continuous Flight Hollow Stem Augers

OUR PROJECT 97TF088A  
ENGINEER M. R. Anderson  
TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH $C_u$		LIQUID LIMIT $W_L$		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3M	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST	WATER CONTENT %	
	GROUND ELEVATION 254.34								
0									
0.33	TOPSOIL : Dark brown silty sand, low organic		254						Upon completion of augering, no free water, no cave.
	SAND : Compact, brown, fine to coarse sand, trace of silt, damp		253						
1.5				1	SS	24			
3.0				2	SS	27			
4.00									
4.5	becoming dense, light brownish grey silt and fine sand		250						
5.00				3	SS	41			
5.05	becoming fine to medium sand, trace of silt		249						
	BOREHOLE TERMINATED AT 5.05m								
6.0									

NOTES:

CHECKED BY: *[Signature]*

LOG OF BOREHOLE NO. 384-10      N 5 017 117  
E 278 357

PROJECT W.P. 290-97-00 HIGHWAY 69, DISTRICT 52, HUNTSVILLE

OUR PROJECT 97TF088A

SITE Rankin Lake Service Road Underpass, Site 44-384

BORING DATE Feb. 12, 1998 ENGINEER M. R. Anderson

**LOCATION** Station 10+061 (Rankin Lake Service Road) 6.4m Rt.

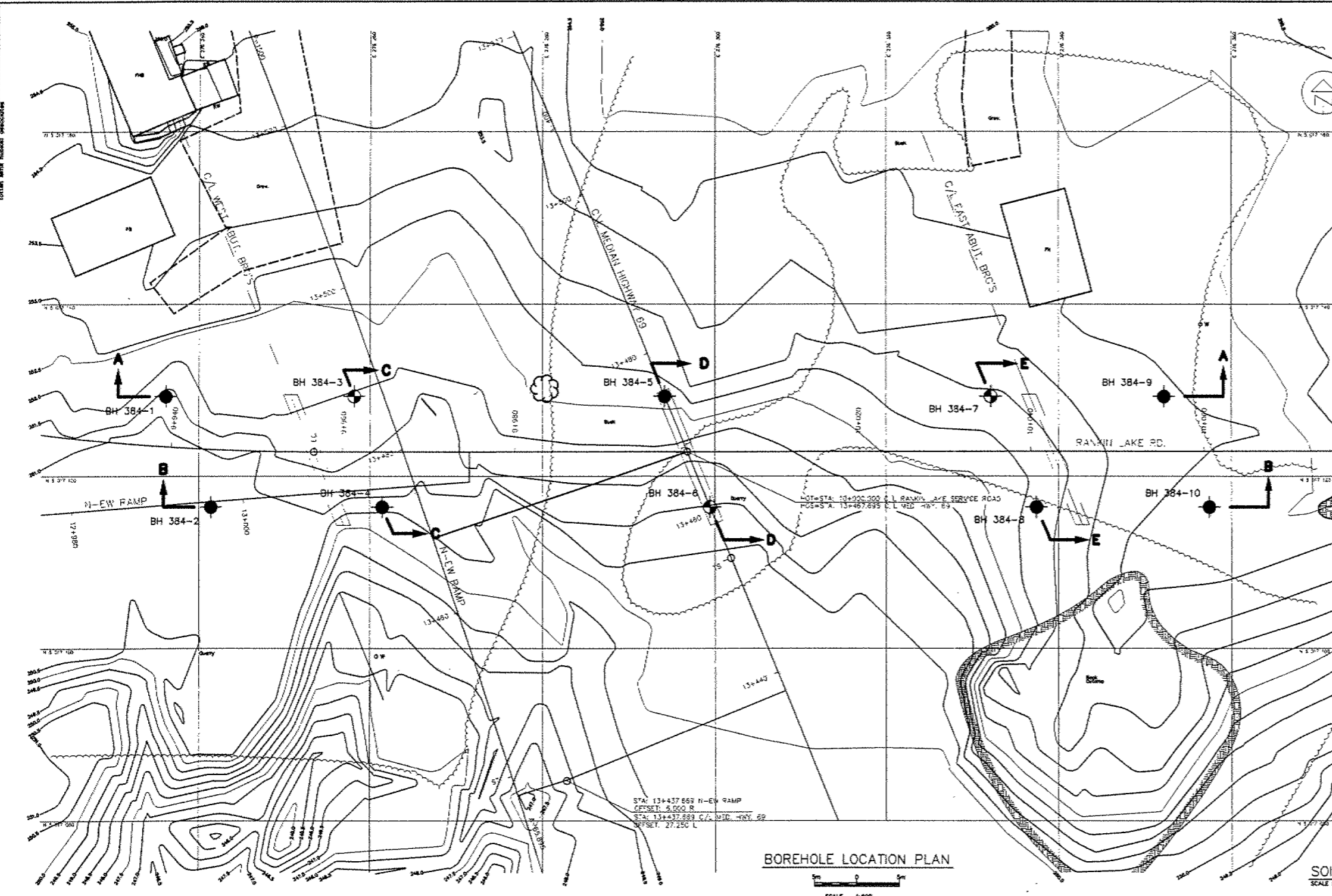
TECHNICIAN M. Rapsey

**BORING METHOD** Continuous Flight Hollow Stem Augers

SOIL PROFILE				SAMPLES		SHEAR STRENGTH $c_u$	LIQUID LIMIT $W_L$	PLASTIC LIMIT $W_P$	WATER CONTENT $W$	GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •		WATER CONTENT % $W_P$ $W$ $W_L$	
							BLOWS/0.3M 20    40    60    80			
0	GROUND ELEVATION      254.11									
0.20	TOPSOIL : Dark brown silty sand, low organic									
1.5	SAND : Dense, brown, fine to coarse sand, trace of silt, dry to damp		253							
			252	1	SS	39				
2.50										
3.0	becoming fine-grained		251	2	SS	34				
			250							
4.5										
4.44	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 4.44m BEDROCK ASSUMED.		249							
6.0										
										Upon completion of augering, no free water, no cave.

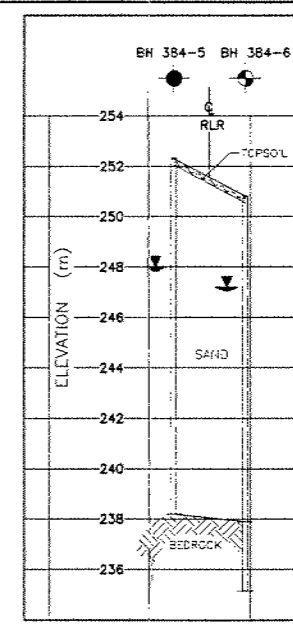
NOTES:

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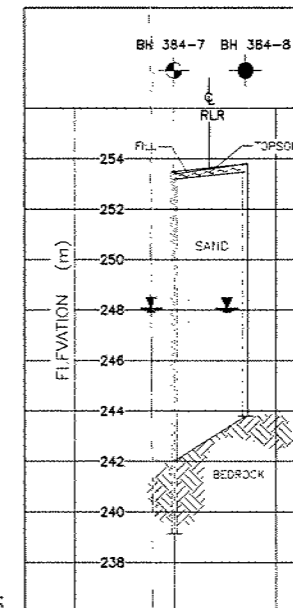


BOREHOLE LOCATION PLAN

SCALE: 1:600

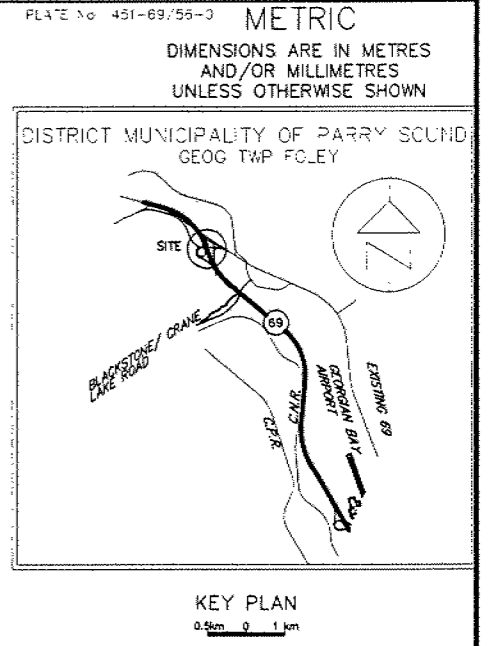
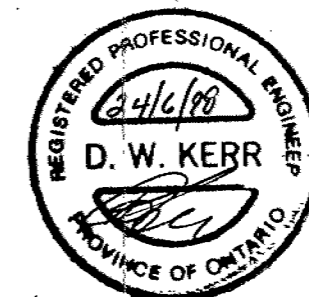


SECTION D-D



SECTION E-E

SOIL PROFILES  
SCALE: VERTICAL 1:300 HORIZONTAL 1:1500



BOREHOLE	LOCATION	ELEVATION
384-1	N 5 017 130 E 276 236	252.08
384-2	N 5 017 117 E 276 241	250.46
384-3	N 5 017 129 E 276 258	251.79
384-4	N 5 017 116 E 276 262	250.67
384-5	N 5 017 129 E 276 294	252.33
384-6	N 5 017 116 E 276 300	250.76
384-7	N 5 017 129 E 276 332	253.52
384-8	N 5 017 116 E 276 338	253.68
384-9	N 5 017 129 E 276 352	254.34
384-10	N 5 017 117 E 276 357	254.11

**LEGEND**

- BOREHOLE
- BOREHOLE AND ROCK CORE
- OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)

**NOTE**

- REFER TO LOG OF BOREHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
- THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES, THE BOUNDARIES ARE ASSUMED FROM GEOTECHNICAL EVIDENCE.

