DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 31C-145

DIST. 7 REGION

W.P. No. 66-89-01

CONT. No. 90-89

W. O. No.

STR. SITE No. 21-74

HWY. No. 30

LOCATION Mill (Peray) Creek Bridge Replacement

No. of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

Distance from
Downsview to Mill Ck

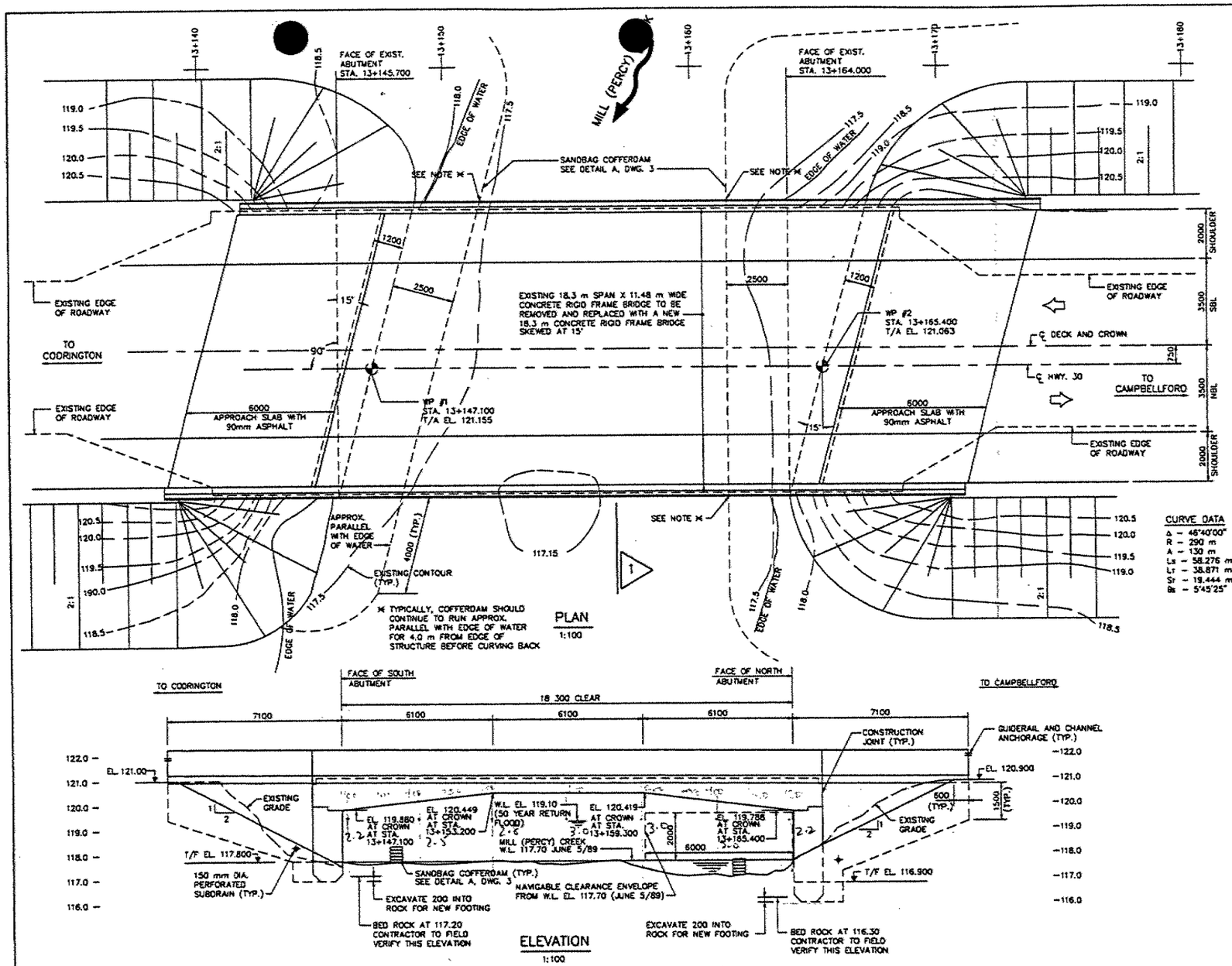
401: Keele to Hwy 30
147.2

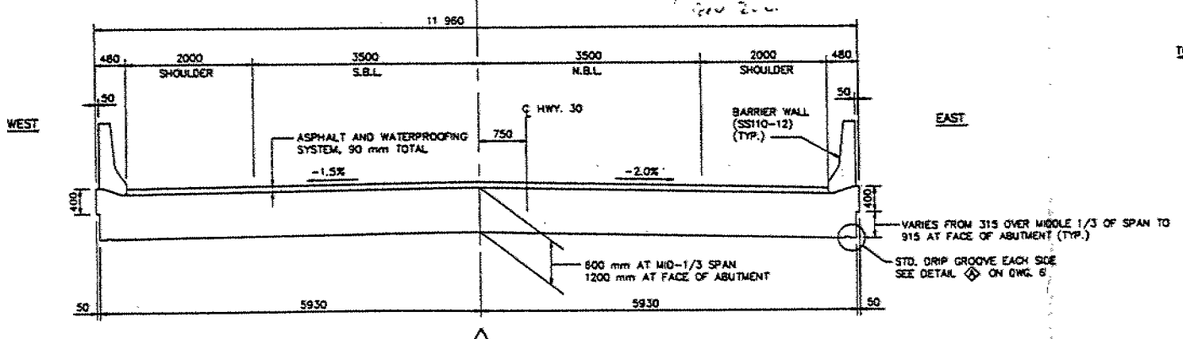
Hwy 30: 401 to
Meyersburg 20.9

168.1

(2HRS)

MH 19-319.00 (A-1:100) MC1





MTC PBM 728504
BM 120.347
5.10 RT 13+167.9
TAB SET HOR. E. FACE OF N. ABUT. 0.052m. BELOW COP ROUTE 91

NOTE : BM TO BE RELOCATED PRIOR TO START OF CONSTRUCTION.

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

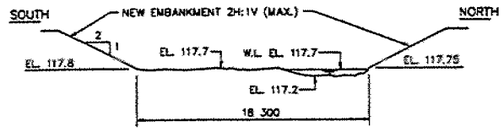
DIST. No. 7
CONT. No. 90-89
WP. No. 66-89-01

MILL CREEK BRIDGE RECONSTRUCTION AT HWY. 30

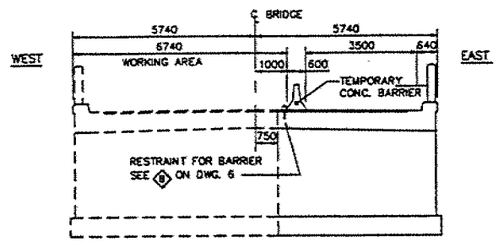
GENERAL ARRANGEMENT

SHEET 122

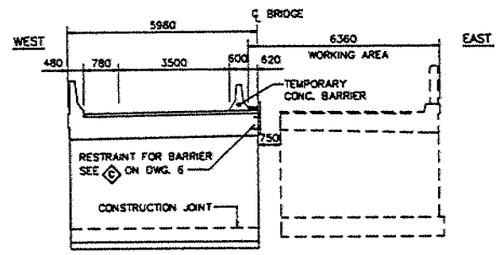
Morrison Hershfield Limited
Consulting Engineers



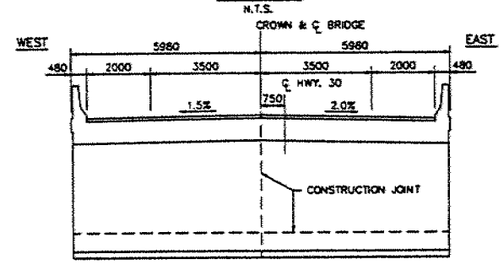
CHANNEL SECTION AT STRUCTURE
N.T.S.



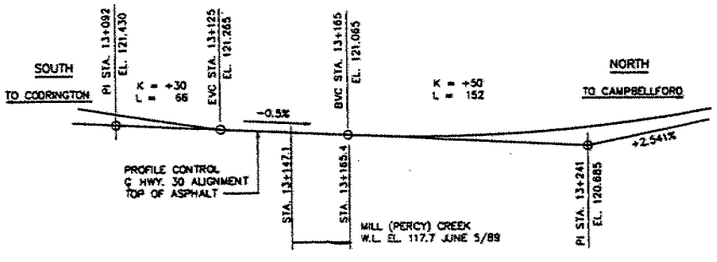
STAGE 1
N.T.S.



STAGE 2
N.T.S.



FINAL DECK CROSS SECTION
N.T.S.



PROFILE OF HWY. 30
N.T.S.

DRAWING NOT TO BE SCALED

100 mm ON ORIGINAL DRAWING

GENERAL NOTES

1. CLASS OF CONCRETE 30 MPa
2. CLEAR COVER TO REINFORCING STEEL
   - FOOTINGS: 100±25
   - ABUTMENTS AND WINGWALLS
     - FRONT FACE 80±20
     - BACK FACE 70±20
   - DECK
     - TOP 70±20
     - BOTTOM AND SIDES 50±10
   - REMAINDER 70±20

   UNLESS OTHERWISE NOTED
3. REINFORCING STEEL
   REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.
   BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS.
4. CONSTRUCTION NOTES :
   - BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500 mm.

CONSTRUCTION STAGING :

STAGE 1
1. RESTRICT TRAFFIC TO A SINGLE LANE USING TEMPORARY CONCRETE BARRIERS.
2. REMOVE ONE HALF OF THE EXISTING BRIDGE (INCLUDING FOUNDATIONS). TEMPORARILY SHORE THE FILL BELOW THAT PORTION OF THE ROADWAY STILL IN SERVICE SO THAT SETTLEMENT OF THE ROADWAY DOES NOT OCCUR.
3. CONSTRUCT ONE HALF OF THE NEW BRIDGE LEAVING A GAP TO ALLOW FOR SPLICING OF THE TRANSVERSE REINFORCEMENT.
4. CONSTRUCT THE BARRIER WALL ON THE NEW BRIDGE DECK AND NEW WINGWALLS.
5. PLACE WATERPROOFING AND ASPHALT.
6. RELOCATE TEMPORARY CONCRETE BARRIERS TO POSITION SHOWN IN STAGE 2 AND DIVERT TRAFFIC TO THE NEWLY CONSTRUCTED PART OF THE BRIDGE.

STAGE 2
1. REMOVE THE REMAINDER OF THE ORIGINAL BRIDGE (INCLUDING FOUNDATIONS). TEMPORARILY SHORE THAT PORTION OF THE ROADWAY WHICH IS TO REMAIN IN SERVICE SO THAT SETTLEMENT OF THE ROADWAY DOES NOT OCCUR.
2. CONSTRUCT THE REMAINDER OF THE NEW DECK AND SUBSTRUCTURE.
3. CONSTRUCT THE BARRIER WALL ON THE NEW BRIDGE DECK AND NEW WINGWALLS. REMOVE TEMPORARY SHORING.
4. PLACE WATERPROOFING AND ASPHALT.
5. REMOVE TEMPORARY CONCRETE BARRIERS AND OPEN HIGHWAY TO TWO WAY TRAFFIC.

LIST OF DRAWINGS :

LEGEND :

℄ - CENTRE LINE
WP - WORKING POINT
T/C - TOP OF CONCRETE
T/A - TOP OF ASPHALT
T/F - TOP OF FOOTING

APPLICABLE STANDARD DRAWINGS

00-3502 MINIMUM GRANULAR BACKFILL REQUIREMENTS (MODIFIED - SEE DWG. 10)

L. MIKELSTEINS — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

A.T.H. CHAN — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

REVISIONS			
	DATE	BY	DESCRIPTION

DESIGN HM	CHK. ATC	CODE OH80C-83	LOAD CLASS B	DATE	JUNE/90
DRAWN HT/DT	CHK. ATC	SITE 21-074	STRUCT.	SCHEME	DWG. 1

499-3110

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

PROJECT No. 7
CONT. No. 90-89
WP. No. 66-89-01

MILL CREEK BRIDGE RECONSTRUCTION AT HWY. 30

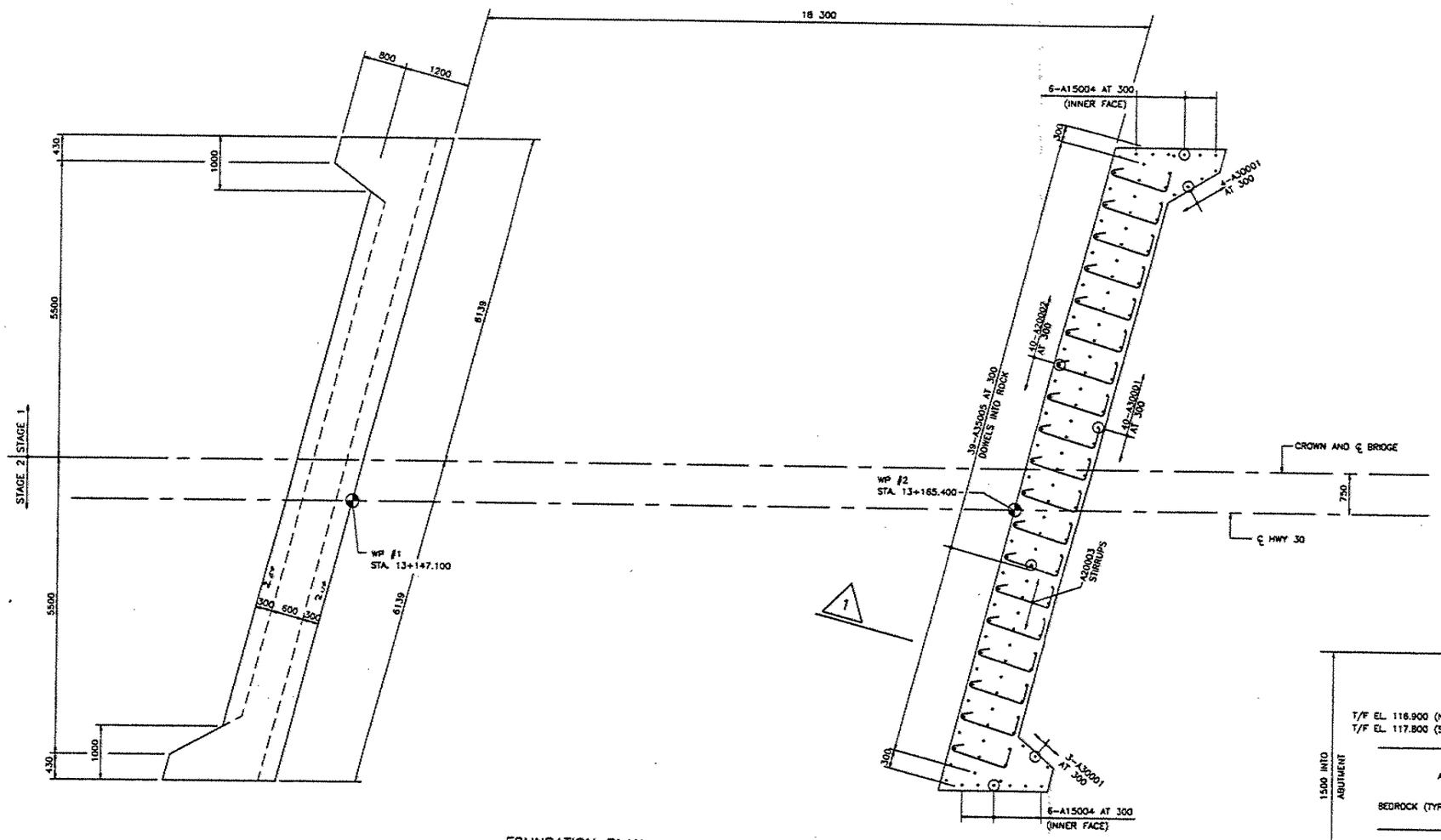
FOUNDATION LAYOUT AND REINFORCING

SHEET 124

Morrison Hershfield Limited
Consulting Engineers

NOTES :