MINISTRY OF TRANSPORTATION  
ENGINEERING AND RIGHT OF WAY OFFICE  
SURVEYS AND PLANS SECTION

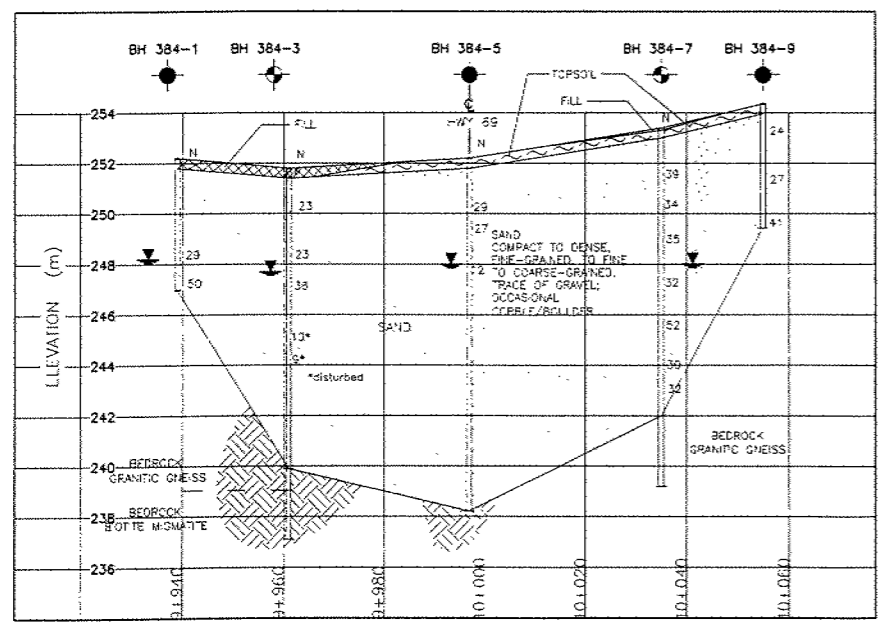
PROPOSED CROSSING  
AT  
RANKIN LAKE ROAD  
AND  
KING'S HIGHWAY 69  
DISTRICT MUNICIPALITY OF PARRY SOUND  
CON A  
GEOG TWP FOLEY TWP OF GEORGIAN BAY

SCALE AS SHOWN	DISTRICT S2 HUNTSVILLE	REGION NORTHERN
WP/NO 290-97-00	PROFILE C-790-69-057	PLAN B-451-69-020
SURVEY 97 12	PLAN 97 12	
SITE 44-384	PLAN E-451-69-056	

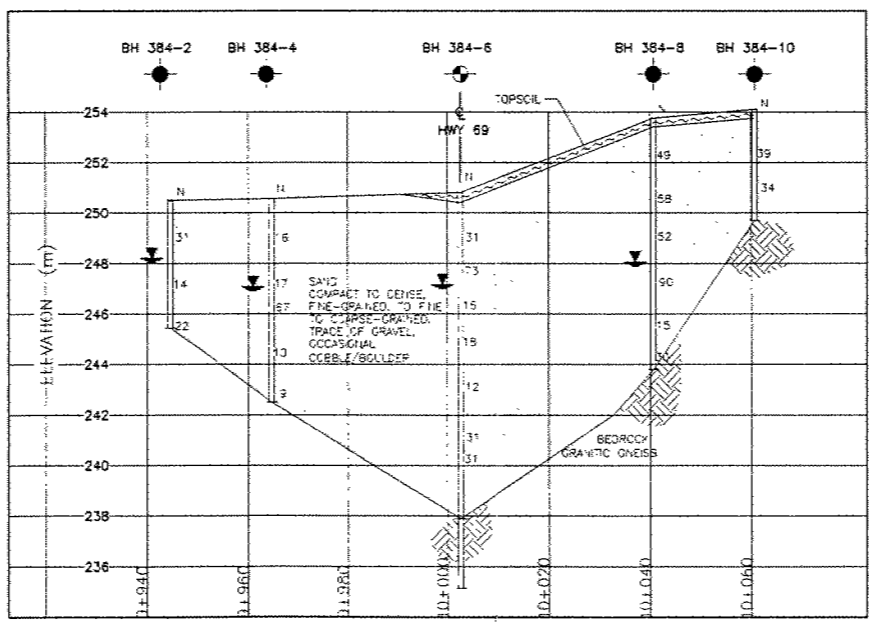
**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS  
45 BURNING ROAD, HAMILTON, ONTARIO L8E 3C8

DRAWN J.S.	DATE APRIL 1998	SCALE AS SHOWN	JOB NO. 97TF088A	DRAWING NO. 1
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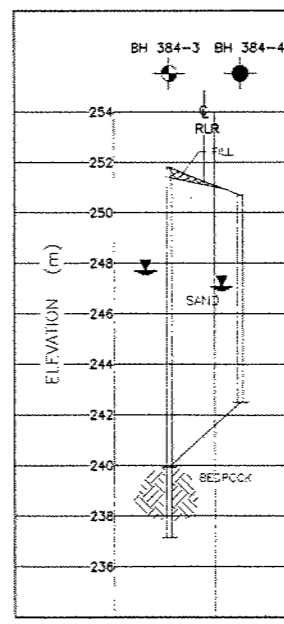
BOREHOLE LOCATION PLAN  
AND SOIL PROFILES



SECTION A-A



SECTION B-B



SECTION C-C

FOUNDATION DESIGN REPORT  
FOR  
RANKIN LAKE SERVICE ROAD UNDERPASS  
W.P. 290-97-00, SITE 44-384  
HIGHWAY 69, DISTRICT 52  
HUNTSVILLE, ONTARIO

Distribution:

15 cc: McCormick Rankin Corporation  
1 cc: PML Hamilton  
1 cc: PML Toronto  
1 cc: PML Barrie

Job No. 97TF088A

June, 1998

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**FOUNDATION DESIGN REPORT**  
For  
Rankin Lake Service Road Underpass  
W.P. 290-97-00, Site 44-384  
Highway 69, District 52, Huntsville

---

**INTRODUCTION**

This report provides geotechnical comments and recommendations regarding design and construction of foundations, abutments and approaches at the proposed Highway 69 underpass at Rankin Lake Service Road.

Construction of a two span underpass structure is planned. At the underpass location, the proposed four-lane Highway 69 will be constructed in a cut of some 3.0 to 4.5 m (road grade at elevation 247.5 SBL and 249.0 NBL). Road grades on Rankin Lake Service Road over the structure will be near elevation 257, some 3 to 7 m above existing grade (based on preliminary grade information (Sheets 34 and 35 of the Environmental Assessment/Route Planning Study, W.P. 529-89-00) and existing ground surface elevations determined at borehole locations).

The subsurface stratigraphy revealed at the bridge site generally comprised a surficial topsoil or sand/gravel fill layer, overlying native compact to dense sand, mantling bedrock contacted at depths of 9.9 to 14.1 m, elevation 239.9 to 243.8.

## FOUNDATIONS

### Integral Abutments on Piles

Based on the borehole information, it is considered feasible to construct the underpass structure using integral abutments supported on steel H-piles. The H-piles should be driven to refusal on bedrock anticipated at the following elevations:

Location	Bedrock/Inferred Bedrock Elevation
West Abutment, North End	239.9
West Abutment, South End	< 242.4
Centre Pier, North End	238.3
Centre Pier, South End	237.8
East Abutment, North End	241.9
East Abutment, South End	243.8

Factored pile capacities at the ultimate limit state for selected pile sections are presented below. The capacities were obtained by applying a geotechnical resistance factor of 0.55 to the factored structural resistance of the pile section. A yield strength of 300 MPa is assumed for the steel.