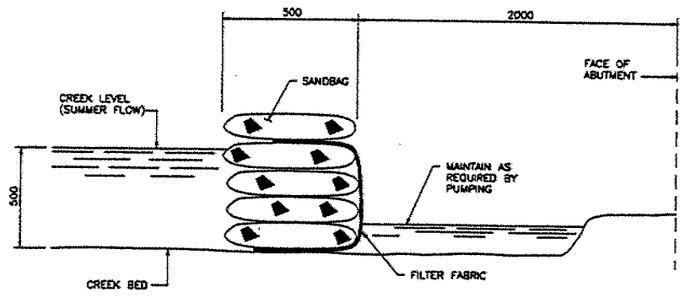
1. EQ. SP. – EQUALLY SPACED
   EA. F. – EACH FACE
   I.F. – INSIDE FACE
   O.F. – OUTSIDE FACE
   T/F – TOP OF FOOTING
   TUL – TOP UPPER LAYER
   TLL – TOP LOWER LAYER
   BUL – BOTTOM UPPER LAYER
   BLL – BOTTOM LOWER LAYER
2. UNLESS OTHERWISE NOTED MINIMUM LAP LENGTHS FOR REINFORCING BARS ARE AS FOLLOWS :
   15M = 650 mm
   20M = 800 mm
   25M = 1200 mm
   30M = 1700 mm
   35M = 2400 mm



FOUNDATION PLAN
1:50

DIMENSIONS GIVEN ARE TYPICAL FOR NORTH AND SOUTH ABUTMENTS

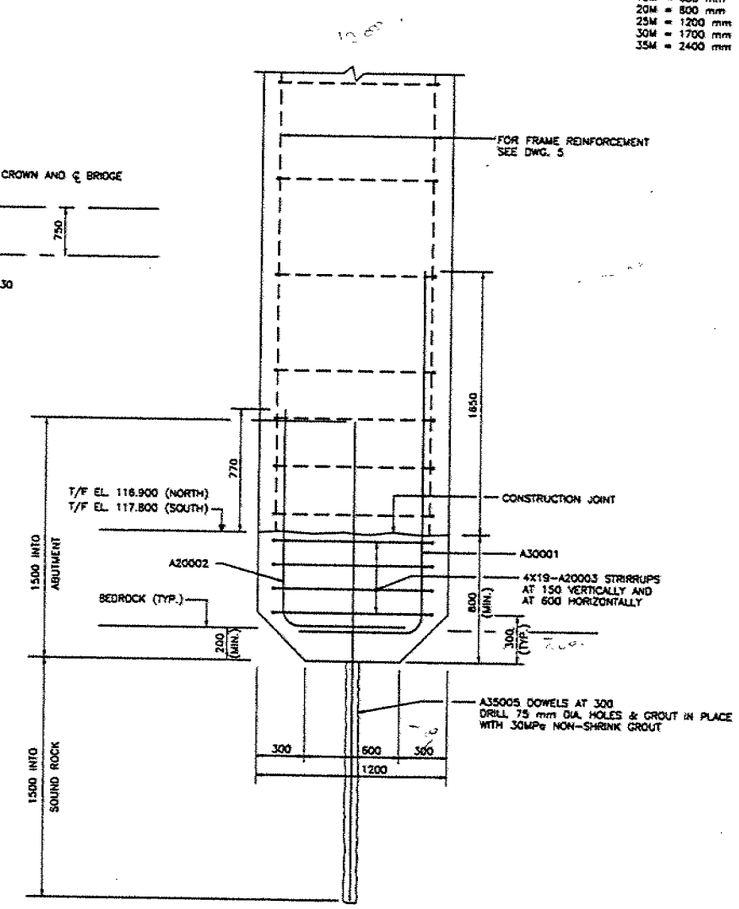
REINFORCING DETAILS SHOWN ARE TYPICAL FOR NORTH AND SOUTH ABUTMENTS



TYPICAL SANDBAG COFFERDAM ISOLATING FOOTING EXCAVATION (A)
N.T.S.

NOTES FOR FOUNDATION CONSTRUCTION :

1. EXCAVATE 200 mm (MINIMUM) INTO ROCK
2. DRILL DOWEL HOLES
3. HOLES SHALL BE CLEAN AND DRY PRIOR TO INSTALLATION OF DOWELS AND GROUT
4. INSTALL DOWELS USING NON-SHRINK GROUT IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS
5. DO NOT DISTURB DOWELS BEFORE NON-SHRINK GROUT HAS SET
6. INSTALL FORMS AND POUR ABUTMENT CONCRETE
7. LATERALLY BRACE ABUTMENT WALL DURING CONSTRUCTION UNTIL CONCRETE DECK SLAB IS IN PLACE.



1
1:20

LICENSED PROFESSIONAL ENGINEER L. MIKELSTEINS PROVINCE OF ONTARIO Dec 3/90

LICENSED PROFESSIONAL ENGINEER A.T.N. CHAN PROVINCE OF ONTARIO Dec 3, 90

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	IM	CHK. ATC	CODE	OHBDC-83	LOAD CLASS B	DATE	JUNE/90
DR & WK	DT	CHK.					

MH 19-319.00 (M-1:50) M

SATCH Contract 1

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 90-89

Ontario

Ministry of
Transportation

INDEX

Note: For purposes of the contract, this report supercedes all other Foundation Reports prepared by, or for the Ministry in connection with the above mentioned project.

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O D 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1, %	VOID RATIO	
n	1, %	POROSITY	
w	1, %	WATER CONTENT	
S_r	%	DEGREE OF SATURATION	
w_L	%	LIQUID LIMIT	
w_p	%	PLASTIC LIMIT	
w_s	%	SHRINKAGE LIMIT	
I_p	%	PLASTICITY INDEX = $w_L - w_p$	
I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	
I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	
e_{max}	1, %	VOID RATIO IN LOOSEST STATE	

e_{min}	1, %	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE

FOUNDATION INVESTIGATION REPORT
For
Mill (Percy) Creek Bridge Replacement
Highway 30, Northumberland County
W.P. 66-89-01, Site 21-74
District 7, Port Hope

INTRODUCTION

This report summarizes the results of a foundation investigation carried out for the above-mentioned structure replacement. The fieldwork was conducted during the period from 89-05-15 to 89-05-16 utilizing a 5.2 (i) track-mounted auger machine. The work consisted of two sampled boreholes with rock coring and one dynamic cone penetration test. The boreholes were advanced with continuous flight augers, and BW casing with washboring. Samples were retrieved using a split spoon sampler and a BQ-sized rock core barrel.

SITE DESCRIPTION

The intersection of Mill Creek (also known as Percy Creek) and Highway 30 is located in Meyersburg, approximately 7.0 km south of Campbellford. The existing structure is a single-span rigid frame bridge with shallow foundations founded on bedrock. The width of the creek at the bridge crossing is approximately 18.0 m and its depth, at the time of the investigation, averaged 1.1 m. Mill Creek flows into the Trent River just east of the bridge.

The topography in the immediate vicinity is hilly, the creek and Trent River cutting through the landscape. Physiographically, the site lies in an area that was once a large bay of Lake Iroquois and is characterized by various types of lacustrine deposits (after Chapman and Putnam). The overburden is underlain by limestone of the Trenton Black River Groups.

Land use in the area is largely agricultural and residential.

SUBSURFACE CONDITIONS

The subsurface material encountered consists of a shallow cover of overburden underlain by bedrock. BH 1 was advanced on the east side of the structure in the floodplain at the mouth of Mill Creek. It contains a 0.9 m gravel deposit overlying limestone bedrock. BH 2, advanced on the northwest approach consisted of a fill deposit 3.3 m in thickness, followed by a 1.4 m thick gravel layer and underlain by limestone bedrock.

The boundaries of the different strata, together with the field and laboratory test results appear on the Record of Borehole sheets appended to this report. Refer to these sheets for the locations and elevations of the boreholes. A stratigraphical profile, based on the borehole data, is shown on Dwg. No. 668901-A.* A description of the different strata follows.