H-Pile Section	Factored Capacity at ULS (kN)
HP 250 x 62	890
HP 250 x 85	1215
HP 310 x 79	1110
HP 310 x 110	1570
HP 310 x 174	2470

The capacity at serviceability limit states normally allows for 25 mm of compression of the pile and founding medium. Considering the bedrock to be non-yielding and the relatively short pile length required, the design is not expected to be governed by settlement since the loading required to produce deformation of the pile will be much larger than the factored capacity at ULS.

The type of equipment required to drive the piles will be somewhat dictated by the design capacity. In general, the piles should be driven to practical refusal using a hammer which transfers at least 40 KJ of energy to the pile. Since the piles will set on hard rock, a specific set for this project is not provided.

The installation operations should be inspected on a full-time basis by qualified geotechnical personnel to confirm the toe elevation, driving resistance, alignment, plumbness, uniformity of set, and quality of splices.

The pile tip should be reinforced (OPSD 3301) to minimize the potential for damage from cobbles/boulders in the overburden sand and when setting into bedrock. Rock points should be provided to minimize the potential for sliding of the pile tip along sloping bedrock surfaces.

Pile caps should be provided with the normal 1.6 m of earth cover or equivalent thermal insulation as protection against frost action. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

The soil adjacent to the upper portion of the piles is expected to comprise well compacted approach fill and compact to dense native sand. To accommodate movement of the integral abutments, it is recommended that pre-augered holes filled with loose sand be provided around the piles. The pre-augered holes should be 600 mm diameter and extend 3.0 m below the bottom of the abutment. A CSP will likely be required to prevent cave if the hole extends below the observed water level, near elevation 248. The gradation of the loose sand should be as specified on Table I.

The coefficient of horizontal subgrade reaction,  $k_s$ , for the native sand and approach fill may be computed using the following equation:

$$k_s = n_h z/b$$

where  $z$  = depth  
 $b$  = pile width

The recommended values for  $n_h$  in  $\text{kN/m}^3$  are as follows:

	Above Groundwater	Below Groundwater
Native Sand	12,000	8,000
Granular "B"	12,000	8,000
Rock Fill	15,000	9,000

### Spread Footings

Supporting the structure on conventional spread footings founded in the native compact to dense sand may also be considered. It must be noted however that excavation for footing construction may be problematic if founding levels extend below the groundwater level at the time of construction.

The factored bearing capacities at ultimate (ULS) and serviceability (SLS) limit states of footings constructed in the native sand at anticipated founding levels of elevation 245 to 247 are as follows:

Assumed Footing Width (m)	Factored Capacity (kPa)	
	ULS	SLS
1	580	220
2	670	220
3	750	220

The recommended capacity at SLS allows for 25 mm of total settlement; differential settlement is expected to be less than 75% of this value. A footing embedment depth of 1.6 m was assumed for computation of the ULS capacities.

In general, where founding levels of adjacent footings vary, the founding elevation between footings should be stepped in maximum 600 mm steps at a maximum inclination of 10 horizontal to 7 vertical.

All footings subject to frost action should be provided with the normal 1.6 m of earth cover or equivalent thermal insulation. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

Prior to placement of structural concrete, all foundation excavations should be examined by qualified geotechnical personnel to verify the competency of the founding surface.

### **ABUTMENT WALLS**

The abutment walls should be designed to resist the unbalanced lateral earth pressure imposed by the backfill adjacent to the wall. The lateral earth pressure,  $p$ , may be computed using the equivalent fluid pressures presented in Section 6-7.4 of the Ontario Highway Bridge Design Code

(OHBDC, 3<sup>rd</sup> Edition, 1991) or employing the following equation, assuming a triangular pressure distribution:

$$p = K (\gamma h + q)$$

where  $K$  = coefficient of lateral earth pressure

$\gamma$  = unit weight of free-draining granular material

$h$  = depth below final grade (m)

$q$  = surcharge load (kPa), if present

Free-draining granular material or rock fill should be used as backfill behind the wall. The following parameters are recommended for design:

	Granular "A"	Granular "B"	Rock Fill
Angle of Internal Friction (degrees)	35	32	35
Unit Weight (kN/m <sup>3</sup> )	22.8	21.2	18.0
Active Earth Pressure Coefficient ( $K_a$ )	0.27	0.31	0.27
At Rest Earth Pressure Coefficient ( $K_o$ )	0.43	0.47	0.43
Passive Earth Pressure Coefficient ( $K_p$ )	3.69	3.25	3.69

A weeping tile system and/or weeping holes should be installed to minimize the build-up of hydrostatic pressure behind the wall. The weeping tiles should be surrounded by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet.

If spread footings are employed, the horizontal force will be resisted in part by the friction force developed between the underside of footing and the founding soil. An unfactored friction factor of 0.40 is recommended for footings on the fine sand.

#### **APPROACH FILL**

Backfilling adjacent to the structure should be carried out in conformance with Ontario Provincial Standards specifications for granular or rock backfill.

Recommendations for approach construction are presented in the Pavement Design Report.

#### **EXCAVATION AND GROUNDWATER CONTROL**

Excavation for construction of footings, if employed, is expected to be carried out primarily within native sand. Excavation of the sand should be relatively straightforward using conventional equipment.

The in situ materials are classified as Type 3 soils according to Occupational Health and Safety Act criteria. If open cut procedures are used, temporary cut slopes inclined at 1 horizontal to 1 vertical should be stable above the groundwater level.

Free water was observed in the sand overburden at elevations 247.0 to 248.2 in eight of ten boreholes. It is noteworthy that this is the water level observed at the time of drilling; seasonal/weather dependent fluctuations must be considered. If excavation extends below the groundwater level, positive groundwater control measures (sumps, well points) and/or flattening of the sideslopes will be required due to the potential for "running sands".

All work should be carried out in accordance with the Occupational Health and Safety Act (Ontario Regulation 213/91) and with local/MTO regulations.


**CLOSURE**

This report was written by M.R. Anderson, Project Engineer and reviewed by D.W. Kerr, Manager of Geotechnical and Geo-Environmental Services, Hamilton.

Yours very truly

Peto MacCallum Ltd.



  
Murray R. Anderson, M.Eng., P.Eng.  
Project Engineer

MRA:mmma



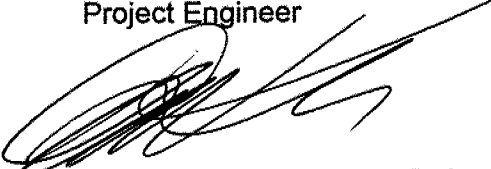
  
Dennis W. Kerr, M.Eng., P.Eng.  
Manager Geotechnical and  
Geo-Environmental Services  
Hamilton

TABLE I

**Gradation Specification for Sand Fill in  
Pre-Augered Holes at Integral Abutments**

MTO Sieve Designation		Percentage Passing by Mass
2 mm	#10	100
600 µm	#30	80 - 100
425 µm	#40	40 - 80
250 µm	#60	5 - 25
150 µm	#100	0 - 6

From MTO Report S0-96-01, Revision 1 - July, 1996

PAVEMENT DESIGN REPORT  
FOR  
RANKIN LAKE SERVICE ROAD UNDERPASS  
W.P. 290-97-00, SITE 44-384  
HIGHWAY 69, DISTRICT 52  
HUNTSVILLE, ONTARIO

Distribution:

15 cc: McCormick Rankin Corporation  
1 cc: PML Hamilton  
1 cc: PML Barrie  
1 cc: PML Toronto

Job No. 97TF088F

June, 1998

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- A     Extract From Design Criteria
- B     Geotechnical Survey Data
- C     Rockfill Drainage in Slope Flattened Areas

**PAVEMENT DESIGN REPORT**  
For  
Rankin Lake Service Road Underpass  
W.P. 290-97-00, Site 44-384  
Highway 69, District 52, Huntsville

---

**INTRODUCTION**

Rankin Lake Service Road underpass is being constructed as an advance contract to the overall 26.5 km four laning of Highway 69, W.P. 290-97-00. The following roadworks are associated with the advance construction of the underpass:

- future north and south bound lanes of Highway 69 between approximate Station 13+360 and Station 13+590 (Foley Township).
- 50 m bridge approaches approximate Station 9+915 to Station 10+085 (Rankin Lake Service Road).

This report presents the geotechnical investigation and survey data as well as recommendations pertaining to the roadworks associated with the advance contract.

**DESIGN CRITERIA**

The approved Design Criteria for the overall project was provided with a memorandum dated March 26, 1998, from Mr. P. Lecoarer, P. Eng., Senior Project Engineer, Planning and Design Section, MTO Northern Region.

Documents showing the proposed design standards and traffic volumes for Highway 69, and the proposed design standards for Rankin Lake Service Road were extracted from the approved Design Criteria and provided in Appendix A. No traffic volumes are provided for Rankin Lake Service Road.

A frost penetration depth of 1.6 m has been provided by MTO for this project.

### **PHYSIOGRAPHY AND GEOLOGY**

The report area is part of the Precambrian Laurentian peneplane. Although the general surface of the country is relatively flat the topography is quite irregular in detail and the area is dotted with many small lakes separated by rocky ridges. The overburden in the region is typically shallow, but can vary substantially in thickness over short distances. Swamp environments have developed in areas of poor drainage.

The bedrock formations are of Precambrian age and are largely composed of veined, banded, and homogeneous pink and grey gneisses produced by injection and granitization of metamorphic gneisses of various types.

Total relief in the vicinity of the project is about 30 m, with existing ground surface dropping in a southerly direction toward the Blackstone River. An existing sand pit is located immediately south of the site. Two residential dwellings exist within the project limits.

### **INVESTIGATION PROCEDURES**

The geotechnical investigation for the advance contract was carried out as part of the overall project, which was conducted during the period December 1997 to April 1998.

The investigation consisted of test holes advanced using hand auger, backhoe and/or power auger. The test hole program was carried out in accordance with the requirements of MTO Northern Region Pavement Design Practices And Guidelines (May 20, 1997), involving test holes along centreline of pavement and offsets left and right.

Soil samples were recovered from each test hole for field identification. Representative samples were returned to our laboratory for detailed examination, moisture content determinations and grain size analyses.

The test holes were referred horizontally to centreline median for Highway 69 and centreline of pavement for Rankin Lake Service Road, as staked out in the field by Totten Sims Hubicki Associates. Elevations were established relative to the ground surface at the control line.

### **SUBSURFACE CONDITIONS**

Reference is made to Appendix B for the geotechnical survey data collected within and extending just beyond the limits of the advance contract. Reference is also made to the test holes drilled in connection with the foundation investigation for the proposed underpass structure.

#### **Overburden**

Overburden at the site was variable in thickness, ranging from 50 mm to in excess of 7.6 m at the borehole locations (14.1 m at bridge structure). The overburden typically comprised 50 to 200 mm of black sandy silt topsoil (locally 500 to 750 mm) underlain by compact to dense fine to medium sand. Boulders were noted within the overburden at some locations. The soil was generally moist, becoming wet near the contact with the underlying bedrock surface.

#### **Bedrock**

Bedrock outcrops occur locally and was assumed below the overburden in a number of test holes.

#### **Groundwater**

Free water was noted in a number of boreholes near the centre of the site at depths of 600 mm to 3.0 m below existing grade.

## RECOMMENDATIONS

### Pavement Types and Depths

It is understood that no pavement, granulars or bridge deck waterproofing will be placed as part of the advanced contract.

### Granular Types and Depths

The advanced portion of Highway 69 and Rankin Lake Service Road approaches will not be used for traffic. Therefore there is no functional need at this time for granulars. Delaying placement of granulars is desirable to prevent potential contamination, which may otherwise occur.

### Cut Sections

The portion of Highway 69 north bound and south bound lanes from about Station 13+400, northerly, will require up to about 7 m of cut to achieve the proposed final grade. The excavation will be carried out within overburden, with some sections of shallow overburden over bedrock. The limits of earth cut and rock cut, including earth pockets, will be determined when the final road grades are established.

#### Earth Cut

Overburden within cut sections will comprise predominantly fine to medium sand, where OPSD-200.02 is applicable.

The earth cut material will be generally suitable for embankment construction. The soil in the lower portion of the cut above the bedrock surface is likely to be too wet and will require drying or blending prior to reuse.

### Rock Cut

Rock excavation will require standard rock excavation techniques including blasting. Refer to OPSD 201.02.

### Rock Cuts With Earth Pockets

Treat rock cuts with earth pockets at grade as follows:

- Excavate earth and rock to the full depth of earth pocket, or to a maximum 1.6 m below the profile grade, whichever is less, for the full roadway width.
- Backfill with rockfill or granular material.
- Provide for positive drainage from excavated earth pockets along the full length of the pockets.

There is the potential for drainage from earth pocket excavation areas at or near the limit of a cut to be blocked by local rock knobs. Remove rock knobs to sufficient depth (maximum 1.6 m below profile grade) to ensure adequate drainage.

### Bouldery Subgrade

Boulders were noted within the overburden. Where boulders are encountered at subgrade level, treat in accordance with OPSD 204.01.

### Transition Treatment

Transition zones should be treated in accordance with applicable OPSD 205.01 to 205.05. Use  $t = 1.6$  m for transition treatment depth, and  $H = 300$  mm. Topsoil will form part of the grubbing quantity and will not be available for reuse.

### Disposal of Cut Material

Excavated rock as well as excavated earth material will be suitable for use as embankment material. Surplus earth material may be utilized for slope flattening.

### Slope Treatment

No particular treatment is specified for rock cuts. It is recommended however, that the exposed rock faces be examined visually for any planes of weakness which should be investigated/addressed on an as required basis during construction.

For cuts in overburden, soils will typically comprise fine to medium sand with K factors of about 0.05 to 0.06. Minimal erosion is anticipated for slopes cut at 2:1 or flatter. New slopes should be seeded and mulched at an early date and should not be left unprotected during the winter months.

In areas where the cut is carried out in sand below the water table, provide rip-rap over filter cloth within the lower third of slope.

### Fill Sections

Up to about 3 m of fill is required for Highway 69 south of approximate Station 13+400. The approaches on Rankin Lake Service Road will require up to about 6 m of fill.

The investigation indicates the proposed fill sections will be founded on generally compact to dense sand where no major construction problems are anticipated.

In general, it is anticipated that, wherever possible, embankments will be constructed with rockfill material generated from sections cut through bedrock at the site. Excavated earth

material will also be generally suitable for embankment construction. Refer to OPSD 200.01, 200.02, 201.01, 201.02 and 202.01.

For high rockfills, MTO Northern Region practice is to provide 2.0 m wide berms so that no uninterrupted rock fill slope is greater than 6.0 m high. The embankments within the limits of the advance construction is not expected to exceed 6 m in total height.

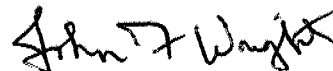
Where slope flattening is proposed, provide drainage gap in accordance with OPSD 202.02. Where slopes are flattened to eliminate the need for guide rail, provide granular infilled drainage gap in accordance with Northern Region practice, refer to Appendix C.

### CLOSURE

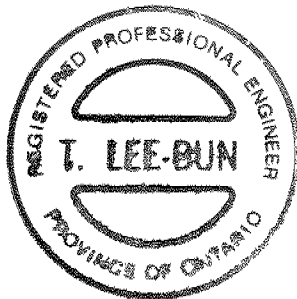
The field investigation was carried out under the direction and supervision of Mr. J. F. Wright, B.Sc., Senior Geologist and Mr. E. Wong, P. Eng. This report was prepared by Mr. J. Wright and reviewed by Mr. T. Lee-Bun, P.Eng. Manager, Geotechnical Engineering, Barrie office.

Yours very truly

**Peto MacCallum Ltd.**



John F. Wright, B.Sc.  
Senior Geologist



JFW:mmma



Turney Lee-Bun, P.Eng.  
Manager, Geotechnical Engineering  
Barrie

## **APPENDIX A**

EXTRACT FROM DESIGN CRITERIA

Ministry of  
Transportation

Ontario

## DESIGN CRITERIA

Page: 1 of 1

Date:

February 1998

Reg. Rev. Date:

GROUP WORK PROJECT 290-97-00 Dist. No. 52 Hwy. No. 69

TYPE OF PROJECT Grading, Drainage, Granular Base, Hot Mix Paving, Structures, Partial Illumination

LOCATION From South of Tower Road Northerly to 2.7 km North of Hwy 141 LENGTH 26.5

LIMITS FROM STA 11+000 PLAN 790-69/5-0 TO STA 14+900 PLAN 451-69/122-0

HIGHWAY CLASSIFICATION

MINIMUM STOPPING SIGHT DISTANCE

EQUIVALENT MINIMUM "K" FACTOR

GRADES MAXIMUM

MINIMUM RADIUS

PAVEMENT WIDTH

SHOULDER WIDTH

SHOULDER ROUNDING

MEDIAN WIDTH

ROW WIDTH

POSTED SPEED

MISCELLANEOUS

PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS
	RFD 120	RFD 120
	245 m	300 m
	K = 120 Crest; 60 Sag	K = 180 Crest; 100 Sag
	3%	2%
	850 m	1000 m
	4 @ 3.75 m	4 @ 3.75 m
	1.0 m Lt 3.0 m Rt	1.0 m Lt (a) 3.0 m Rt
	1.0 m	1.0 m
	30 m	30 m
	100 m	100 m (b)
	100 km/h	100 km/h

RECOMMENDED BY:

P.Eng.