Sand, Gravel and Silt Mixture (Fill Material)

A non-cohesive deposit composed of a heterogeneous mixture of sand, gravel and silt was encountered in BH 2. It extends from ground surface to El. 117.7 m, a depth of 3.3 m. Organics were present to a depth of approximately 2.0 m and the deposit contained occasional cohesive pockets. Because of the heterogeneous nature of the deposit and the topography in the immediate vicinity of the borehole, the material is believed to be a fill deposit. The N values obtained from the Standard Penetration Test varied from 8 to 13 blows per 30 cm, reflecting a denseness that ranges from loose to compact. Laboratory testing performed on this material varied considerably due to its heterogeneous nature. Natural moisture contents of 10% and 20% were measured. A plasticity index of 8.5% was measured on a slightly cohesive zone. A liquid limit of 30% and plastic limit of 21.5% were recorded on this sample.

Gravel

A gravel deposit containing some/with sand, some silt, trace organics and occasional clayey silt pockets was encountered as the surficial and only

* SHEET NO 123 OF THE CONTRACT DWG'S.

overburden deposit in BH 1 and occurred beneath the fill deposit in BH 2. This deposit ranges in thickness from 0.9 m to 1.1 m and overlies the bedrock in both boreholes. Cobbles were present directly atop the bedrock in BH 1. It is probable that boulders are also present at this interface. As in the previous deposit, the field and laboratory results indicate a largely heterogeneous material. 'N' values ranges from 6 to blows in excess of 120 per 30 cm reflecting a relative density ranging from loose to very dense.

Bedrock

Bedrock was proven in both boreholes using BQ-sized rock coring equipment. The cores were logged by S.A.Senior, MTO Geological Engineer, and described as limestone bedrock of the Trenton Black River Groups. The following are bedrock elevations encountered at the borehole locations:

Borehole	Bedrock Elevation
1	117.5
2	116.3

The bedrock appears to dip in a northerly direction. The bedrock was weathered to El. 117.4 m BH 1, and El. 116.2 in BH 2. Detailed bedrock descriptions for the rock core recovered may be found in the Appendix of this report.

GROUNDWATER CONDITIONS

Groundwater levels may be assumed to reflect the creek water level. In BH 1 the groundwater elevation was recorded at ground surface, i.e. El. 118.4 m. A reading for BH 2 was not established as a stabilized water level was not achieved. The water level in the creek, at the time of the investigation, was El. 118.3 m.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of B. Bennett, Foundation Engineer and J. White, University of Toronto Engineering Student. The drilling equipment was owned and operated by Master Soil Investigations Limited. The report was prepared by Ms. B. Bennett under the general supervision of Mr. D. Dundas, Sr. Foundation Engineer and reviewed by Mr. M. Devata, Chief Foundation Engineer.

Dr. B. Iyer, P. Eng.
Sr. Foundation Engineer

M. Devata, P. Eng.
Chief Foundation Engineer

APPENDIX

Ministry of Transportation Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 66-89-01 LOCATION Sta. 13 + 136.4 O/S 12.9 m Rt. ℄ Hwy. 30 ORIGINATED BY BB/JN

DIST 7 HWY 30 BOREHOLE TYPE S.S. Auger, BW Casing, BQ Rock Core COMPILED BY BB

DATUM Geodetic DATE 89 05 15 CHECKED BY [signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
118.4	Ground Level										
0.0	Gravel with Sand Occasional Clayey Silt Pockets Trace Organics		1	SS	6		118				40 27 (33)
			2	SS	60/20 cm						58 32 (10)
117.5	Occ. Cobbles/Boulders										
0.9	Sound		3	RC	90% REC						RQD 0 %
	Bedrock						117				
	Limestone		4	RC BQ	100% REC						RQD 53 %
	Interbedded						116				
	with										
	Calcareous Shale		5	RC BQ	100% REC						RQD 24 %
114.6							115				
3.8	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No 2 METRIC

W P 66-89-01 LOCATION Sta. 13 + 187.0 O/S 7.6 m Lt. ℄ Hwy. 30 ORIGINATED BY BB/JW

DIST 7 HWY 30 BOREHOLE TYPE Cone Test, H.S. Auger, BW Casing, BQ Rock Core COMPILED BY BB

DATUM Geodetic DATE 89 05 16 CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPo: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
121.0	Ground Level										
0.0	Gravel, Sand Silt Mixture		1	SS	8	*	120				
	Trace Organics		2	SS	13		119		○		63 25 (12)
	Occ. Cohesive Pockets Loose to Compact (Fill Material)		3	SS	11				○		12 45 (43)
117.7							118				
3.3	Trace Organics Gravel Some/With Sand Some Silt Dense to Very Dense		4	SS	45						
			5	SS	37		117		○		63 24 (13)
116.3			6	SS	30/1 cm						
4.7	Sound Bedrock Limestone Interbedded With Calcareous Shale		7	RC BQ	100% REC		116				RQD 0 %
			8	RC BQ	100% REC						RQD 32 %
			9	RC BQ	100% REC		115				RQD 30 %
113.2			10	RC BQ	100% REC		114				RQD 33 %
7.8	End of Borehole										

* Stabilized GWL Not Established

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

15 (20/10) 5 (%) STRAIN AT FAILURE

ROCK CORE DESCRIPTION
WP 66-89-01

CORE RECOVERY					CORE DESCRIPTION	
BH #	RC #	DEPTH (m)	CR* (%)	RQD* (%)	DEPTH (m)	DESCRIPTION
1	3	0.86-1.17	92	0	0.86-3.76	ARGILLACEOUS LIMESTONE, light to medium grey, fine to medium grained, thin to medium bedded, interbedded with dark grey, very fine grained **CALCAREOUS SHALE**; weak to medium strong rock; slightly weathered to unweathered; very close to closely spaced bedding joints and weak bedding planes (2-15 cm): planar, (0-20°), smooth to irregular.
	4	0.17-2.51	100	53		
	5	2.51-3.76	100	24		
2	7	4.75-5.03	100	0	4.75-7.80	ARGILLACEOUS LIMESTONE, light to medium grey, fine to medium grained, thin to medium bedded, interbedded with dark grey, very fine grained **CALCAREOUS SHALE**; weak to medium strong rock; slightly weathered to unweathered; very close to closely spaced bedding joints and weak bedding planes (2-15 cm): planar, (0-20°), smooth to irregular.
	8	5.03-6.58	100	32		
	9	6.58-7.42	100	30		
	10	7.42-7.80	100	33		

***CR = CORE RECOVERY** (NOTE: Depths are approximated in zones of poor core recovery.)
***RQD = ROCK QUALITY DESIGNATION**

Logged by: S. A. Senior, Soils and Aggregates Section.

CONT 90-89

Ministry
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Ontario

FOUNDATION DESIGN SECTION

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 66-89-01 DIST 7

HWY 30 STR SITE 21-74

Mill (Percy) Creek Bridge Replacement

CONT 90-89

DISTRIBUTION

G.C.E. Burkhardt (3)
G. Cautillo
J. Smrcka (2)
A. Wittenberg
K.G. Bassi
S. Dunham
T. Yakutchik
G. Szekreny
B. Steeves (Cover Only)
M. MacLean (Cover Only)
File

GEOCRES 31C - 145

DATE SEP 19 1989

FOUNDATION INVESTIGATION REPORT
For
Mill (Percy) Creek Bridge Replacement
Highway 30, Northumberland County
W.P. 66-89-01, Site 21-74
District 7, Port Hope

INTRODUCTION

This report summarizes the results of a foundation investigation carried out for the above-mentioned structure replacement. The fieldwork was conducted during the period from 89-05-15 to 89-05-16 utilizing a 5.2 (i) track-mounted auger machine. The work consisted of two sampled boreholes with rock coring and one dynamic cone penetration test. The boreholes were advanced with continuous flight augers, and BW casing with washboring. Samples were retrieved using a split spoon sampler and a BQ-sized rock core barrel.

In addition to the results of the field investigation, this report contains recommendations for the design and construction of the proposed structure foundations.

SITE DESCRIPTION

The intersection of Mill Creek (also known as Percy Creek) and Highway 30 is located in Meyersburg, approximately 7.0 km south of Campbellford. The existing structure is a single-span rigid frame bridge with shallow foundations founded on bedrock. The width of the creek at the bridge crossing is approximately 18.0 m and its depth, at the time of the investigation, averaged 1.1 m. Mill Creek flows into the Trent River just east of the bridge.

The topography in the immediate vicinity is hilly, the creek and Trent River cutting through the landscape. Physiographically, the site lies in an area that was once a large bay of Lake Iroquois and is characterized by various types of lacustrine deposits (after Chapman and Putnam). The overburden is underlain by limestone of the Trenton Black River Groups.

Land use in the area is largely agricultural and residential.

SUBSURFACE CONDITIONS

The subsurface material encountered consists of a shallow cover of overburden underlain by bedrock. BH 1 was advanced on the east side of the structure in the floodplain at the mouth of Mill Creek. It contains a 0.9 m gravel deposit overlying limestone bedrock. BH 2, advanced on the northwest approach consisted of a fill deposit 3.3 m in thickness, followed by a 1.4 m thick gravel layer and underlain by limestone bedrock.

The boundaries of the different strata, together with the field and laboratory test results appear on the Record of Borehole sheets appended to this report. Refer to these sheets for the locations and elevations of the boreholes. A stratigraphical profile, based on the borehole data, is shown on Dwg. No. 668901-A. A description of the different strata follows.

Sand, Gravel and Silt Mixture (Fill Material)

A non-cohesive deposit composed of a heterogeneous mixture of sand, gravel and silt was encountered in BH 2. It extends from ground surface to El. 117.7 m, a depth of 3.3 m. Organics were present to a depth of approximately 2.0 m and the deposit contained occasional cohesive pockets. Because of the heterogeneous nature of the deposit and the topography in the immediate vicinity of the borehole, the material is believed to be a fill deposit. The N values obtained from the Standard Penetration Test varied from 8 to 13 blows per 30 cm, reflecting a denseness that ranges from loose to compact. Laboratory testing performed on this material varied considerably due to its heterogeneous nature. Natural moisture contents of 10% and 20% were measured. A plasticity index of 8.5% was measured on a slightly cohesive zone. A liquid limit of 30% and plastic limit of 21.5% were recorded on this sample.

Gravel

A gravel deposit containing some/with sand, some silt, trace organics and occasional clayey silt pockets was encountered as the surficial and only

overburden deposit in BH 1 and occurred beneath the fill deposit in BH 2. This deposit ranges in thickness from 0.9 m to 1.1 m and overlies the bedrock in both boreholes. Cobbles were present directly atop the bedrock in BH 1. It is probable that boulders are also present at this interface. As in the previous deposit, the field and laboratory results indicate a largely heterogeneous material. 'N' values ranges from 6 to blows in excess of 120 per 30 cm reflecting a relative density ranging from loose to very dense.

Bedrock

Bedrock was proven in both boreholes using BQ-sized rock coring equipment. The cores were logged by S.A.Senior, MTO Geological Engineer, and described as limestone bedrock of the Trenton Black River Groups. The following are bedrock elevations encountered at the borehole locations:

Borehole	Bedrock Elevation
1	117.5
2	116.3

The bedrock appears to dip in a northerly direction. The bedrock was weathered to El. 117.4 m BH 1, and El. 116.2 in BH 2. Detailed bedrock descriptions for the rock core recovered may be found in the Appendix of this report.

GROUNDWATER CONDITIONS

Groundwater levels may be assumed to reflect the creek water level. In BH 1 the groundwater elevation was recorded at ground surface, i.e. El. 118.4 m. A reading for BH 2 was not established as a stabilized water level was not achieved. The water level in the creek, at the time of the investigation, was El. 118.3 m.

DISCUSSION AND RECOMMENDATIONS

The existing structure at Mill Creek is a single-span rigid frame bridge built under Contract 37-72. The original drawings show a structure with a span length of 18.5 m± and spread footing foundations on bedrock. It is proposed to replace the existing bridge with an identical structure using stage construction.

Structure Foundations

The proposed structure may be founded on spread footings on bedrock. The following are design values, as per the O.H.B.D.C., for limestone bedrock:

Factored Bearing Capacity at U.L.S.	3000 kPa
Bearing Capacity at S.L.S. Type II	N/A

The footings should be placed on bedrock at the same elevation as previously constructed. These elevations should be determined during construction. For design purposes, the bedrock elevations are estimated as follows:

~~North~~ South Abutment	117.2 m
~~South~~ North Abutment	116.3 m

Dewatering

Because the footings will be placed below the creek water level, a dewatering scheme will be required. This scheme could consist of a pre-fabricated cofferdam that is sealed at its base to ensure that the footings are placed in the "dry". Alternatively, an impervious earth dyke could be constructed for dewatering purposes.

Sliding Resistance

A friction angle of 28° may be assumed for resistance against sliding between the concrete footing and the limestone bedrock. If additional

lateral resistance is required, it could be achieved with the use of keys or dowelling. Our office should be consulted in the event that these items are considered in design. In any case, the bedrock bearing surface should be scraped rough.

Frost Protection

Frost protection is not required for footings on bedrock.

Lateral Earth Pressure

Backfill to the structure should consist of granular material in accordance with MTO Special Provision No. 109F03, for which the following properties apply:

	ϕ	γ
Granular 'A'	35°	22.8 kN/m^3
Granular 'B'	30°	21.2 kN/m^3

Lateral earth pressures should be computed in accordance with Section 6.6.1.2 of the O.H.B.D.C.. An at-rest condition may be assumed to apply.

Approach Embankments

No stability or settlement problems are anticipated at this site.

The embankment slopes should be maintained at 2H:1V or flatter. Any new fill placed on the existing embankments should be keyed into the existing fill.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of B. Bennett, Foundation Engineer and J. White, University of Toronto

Engineering Student. The drilling equipment was owned and operated by Master Soil Investigations Limited. The report was prepared by Ms. B. Bennett under the general supervision of Mr. D. Dundas, Sr. Foundation Engineer and reviewed by Mr. M. Devata, Chief Foundation Engineer.

B. Bennett, P.Eng.
Foundation Engineer

M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1,%	VOID RATIO
n	1,%	POROSITY
w	1,%	WATER CONTENT
S_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_p	%	PLASTIC LIMIT
w_S	%	SHRINKAGE LIMIT
I_p	%	PLASTICITY INDEX = $w_L - w_p$
I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	1,%	VOID RATIO IN LOOSEST STATE
e_{min}	1,%	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE

ROCK CORE DESCRIPTION
WP 66-89-01

CORE RECOVERY					CORE DESCRIPTION	
BH #	RC #	DEPTH (m)	CR* (%)	RQD* (%)	DEPTH (m)	DESCRIPTION
1	3	0.86-1.17	92	0	0.86-3.76	ARGILLACEOUS LIMESTONE, light to medium grey, fine to medium grained, thin to medium bedded, interbedded with dark grey, very fine grained **CALCAREOUS SHALE**; weak to medium strong rock; slightly weathered to unweathered; very close to closely spaced bedding joints and weak bedding planes (2-15 cm): planar, (0-20°), smooth to irregular.
	4	0.17-2.51	100	53		
	5	2.51-3.76	100	24		
2	7	4.75-5.03	100	0	4.75-7.80	ARGILLACEOUS LIMESTONE, light to medium grey, fine to medium grained, thin to medium bedded, interbedded with dark grey, very fine grained **CALCAREOUS SHALE**; weak to medium strong rock; slightly weathered to unweathered; very close to closely spaced bedding joints and weak bedding planes (2-15 cm): planar, (0-20°), smooth to irregular.
	8	5.03-6.58	100	32		
	9	6.58-7.42	100	30		
	10	7.42-7.80	100	33		

***CR = CORE RECOVERY** (NOTE: Depths are approximated in zones of poor core recovery.)
***RQD = ROCK QUALITY DESIGNATION**

Logged by: S. A. Senior, Soils and Aggregates Section.