PROJECT MANAGER  
HIGHWAY 69 JOINT VENTURE (MRC/TSH)

DISTRICT ENGINEER  
MANAGER, CONSTRUCTION OFF

APPROVED BY:

REGIONAL MANAGER  
ENGINEERING OFFICE
 98/03/25  
DATE OF APPROVAL

TRAFFIC DATA: See page No. 2



Ontario

Ministry of  
Transportation

## DESIGN CRITERIA

Page 4 of 11

P.04

12

Date:

February 1998

Reg.Rev.Date:

GROUP WORK PROJECT 290-97-00 Dist. No. 52 Hwy. No. 69

TYPE OF PROJECT Grading, Drainage, Granular Base, Hot Mix Paving, Structures, Partial Illumination

LOCATION From South of Tower Road Northerly to 2.7 km North of Hwy 141 LENGTH 25.6

LIMITS FROM STA 11+000 PLAN 790-69/5-0 TO STA 14+900 PLAN 451-69/122-0

## TRAFFIC DATA

EXISTING HIGHWAY 69				
		2001	2011	2021
Muskoka Road 11 (W)	AADT	7600	9100	106
	SADT	13000	15800	181
	DHV	1490	1780	20
	PHV	1460	1750	20
	% Com	8.1%		
	AR*	0.8	(PAR 1.0)	
	LOS	E	F	
Highway 169 (E) - South Junction of Buckeye Road	AADT	7000	8400	98
	SADT	12000	14400	168
	DHV	1370	1650	19
	PHV	1440	1730	20
	% Com	9.2%		
	AR*	0.8	(PAR 1.0)	
	LOS	F	F	
Murphy Road (E)	AADT	7000	8400	98
	SADT	12000	14400	168
	DHV	1370	1650	19
	PHV	1440	1730	20
	% Com	10.7%		
	AR*	0.6	(PAR 1.0)	
	LOS	E	F	
Hwy 612 (W)	AADT	7300	8800	102
	SADT	12500	15000	174
	DHV	1430	1720	20
	PHV	1450	1740	20
	% Com	10.7%		
	AR*	0.9	(PAR 1.0)	
	LOS	F	F	

Ministry of  
Transportation

Ontario

## DESIGN CRITERIA

Page 10 of

12

Date:

February 1998

Reg. Rev. Date:

GROUP WORK PROJECT 290-97-00 Dist. No. 52 Hwy. No. 69

TYPE OF PROJECT Grading, Drainage, Granular Base, Hot Mix Paving, Structures, Partial Illumination

LOCATION From South of Tower Road Northerly to 2.7 km North of Hwy 141 LENGTH 26.6 km

LIMITS FROM STA 11+000 PLAN 790-69/5-0 TO STA 14+900 PLAN 451-69/122-0

Rankin Lake Service Road, Rankin Lake Road to Proposed Highway 69, 1.5 km		
ITEM	DESIGN STANDARD	PROPOSED STANDARD
Classification	RAU 80	RAU 80
Design Speed (km/h)	80	80
Minimum Stopping Sight-Distance (m)	135	135
Equivalent 'K' Factor		
Sag	30	30
Crest	35	50
Maximum Grade (%)	8	4.2
Minimum Radius (m)	250	250
Pavement Width (m)	6.5	6.5
Shoulder Width (m)	2.0	2.0
Minimum ROW Width (m)	30	30
Posted Speed (km/h)	70	70

Rankin Lake Service Road, Proposed Highway 69 to Existing Highway 69, 450 m		
ITEM	DESIGN STANDARD	PROPOSED STANDARD
Classification	RAU 100	RAU 100
Design Speed (km/h)	100	100
Minimum Stopping Sight-Distance (m)	185	185
Equivalent 'K' Factor		
Sag	45	45
Crest	70	70
Maximum Grade (%)	8	5.5
Minimum Radius (m)	420	450
Pavement Width (m)	7.0	7.0
Shoulder Width (m)	2.5	2.5
Minimum ROW Width (m)	40	40
Posted Speed (km/h)	70	70

## **APPENDIX B**

### **GEOTECHNICAL SURVEY DATA**

## **GEOTECHNICAL SURVEY DATA**

**W.P. 290-97-00**

**SURVEY DATE**

December 1997 to April 1998

**TYPE OF SURVEY**

Peto MacCallum Ltd.  
(Hand Auger, Power Auger, Backhoe)

**NOTES**

1. Conditions and pavement depths apply only to the date of the survey.
2. The boundaries between the strata have been established only at test hole locations. Between test holes the boundaries are assumed and may be subject to error.
3. Soils are described according to the MTO Soils Classification System.
4. Abbreviations for test holes and test data conform to OPSD 100.06.

WP 290-97-00 Highway 69

District 52, Huntsville

Highway 69, Southbound Lane, Twp. of Foley

Datum Centre Line Median

13+300 18.8 LT C/L D+3.00

0- 4.00 L To Comp Lt Br F To Med Sa W Si  
Moist  
4.00 NFP Sloughing  
Fr Wat @ 4.00

13+350 18.8 LT C/L D-1.20

0- 2.80 Br Med To Co Sa Moist  
2.80 NFP BR

13+400 8.0 LT C/L D+850

0- 1.00 Dk Br Sa Fill W Tps  
1.00- 1.15 Blk Say Si Tps  
1.15- 3.00 Comp Br F To Med Sa Tr Si And Gr

13+400 18.8 LT C/L D-1.25

0- 100 Blk Say Si Tps  
100- 1.80 Comp Br F To Med Sa Tr Si Tr Gr

13+400 29.5 LT C/L D-1.15

0- 300 Dk Br F To Med Sa Tr Si  
300- 1.80 Comp Lt Br F To Med Sa Tr Gr

13+410 8.0 LT C/L D-700

0- 200 Blk Say Si Tps  
200- 2.00 Comp Br F To Med Sa Tr Gr

13+410 18.8 LT C/L D-650

0- 100 Blk Say Si Tps  
100- 2.00 Comp Br F To Med Sa Tr Si Tr Gr

13+410 29.5 LT C/L D-1.55

0- 100 Blk Say Si Tps  
100- 2.00 Comp Br F To Med Sa Tr Si Tr Gr

13+430 3.0 LT C/L D-350

0- 300 Blk Say Si Tps  
300- 2.50 Comp Br F To Med Sa Tr Si  
Tr Gr W  
Num Blds  
2.50 NFP BR/Blds

13+430 8.0 LT C/L D-350

0- 300 Blk Si Tps  
300- 2.70 Comp Br F To Med Sa Tr Gr  
OCC Blds  
2.70 NFP BR/Blds

13+430 18.8 LT C/L D-550

0- 300 Blk Si Tps  
300- 3.00 D Lt Br F To Med Sa W Si Tr Gr  
Seams Moist

13+430 29.5 LT C/L D-1.55

0- 100 Blk Say Si Tps  
100- 3.00 L To Comp Br F To Med Sa Tr Si Tr  
Gr Moist To Wet

13+450 8.0 LT C/L D-300

0- 300 Blk Say Si Tps  
300- 3.50 Comp Br F To Med Sa Tr Si Tr Gr  
3.50 NFP Sloughing  
Fr Wat @ 3.00

13+450 18.8 LT C/L D-1.15

0- 3.50 L To Comp Br F To Med Sa Tr Gr  
Moist To Wet  
w @ 1.70 = 20%  
3.50 NFP Sloughing  
Fr Wat @ 2.10

**Highway 69, Southbound Lane, Twp. of Foley**

**Datum Centre Line Median**

13+450 29.5 LT C/L D-2.05  
0- 400 Blk Si Tps  
400- 3.45 Comp Br F Sa Tr Si Tr Gr Moist To  
Wet  
3.45 NFP Sloughing  
Fr Wat @ 1.50

13+475 8.0 LT C/L D  
0- 450 Dk Br F To Med Sa W Si Tps  
450- 3.90 Comp To D Br F To Med Sa Tr Si Tr  
Gr  
Moist  
3.90 NFP Sloughing  
Fr Wat @ 3.90

13+475 18.8 LT C/L D-800  
0- 5.40 Comp To D Br F To Med Sa Tr Si Tr  
Gr  
Moist To Wet  
w @ 1.70 = 8%

13+475 36.0 LT C/L D-1.70  
0- 5.40 Comp To D Br F To Med Sa Tr Si Tr  
Gr  
Moist To Wet

13+500 8.0 LT C/L D-600  
0- 5.70 Comp To D Br F Sa Tr Si Tr Gr  
Moist  
5.70 NFP Sloughing

13+500 18.8 LT C/L D-1.80  
0- 5.55 Comp Br To Gry F Sa Tr Si Tr Gr  
Moist To Wet  
w @ 1.70 = 18%  
w @ 4.70 = 19%  
5.55 NFP Sloughing  
Fr Wat @ 1.05

13+500 36.5 LT C/L D-1.60  
0- 5.45 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist To Wet  
5.45 NFP Sloughing  
Fr Wat @ 3.90

13+520 8.0 LT C/L D-400  
0- 300 Dk Br Sa Tps  
300- 6.00 Comp Br F Sa Tr Si Tr Gr Moist To  
Wet  
Fr Wat @ 4.20

13+520 18.8 LT C/L D-200  
0- 4.95 Comp Br F Sa Tr Si Tr Gr Moist To  
Wet  
w @ 1.70 = 15%  
w @ 3.20 = 17%

13+520 36.0 LT C/L D-400  
0- 6.00 Comp Br F Sa Tr Si Tr Gr Moist  
6.00 NFP Sloughing

13+540 3.6 LT C/L D-100  
0- 600 Dk Br Sa Tps  
600- 7.50 Comp To D Br F Sa Tr Si Tr Gr  
Moist

13+540 8.0 LT C/L D  
0- 500 Red Br F Sa Tr Gr Tps  
500- 7.20 Comp To D Br F Sa Tr Si Moist

13+540 18.8 LT C/L D-400  
0- 175 Red Br F Sa Tps  
175- 6.45 Comp To D Br F To Med Sa Tr Si Tr  
Gr OCC Blds  
Moist To Wet  
w @ 1.70 = 6%  
w @ 6.20 = 19%  
6.45 NFP BR

**Highway 69, Southbound Lane, Twp. of Foley**

**Datum Centre Line Median**

13+560 8.0 LT C/L D-300  
0- 3.90 Comp To D Br F Sa Tr Si Tr Gr  
3.90 NFP BR

13+560 18.8 LT C/L D  
0- 4.95 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist To Wet  
w @ 1.70 = 4%  
w @ 4.70 = 11%  
4.95 NFP BR

13+560 33.5 LT C/L D  
0- 750 Dk Br Siy Sa Tr Gr Tps  
750- 5.00 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist  
5.00 NFP BR

13+580 8.0 LT C/L D  
0- 600 Br F to Med Sa W Si Tps  
600- 1.95 Comp Br Med Sa Tr Si Tr Gr Wet  
1.95 NFP BR

13+580 18.8 LT C/L D+100  
0- 500 Dk Br F To Med Sa W Si Tps  
500- 3.30 Comp Br Sa W Si And Gr OCC Cob  
Moist To Wet  
w @ 1.70 = 24%  
w @ 3.20 = 17%  
3.30 NFP BR

13+580 34.0 LT C/L D+100  
0- 500 Dk Br F To Med Sa Tps  
500- 1.35 Comp Br F To Med Sa Tr Si Tr Gr  
1.35 NFP BR

13+590 8.0 LT C/L D-150  
0- 100 Blk Say Si Tps  
100- 600 Dk Br F To Med Sa W Gr Tr Si Moist  
w @ 500 = 21%  
600 NFP BR

13+590 18.8 LT C/L D+500  
0- 300 Blk Si Tps  
300- 800 Br Siy Sa  
800 NFP BR

13+590 29.5 LT C/L D+1.40  
0- 300 Blk Si Tps  
300 NFP BR

13+610 8.0 LT C/L D-500  
0 NFP BR

13+610 18.8 LT C/L D-600  
0- 300 Blk Si Tps  
300 NFP BR

13+610 29.5 LT C/L D-600  
0- 200 Blk Si Tps  
200 NFP BR

WP 290-97-00 Highway 69

District 52, Huntsville

Highway 69, Northbound Lane, Twp. of Foley

Datum Centre Line Median

13+300 18.8 RT C/L D+900  
0- 1.50 Lt Br F To Med Sa W Si Seams  
1.50- 3.00 Comp Lt Br F To Med Sa Tr Si Moist  
3.00 NFP Sloughing

13+350 18.8 RT C/L D+1.30  
0- 50 Blk Say Si Tps  
50 NFP BR

13+390 8.0 RT C/L D+100  
0- 2.00 Lt Br F To Med Sa Tr Si Moist  
2.00 NFP BR

13+390 18.8 RT C/L D+450  
0- 50 Blk Say Si Tps  
50- 2.00 D Br F To Med Sa Tr Gr OCC Blds

13+390 29.5 RT C/L D  
0- 100 Blk Say Si Tps  
100- 1.50 D Br F To Med Sa Tr Si Tr Gr OCC  
Blds

13+400 8.0 RT C/L D+150  
0- 100 Blk Say Si Tps  
100- 2.00 Comp Lt Br F To Med Sa Tr Si Tr Gr  
OCC Blds

13+400 18.8 RT C/L D+400  
0- 100 Blk Say Si Tps  
100- 2.00 Comp Lt Br F To Med Sa Tr Si Tr Gr  
OCC Blds Dry  
w @ 2.00 = 3%

13+400 29.5 RT C/L D+900  
0- 300 Blk Say Si Tps  
300- 2.10 Comp Br F To Med Sa Tr Gr  
Tr Si OCC Blds  
2.10 NFP BR/Blds

13+420 3.0 RT C/L D+350  
0- 150 Blk Say Si Tps  
150- 3.70 Comp Br F To Med Sa W Gr Tr Si  
Moist

13+420 8.0 RT C/L D+350  
0- 100 Blk Say Si Tps  
100- 2.90 Comp Br F To Med Sa W Gr Tr Si  
Moist  
2.90 NFP BR

13+420 18.8 RT C/L D+2.45  
0 NFP BR

13+420 29.5 RT C/L D+4.65  
0- 100 Blk Say Si Tps  
100 NFP BR

13+440 8.0 RT C/L D+250  
0- 100 Blk Say Si Tps  
100- 4.20 Comp Br F To Med Sa W Gr Tr Si  
Wet  
w @ 1.10 = 20%  
Fr Wat @ 3.00

13+440 18.8 RT C/L D+750  
0- 200 Blk Say Si Tps  
200- 2.30 Comp Br F To Med Sa W Gr Tr Si  
Wet  
w @ 400 = 15%  
2.30 NFP BR

**Highway 69, Northbound Lane, Twp. of Foley**  
**Datum Centre Line Median**

13+440 29.5 RT C/L D+2.50  
0- 150 Blk Say Si Tps  
150- 4.00 Comp Br F To Med Sa W Gr Tr Si  
Moist  
4.00 NFP BR

13+450 8.0 RT C/L D+300  
0- 200 Dk Br Sa W Si Tps  
200- 3.45 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist To Wet  
Fr Wat @ 2.85

13+450 18.8 RT C/L D+1.00  
0- 100 Dk Br Sa W Si Tps  
100- 3.45 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist To Wet  
w @ 2.60 = 19%  
w @ 3.15 = 24%

13+450 29.5 RT C/L D+2.50  
0- 3.45 Comp To D Br F Sa Tr Si Tr Gr  
OCC Blds

13+475 8.0 RT C/L D+900  
0- 6.00 Comp To D Br F To Med Sa Tr Si  
Tr Gr Moist

13+475 18.8 RT C/L D+1.10  
0- 5.10 Comp To V D Br Sa Tr Si Tr Gr  
Moist To Wet  
**L9405 SP**  
w @ 3.20 = 15%

% Passing 9.50 mm = 100  
4.75 mm = 99  
2.00 mm = 97  
850 um = 91  
425 um = 72  
250 um = 41  
150 um = 18 LSFH  
75 um = 6 'K' Factor = 0.05  
5.10 NFP Sloughing

13+500 8.0 RT C/L D+600  
0- 750 Dk Br F Sa W Si Tps  
750- 5.70 Comp To D Br F Sa Tr Si Tr Gr  
Moist  
5.70 NFP Sloughing

13+500 18.8 RT C/L D+800  
0- 4.95 Comp To D Br F To Med Sa Tr Gr  
Wet  
w @ 1.70 = 14%  
w @ 3.20 = 19%  
4.95 NFP Sloughing