Ministry of Transportation Ontario

RECORD OF BOREHOLE No 1 — METRIC

W P 66-89-01 LOCATION Sta. 13 + 136.4 O/S 12.9 m Rt. ℄ Hwy. 30 ORIGINATED BY BB/JN

DIST 7 HWY 30 BOREHOLE TYPE S.S. Auger, BW Casing, BQ Rock Core COMPILED BY BB

DATUM Geodetic DATE 89 05 15 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
118.4	Ground Level										
0.0	Gravel with Sand Occasional Clayey Silt Pockets Trace Organics		1	SS	6		118		●		40 27 (33)
117.5	Occ. Cobbles/Boulders		2	SS	60/20 cm				○		58 32 (10)
0.9	Sound		3	RC	90% REC						RQD 0 %
	Bedrock						117				
	Limestone Interbedded with Calcareous Shale		4	RC BQ	100% REC		116				RQD 53 %
			5	RC BQ	100% REC		115				RQD 24 %
114.6											
3.8	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No 2 METRIC

W P 66-89-01 LOCATION Sta. 13 + 187.0 O/S 7.6 m Lt. ℄ Hwy. 30 ORIGINATED BY BB/JW
DIST 7 HWY 30 BOREHOLE TYPE Cone Test, H.S. Auger, BW Casing, BQ Rock Core COMPILED BY BB
DATUM Geodetic DATE 89 05 16 CHECKED BY AO

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
121.0	Ground Level										
0.0	Gravel, Sand Silt Mixture		1	SS	8	*	120				
	Trace Organics		2	SS	13		119		○		63 25 (12)
	Occ. Cohesive Pockets Loose to Compact (Fill Material)		3	SS	11				○⊢		12 45 (43)
117.7							118				
3.3	Trace Organics		4	SS	45						
	Gravel Some/With Sand Some Silt Dense to Very Dense		5	SS	37		117		○		63 24 (13)
116.3			6	SS	30/1 cm						
4.7	Sound		7	RC BQ	100% REC		116				RQD 0 %
	Bedrock Limestone Interbedded With Calcareous Shale		8	RC BQ	100% REC		115				RQD 32 %
			9	RC BQ	100% REC		114				RQD 30 %
113.2			10	RC BQ	100% REC						RQD 33 %
7.8	End of Borehole										

* Stabilized GWL Not Established

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, $\times^5$: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION, ONTARIO PH-D-207 88 10

METRIC

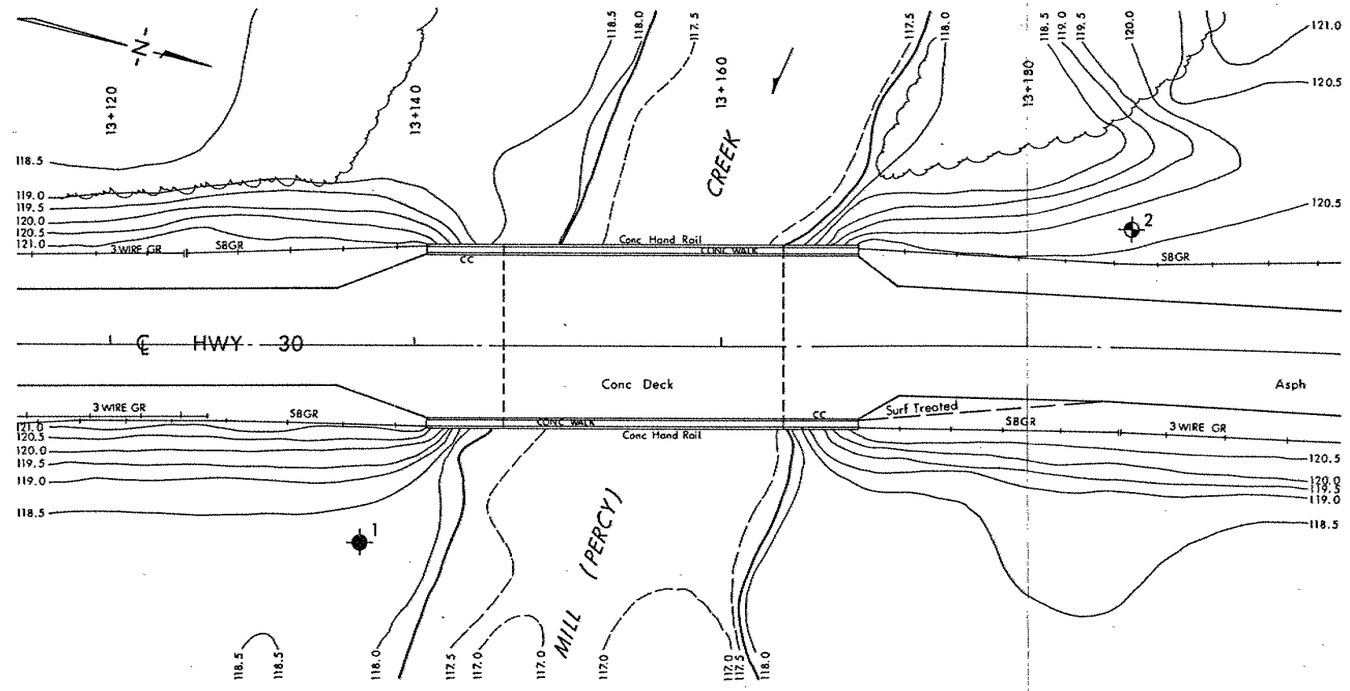
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No
WP No 66-89-01

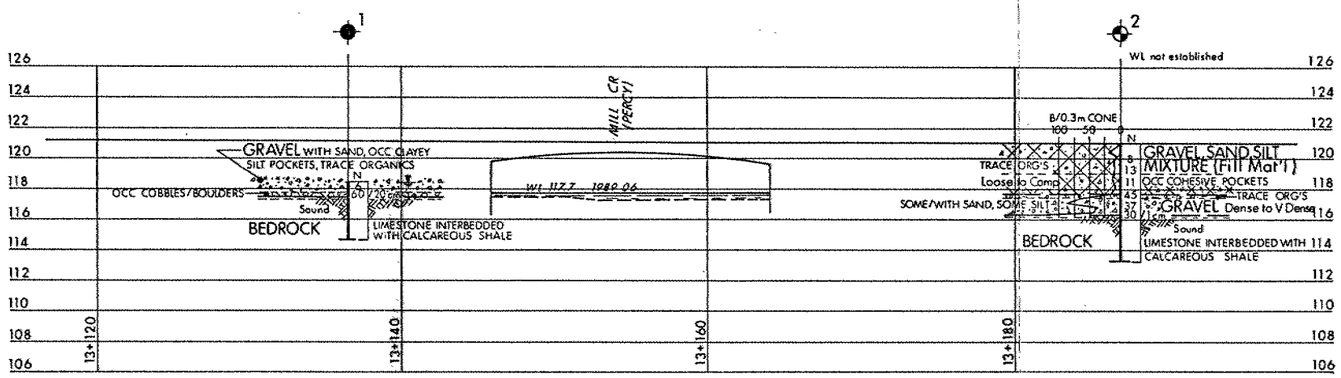
MILL (PERCY) CREEK

BORE HOLE LOCATIONS & SOIL STRATA

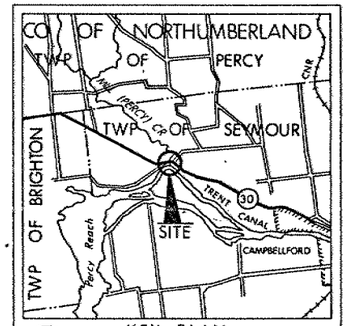
SHEET



PLAN
SCALE
4m 2 0 4m



℄ PROFILE HWY 30
SCALE
4m 2 0 4m



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation 8905

No	ELEVATION	STATION	OFFSET
1	118.4	13+136.4	12.9 m RT
2	121.0	13+187.0	7.6 m LT

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION

Geocres No 31C-145

HWY No 30			DIST 7
SUBMD BB	CHECKED	DATE 1989 08 30	SITE 21-74
DRAWN SO	CHECKED	APPROVED	DWG 668901-A

REF NO E-239-30-1 8907

June 7, 1991

Note to File:

W.P. 66-89-01, Cont 90-89

- Ali Shamji, Central Region Structural, was notified by Construction staff that Contractor had excavated considerably deeper for the structure footings than was necessary.
- A. Shamji expressed concern that, since the Contractor had managed to excavate into bedrock so quickly, ~~that~~ perhaps the bedrock bearing capacity was underestimated
- B Bennett discussed the problem with D. Dundas and it was agreed that ~~Contractor~~ ~~the~~ construction should proceed ~~with~~ as is, i.e. there is no difficulty with the bearing capacity, & dowel capacity

memorandum

Ontario

To: V. Boehnke
Head, Structural Section
Central Region

Date: 1990 04 25

Attn: S. Shamji

From: Foundation Design Section
Room 315, Central Bldg.