13+500 29.5 RT C/L D+400  
0- 900 Dk Br F Sa Tps  
900- 5.70 Comp To D Br F Sa Tr Si Tr Gr  
Moist To Wet  
5.70 NFP Sloughing  
Fr Wat @ 1.50

13+520 8.0 RT C/L D+500  
0- 600 Dk Br Sa W Si Tps Wet  
600- 6.00 Comp To D Br F Sa Tr Gr Wet  
6.00 NFP Sloughing  
Fr Wat @ 2.10

13+520 18.8 RT C/L D+900  
0- 4.95 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist To Wet  
w @ 1.70 = 18%  
w @ 3.20 = 16%  
4.95 NFP Sloughing  
Fr Wat @ 1.35

13+520 29.5 RT C/L D+900  
0- 200 Cr Gr  
200- 500 Br Sa And Gr  
500- 6.00 Comp To D Br F Sa Tr Si Tr Gr  
OCC Cobs  
6.00 NFP Sloughing  
Fr Wat @ 3.15

**Highway 69, Northbound Lane, Twp. of Foley**  
**Datum Centre Line Median**

13+540 8.0 RT C/L D  
0- 200 Cr Gr  
200- 500 Br Sa And Gr  
500- 6.55 Comp To D Br F Sa Tr Si Tr Gr  
OCC Blds Moist  
6.55 NFP Bld/BR

13+540 18.8 RT C/L D-200  
0- 175 Br F Sa Tps  
175- 1.50 Comp Br F Sa Tr Si Tr Gr  
1.50- 3.20 Comp Gry Si Tr F Sa Wet  
w @ 1.70 = 21%  
3.20- 5.55 D To V D Gry F To Med Sa Tr Si Tr  
Gr OCC Blds Moist To Wet  
w @ 3.20 = 12%  
5.55 NFP BR  
Fr Wat @ 1.50

13+540 29.5 RT C/L D  
0- 500 Br F Sa And Si Tps  
500- 3.90 Comp To D Br F To Med Sa W Si  
OCC Blds Moist To Wet  
3.90 NFP BR  
Fr Wat @ 2.40

13+560 8.0 RT C/L D-100  
0- 500 Red Br F Sa W Si Tr Gr Tps  
500- 4.65 Comp To D Br F Sa W Si Tr Gr  
OCC Cobs  
4.65 NFP BR

13+560 18.8 RT C/L D  
0- 175 Br F Sa Tps  
175- 4.30 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist To Wet  
w @ 1.70 = 3%  
w @ 3.20 = 20%  
4.30 NFP BR

13+560 29.5 RT C/L D-100  
0- 500 Dk Br F Sa W Si Tps  
500- 3.65 Comp To D Br F To Med Sa Tr Si Tr  
Gr Moist  
3.65 NFP BR

13+580 8.0 RT C/L D  
0- 750 Dk Br Sa W Si Tps  
750- 1.05 Br F To Med Sa Tr S Tr Gr  
1.05 NFP BR

13+580 18.8 RT C/L D  
0- 750 Br F To Med Sa W Gr Tr Si  
750 NFP BR  
Fr Wat @ 600

13+590 8.0 RT C/L D+100  
0- 100 Blk Say Si Tps  
100- 500 Br F To Med Sa Tr Gr Tr Si Moist  
500 NFP BR

13+590 18.8 RT C/L D-100  
0- 300 Blk Si Tps  
300- 500 Br Siy Sa Tr Gr  
500 NFP BR

13+590 29.5 RT C/L D+150  
0- 300 Blk Si Tps  
300- 550 Br Siy Sa Tr Gr  
550 NFP BR

13+610 8.0 RT C/L D-1.05  
0 NFP BR

13+610 18.8 RT C/L D-1.90  
0 NFP BR

13+610 29.5 RT C/L D-1.90  
0- 300 Blk Si Tps  
300 NFP BR

WP 290-97-00 Highway 69

District 52, Huntsville

Rankin Lake Service Road

Datum Centre Line Pavement

9+900 C/L D  
0- 2.45 L Dk Br Si And F Sa Moist  
w @ 2.00 = 28%  
2.45- 6.10 D To V D Lt Br F Sa Tr Si Dry To  
Wet  
w @ 3.50 = 4%  
w @ 4.90 = 20%  
Fr Wat @ 4.20

9+950 C/L D  
0- 2.50 Comp Lt Gry To Br F Sa Tr Si And  
Gr Dry  
w @ 2.00 = 5%  
2.50- 7.60 D To Comp Lt Br F To Med Sa Tr Si  
And Gr Moist To Wet  
w @ 3.50 = 13%  
w @ 5.00 = 17%  
Fr Wat @ 2.70

9+950 17.0 LT C/L D+150  
0- 7.60 D To Comp Lt Br F Sa Tr Si Dry To  
Wet  
w @ 2.00 = 8%  
w @ 3.50 = 20%  
w @ 4.60 = 19%  
Fr Wat @ 3.60

9+950 17.0 RT C/L D-400  
0- 2.75 L Br F Say Si Fill Moist  
w @ 2.00 = 16%  
2.75- 4.00 Comp Br To Gry F Sa Tr Si Wet  
w @ 3.50 = 22%  
4.00- 7.60 D Br F To Med Sa Tr Si Moist To  
Wet  
w @ 4.60 = 17%  
Fr Wat @ 1.80

10+050 C/L D  
0- 305 Dr Br Tps  
305- 2.50 D Br F Sa Tr Si Dry To Moist  
2.50- 4.25 Comp Lt Br F Sa Tr Si Dry  
w @ 3.50 = 7%