Re: Mill (Percy) Creek Bridge Replacement
W.P. 66-89-01, Site 21-74
Hwy. 30, District 7, Port Hope

Further to your memo dated 90 04 18 and our verbal recommendation to you in our telephone conversation of 90 04 26, the following are our responses to your querries:

1) Regarding your request for the factored shear strength at U.L.S. for the situation shown in Sketch #1:

We assume the proposed shear key is intended to supplement sliding resistance. From our experience, it is difficult to predict the shear strength of the rock under this situation since the construction of the key may affect its integrity. Therefore, we recommend that dowelling should be considered as an alternative.

For design purposes, the following O.H.B.D.C. capacities may be assumed for the bond between bedrock and grout:

Factored Bearing Capacity at U.L.S.	=	500 kPa
Bearing Capacity at S.L.S. Type II		Will not govern

However, the minimum dowel embedment should be 1 m into sound bedrock.

Neither the structural strength of the dowel, nor the compressive strength of the grout should be exceeded. Also, the annular space around the dowel should be in the order of 2 cm.

2) Regarding your request for bearing capacities on sloping foundations:

- On bedrock, the values provided in the Foundation Report will apply.

  i.e.

  Factored Capacity at U.L.S. = 3000 kPa
  Bearing Capacity at S.L.S. Type II will not apply.

- On fill, the value can not be predicted without knowledge of the type of material and extent of the fill.

.../2

3) Regarding your request for comments on the proposed dewatering scheme.

- The filter fabric will not prevent water from entering the excavation and if an impermeable membrane was used, the system may not be sufficient to retain the water pressure. Alternatives might include a prefabricated cofferdam or an impermeable dyke. In any case, we recommend that this detail should be left to the responsibility of the contractor.

If there are any questions, please advise.

D. Dundas, P. Eng.
Sr. Foundation Engineer

DD/jb

M I N I S T R Y O F T R A N S P O R T A T I O N

M E M O R A N D U M

To: Mr.M.Devata
Foundation Design Section
3rd Floor, Central Building
Downsview
Attn. : Ms. B. Bennett

Date: 1990-04-18

FROM: Structural Section
Central Region

Tel: 235-5513

RE: Hwy 30 Mill (Percy) Creek Bridge
Site 21-74, W.P. 66-89-01
District 7, Port Hope

This is to confirm our telephone request today for the following information:

1) What is the factored shear strength at ULS for bedrock? This information is required for the design of abutment foundations, typically shown in sketch 1.

2) What is the allowable factored bearing capacity at ULS and SLS II for a sloping foundation (1:1 slope), shown in sketch 2, supported on (a) bedrock, (b) fill behind existing abutments? This information is required for temporary roadway protection scheme during the staged construction of the replacement bridge.

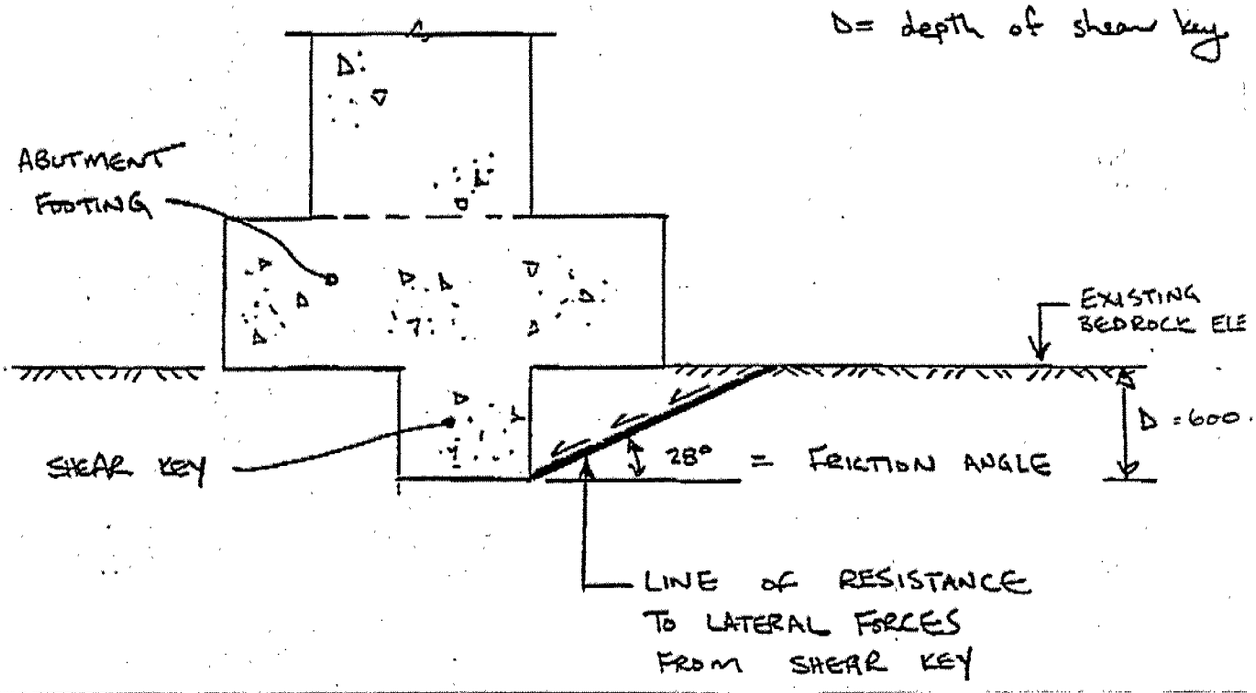
Please also provide your comments and any additional recommendations on the Consultant's dewatering scheme shown in sketch 3.

Your early response will be greatly appreciated; if you require any clarification please contact the undersigned.

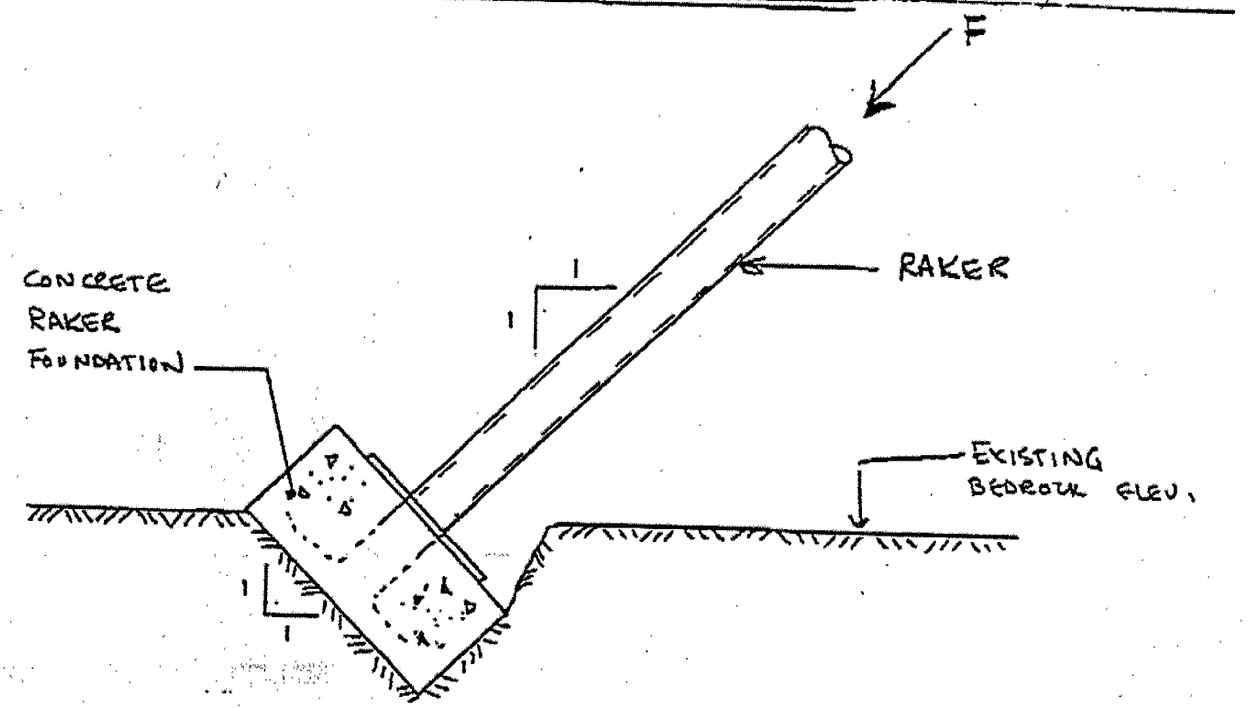
S.A.I.Shamji.
Sr. Structural Engineer
for
V. Boehnke
Head, Structural Section

disk file:percy
encls.

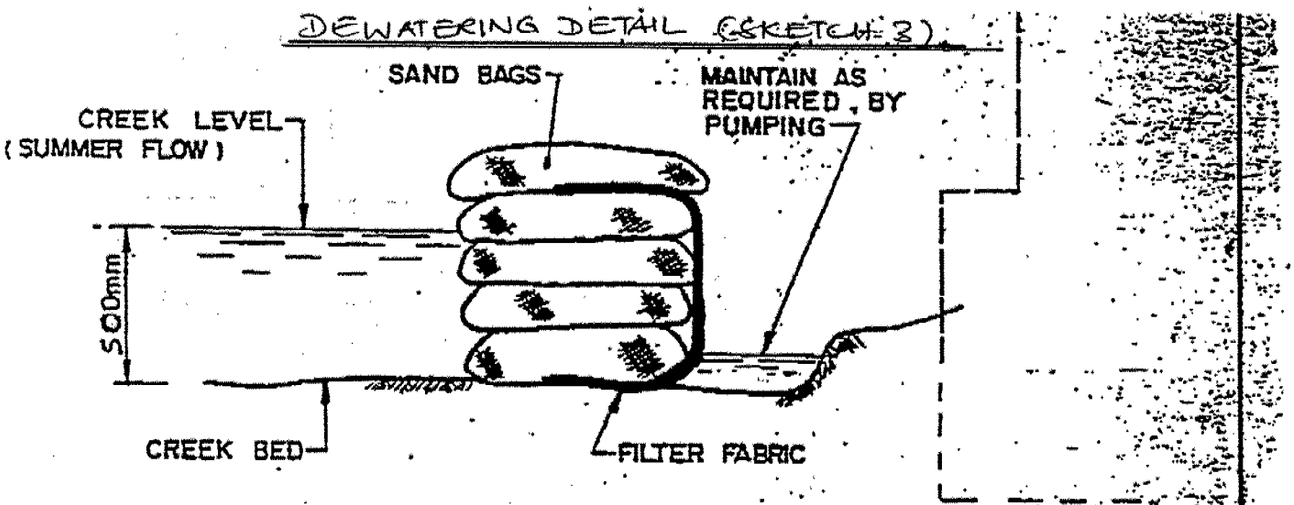
SHEAR KEY IN ABUTMENT FOUNDATION (SKETCH 1)



RAKER FOUNDATION FOR ROADWAY PROTECTION (SKETCH 2)



DEWATERING DETAIL (SKETCH 3)



TYPICAL SAND BAG COFFER DAM ISOLATING FOOTING EXCAVATION

N.T.S.

memorandum

Ontario

To: V.F. Boehnke
Head, Structural Section
Central Region

Date: 1990 03 23

Attn: S.A.I. Shamji

From: Foundation Design Section
Room 315, Central Building

Re: Mill (Percy) Creek Bridge,
Highway 30, Site 21-74,
W.P. 66-89-01,
District 7, Port Hope

This memo is in response to your memo of February 26, 1990.

Recommendations for dewatering during excavations were provided in the foundation report. Reference to this item is not seen in the documents provided for review.

We have no other comments. We trust that the delay in the submission of this reply did not cause any problem.

(Signed & Sealed)

Dr. B. Iyer, P. Eng.
Sr. Foundation Engineer

for

M.S. Devata, P. Eng.
Chief Foundation Engineer

MSD/BI/jb

memorandum

Ontario

To: G.C.E. Burkhardt
Head, Structural Section
4th Floor, Atrium Tower

Date: 1989 07 17

Attn: A. Shamji
Structural Engineer

From: Foundation Design Section
Room 315, Central Building

RE: Mill Creek Bridge Replacement
W.P. 66-89-01, Site 21-74
Hwy. 30, District 7, Port Hope

The foundation investigation for the above-mentioned project has been completed. Two boreholes were advanced during the period from 89 05 15 - 16 for the proposed structure.

This memo contains preliminary foundation recommendations and provides sufficient detail for the design of the project to proceed.

The intersection of Mill Creek and Hwy. 30 is located approximately 7.0 km south of Campbellford. The existing structure is a single-span rigid frame bridge with shallow foundations on bedrock. It is proposed to replace the existing bridge with an identical structure using stage construction.

The subsurface material consists of a shallow cover of overburden underlain by limestone bedrock. The overburden ranges from 0.9m to 3.3m of largely gravel deposits. The elevation of the bedrock in the immediate vicinity of the structure ranges from 116.3m in the south-east quadrant of the bridge to 117.5m in the north-west quadrant. The groundwater level may be assumed to be the same as the creek level, approximate El. 118.3m at the time of the investigation.

Recommendations

The proposed structure may be founded on spread footings on bedrock. The following are design values, as per the O.H.B.D.C., for limestone bedrock.

Factored Bearing Capacity at U.L.S.	3000 kPa
Bearing Capacity at S.L.S. Type II	N/A

The footings should be placed on bedrock at the same elevation as previously constructed. The elevations should be determined during construction. For design purposes, the bedrock elevations are estimated as follows:

~~North~~ South Abutment	117.2m
~~South~~ North Abutment	116.3m

.../2

Because the footings will be placed below the creek water level, a dewatering scheme will be required. This scheme could consist of a pre-fabricated cofferdam that is sealed at its base to ensure that the footings are placed in the "dry".

A friction angle of 28° may be assumed for resistance against sliding between the concrete footing and the limestone bedrock. Additional lateral resistance could be achieved with the use of keys or dowelling. Our office should be consulted in the event that these items are considered in design. In any case, the bedrock bearing surface should be scraped rough.

Frost protection is not required for footings on bedrock.

Backfill to the structure should consist of granular material in accordance with MTO Special Provision No. 109F03, for which the following properties apply:

	ϕ	γ
Granular "A"	35°	22.8 kN/m^3
Granular "B"	30°	21.2 kN/m^3

Lateral earth pressures should be computed in accordance with Section 6.6.1.2 of the O.H.B.D.C.. An at-rest condition may be assumed to apply.

No stability or settlement problems are anticipated at this site.

The final recommendations will be provided in the Foundation Report which will be issued six weeks after the E-plan becomes available.

If there are any questions, please contact the undersigned.

B Bennett

B. Bennett, P. Eng.
Foundation Engineer

BB/jb