10+050 12.5 LT C/L D  
0- 305 Dk Br Tps  
305- 4.25 Br F Sa Tr Si

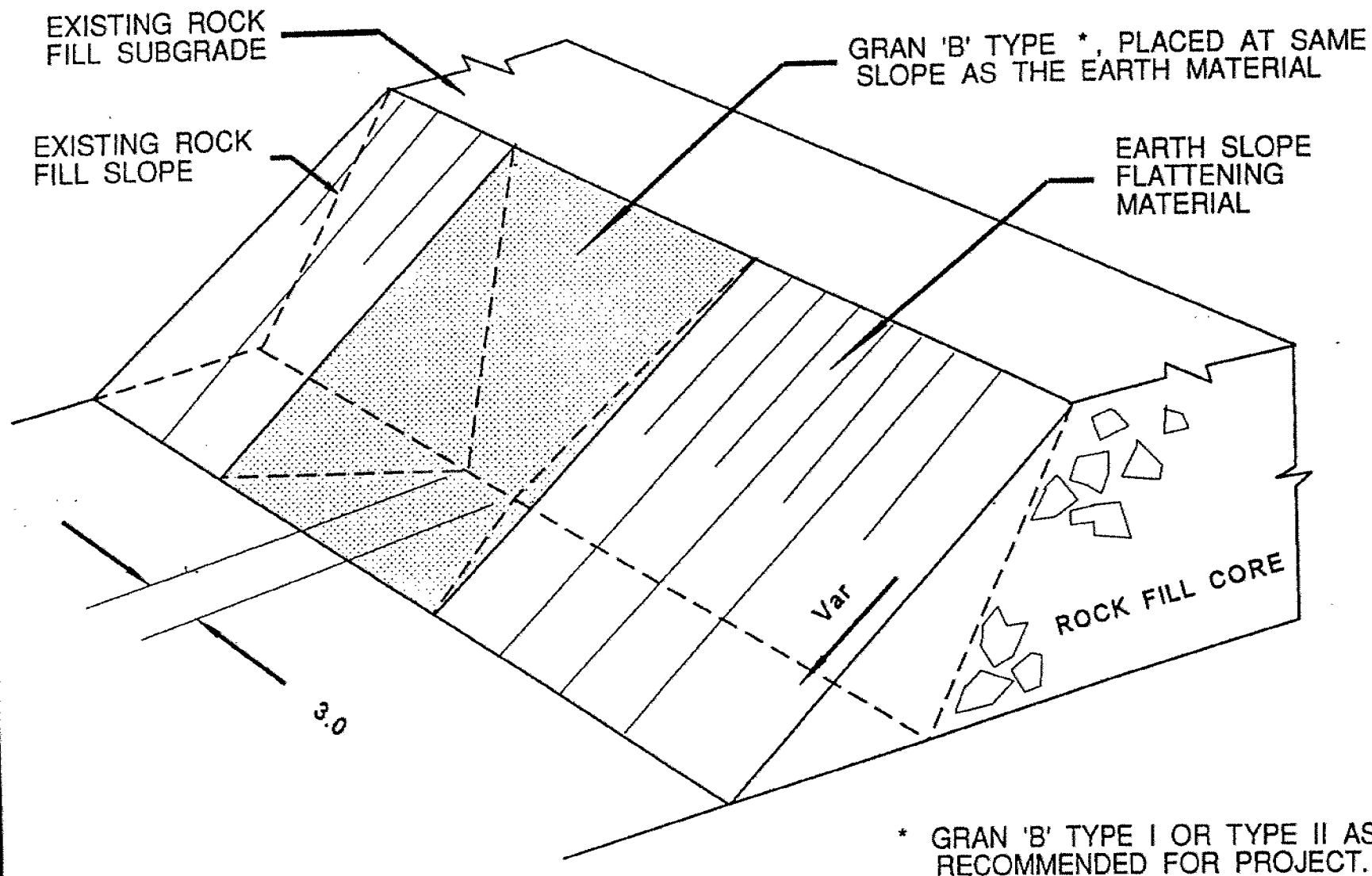
10+050 12.5 RT C/L D+100  
0 NFP BR

10+100 C/L D  
0- 610 Br Sa W Blds  
610 NFP BR/Blds

## **APPENDIX C**

### **ROCKFILL DRAINAGE IN SLOPE FLATTENED AREAS**

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



ROCK FILL DRAINAGE IN SLOPE FLATTENED AREAS

NOT TO SCALE



# memorandum

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To: Paul Lecoarer, P. Eng.  
Senior Project Engineer  
Planning and Design Section  
Northern Region

1998 08 07

From: Pavements and Foundations Section  
Room 223, Central Building  
Downsview, Ontario

Re: Foundation Investigation Reports  
G.W.P. 290-97-00  
Hwy 169 Underpass, W.P. 398-97-00, Site 42-320  
Lawson Bay Road Overpass, W.P. 403/404-97-00, Site 44-380 N&S  
Rankin Lake Service Road Underpass, W.P. 409-97-00, Site 44-384  
Hwy 69, District 52, Huntsville

We have conceptually reviewed the Foundation reports for the above projects produced by Peto MacCallum Ltd. Consulting Engineers for McCormick Rankin Corporation to determine the consultant's performance in providing the deliverables as would be required by MTO for similar consultant assignments. The accuracy of the subsurface information and the adequacy and technical aspects of the recommendations remain the responsibility of the consultant. The Ministry assumes no responsibility or liability for these aspects of the reports. These aspects will be reviewed in order to assess the consultant's performance in this assignment upon implementation of the recommendation in the design and upon review of the performance of the foundations for the completed project. Following are our comments:

## **General Comments for all the above Projects**

All reports show WP 290-97-00 as the work project number. From the previous correspondence we understand that each project has been assigned individual project numbers. We think the work project number shown on the reports (WP 290-97-00) should be GWP 290-90-00. It should be corrected to avoid any confusion.

The reports are not signed by the MTO designated principals. The MTO policy requires that the Foundation reports should be signed by one of the MTO designated principal. The MTO designated principal of Peto MacCallum are Brian Gray or G.D. Bonner.

As mentioned in our previous memo dated 1998 06 09, the cross sections are very small. Also, profiles along the major highway showing the proposed grades of the highways, abutment locations and approach fills would be useful to understand the design arrangements.

The bar scale on the Key Plan is not correct

#### **Hwy 169 Underpass, Site 42-320**

As indicated in our memo of 1998 06 09, The bedrock elevation at this site is very shallow. The site may not meet the minimum pile length requirement for integral abutments. This should be verified by the MTO Structural Office.

Page 3, Paragraph 3: For pile driving it is recommended to use hammer which transfers at least 40 kJ energy. Normally for this type of soil condition 50 kJ hammer is recommended. However, to avoid any claims, the selection of the hammer may be left up to the Contractor.

The Cross Sections A-A and B-B shows the centre line of Hwy 169. It should be Hwy 69 (not Hwy 169).

#### **Lawson Bay Road Overpass, Site 44-380 N&S**

Please refer to the General Comments for all projects.

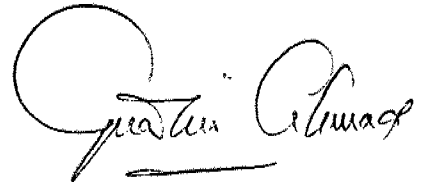
#### **Rankin Lake Service Road Underpass, Site 44-384**

Page 1, Introduction. Please verify if the noted Station 14+468 of Highway 69 chainage is correct. This does not match with the station shown on the drawing.

The skew of the foundation is greater than 20 degrees. According to the Integral Abutment Report, such structures should be considered for the integral abutment if rigorous analysis is carried out to account for the skew effects. Therefore, further analysis may be required to consider this structure for the integral abutment.

Page 3, Paragraph 2: For pile driving it is recommended to use hammer which transfers at least 40 kJ energy. Normally for this type of soil condition 50 kJ hammer is recommended. To avoid any claims, the selection of the hammer may be left up to the Contractor.

If you have any questions, please advise.

A handwritten signature in black ink, appearing to read 'K. Ahmad', with a large, stylized initial 'K'.

K. Ahmad, P. Eng  
Foundation Engineer

For

T.C. Kim, P. Eng.  
Senior Foundation Engineer

cc: P. Furst  
I. Hussain  
T. Kazmierowski



# memorandum

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To: Paul Lecoarer, P. Eng.  
Senior Project Engineer  
Planning and Design Section  
Northern Region

1998 06 09

From: Pavements and Foundations Section  
Room 223, Central Building  
Downsview, Ontario

Re: Foundation Investigation Reports and Technical Review Package  
G.W.P. 290-97-00  
Hwy 169 Underpass, W.P. 398-97-00, Site 42-320  
Lawson Bay Road Overpass, W.P. 403/404-97-00, Site 44-380 N&S  
Rankin Lake Service Road Underpass, W.P. 409-97-00, Site 44-384  
Hwy 69, District 52, Huntsville

We have conceptually reviewed the Foundation reports and the Technical Review Package for the above projects produced by Peto MacCallum Ltd. Consulting Engineers for McCormick Rankin Corporation to evaluate the performance of the Consultant. Since, we were given a very short time to review, we have not reviewed the report in detail. The accuracy of the subsurface information and the technical recommendations remain the responsibility of the consultant. Following are our comments:

## Hwy 169 Underpass

### Foundation:

- The bedrock elevation is very shallow. The site may not meet the minimum pile length requirement for integral abutments. This should be checked out with the Structural Office.

### Drawing:

Drawing No. 1, dated April 1998

- Existing Hwy 169 should be shown on the Key Plan.
- Proposed foundation location should be shown on the plan.
- A large scale profile with a proposed grade of Hwy 169 should be provided.

- N-values and soil description should be provided on the cross sections and profiles.
- The cross sections are very small. When the drawing will be reduced to half size for the contract package, then it would not be legible. The cross sections should be produced in large scale. There is enough room on the drawing to draw cross sections in large scale.

#### Logs:

- For the borehole locations it is preferable to have Northing and Eastings instead of stations and offsets.

#### Lawson Bay Road Overpass

##### Drawing:

Drawing No. 1, Job No. 97TF088A, dated March 1998

- Proposed foundation location should be shown on the plan.
- Locations of the boreholes should be shown by coordinates, instead of stations and offset.
- N-values and soil description should be provided on the cross sections and profiles.
- The cross sections are very small. When the drawing will be reduced to half size for the contract package, then it would not be legible. The cross sections should be drawn in large scale.

#### Rankin Lake Service Road Underpass

##### Foundations

- Foundation Design Report, Page 3, Last Paragraph. It is recommended to use loose sand to fill the pre-augured holes. Just loose sand is not enough. It should be uniformly graded (Ottawa Sand) or equivalent. The Ministry has specification for the grain size distribution for Ottawa Sand.
- The denseness of the material described on the borehole logs do not agree with the Standard Penetration test results, N-values.

##### Drawing:

Drawing No. 1, Job No. 97TF088A, dated April 1998

- Proposed foundation locations should be shown on the plan.
- Locations of the boreholes should be shown by coordinates, instead of stations and offset.
- N-values and soil description should be provided on the cross sections and profiles.

- The cross sections are very small. When the drawing will be reduced to half size for the contract package, then it would not be legible. The cross sections should be produced in large scale.

If you have any questions, please advise.

A handwritten signature in black ink, appearing to read 'K. Ahmad', with a horizontal line underneath the name.

K. Ahmad, P. Eng  
Foundation Engineer

For

T.C. Kim, P. Eng.  
Senior Foundation Engineer

cc: P. Furst  
I. Hussain  
T. Kazmierowski