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G.I.-30 SEPT. 1976

GEOCRES No. 42F-11

DIST. 16 REGION _____

W.P. No. 37-79-00 37-79-01

CONT. No. _____

W. O. No. _____

STR. SITE No. 39W-8

HWY. No. 11

LOCATION 25.5 MILES WEST OF

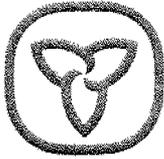
HEARST (3.2 MILES WEST OF HWY 663)



OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____

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Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 37-79-00 DIST 16
HWY 11 STR SITE 39W-8
Forde Creek Structure
(3.2 Miles west of Jct. Hwy. 11 & 663)

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FOUNDATION INVESTIGATION REPORT

For

Forde Creek Bridge, Highway #11

Approximately 3.2 miles West of Junction of

Highway #11 & #663,

W.P. 37-79-00, SITE #39W-8

District 16, Cochrane, Ontario

INTRODUCTION:

This report contains the results of a foundation investigation carried out at the above mentioned site. The fieldwork which consisted of five sampled boreholes and three Dynamic Cone Penetration tests were carried out during the period of 80-04-29 to 80-04-30. A continuous flight auger machine mounted on a muskeg vehicle and equipped with 3.5 in. I. D. hollow stem augers were utilized to drill all sampled boreholes. Boreholes #1, 2 & 5 were drilled from the bridge deck by extending auger over the decks edge.

SITE DESCRIPTION

The site is located at Forde Creek some 3.2 mi. west of the junction of Highways 11 and 663, the nearest settlement east of the site is Hearst. The surrounding terrain is undulating and bush covered. The vegetation consists of evergreen (Spruce) species. At the present time there is an off road parking area at a turnaround located approximately 1000 feet east of the site but no side roads are open to travel. The right-of-way is clear of all tree growth with no rock outcrops visible. Hydro and Bell cables are overhead on poles at the extreme south limit. The width of the creek along the present alignment is about 25 feet and has a depth of up to 2.5 ft. the direction of flow is from south to north.

SUBSURFACE CONDITIONS

The subsoil at this site within the depth of exploration was found to consist of fill material (gravelly sand), organic silt and clay, silty clay and glacial till. The boundaries of the different deposits are shown on the Record of Borehole Sheets attached to the Appendix. All the field and laboratory test results are plotted on these sheets. The

estimated stratigraphical sections shown on Drawing No. 377900-A are based upon these informations. A brief description of the encountered various soil types is given below.

Gravelly Sand (FILL MATERIAL)

Boreholes #2 and #5 which were located on the forward slopes of the existing structure show the fill material to consist of gravelly sand, some silt and traces of clay. The lower boundary was found to be at el. 838.5±. The relative density is estimated to be compact.

Organic Silt and Clay

Immediately below the original ground surface, in boreholes #3 and #4 an approximate 5 to 7 feet thick very soft to firm organic silt and clay was encountered.

Silty Clay

This deposit was observed below the fill material or at original ground surface (BH #6) and extended for a depth of about 7 feet. The material was found to be mainly of silt clay (low plasticity) with some sand traces of gravel and organics. The following moisture content ranges were established in the laboratory:

Natural	:	20 - 26 %
Liquid Limit	:	22 - 30 %
Plastic Limit:		15 - 19 %

The consistency of the overall deposit is estimated to be soft to firm. For design purposes and undrained shear strength value of 600 PSF is recommended.

HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND AND GRAVEL (GLACIAL TILL)

Immediately beneath the above described cohesive deposits (silty clay and organic material) is a glacial till stratum composed of heterogeneous mixture of silty clay sand and gravel. The lower boundary was not determined since the borings were terminated within this deposit. The encountered maximum thickness is about 19 ft. The matrix of this till is silty clay of low plasticity binding coarser particles.

There are random zones where the matrix is slightly plastic. The natural moisture content ranges between 9% and 21%.

Standard penetration tests carried out within the deposit, gave 'N' values ranging from 6 to 159 blows per foot. Based on these results, it is estimated that the consistency of the stratum varies from firm to hard.

Groundwater Conditions

No groundwater observations were carried out during the field investigation. It is assumed that the groundwater level is same as the prevailing water level in the creek.

DISCUSSION AND RECOMMENDATIONS

Existing Structure

The structure over Forde Creek comprises five spans of asphalt paved, longitudinally laminated treated timber decking (Total length: 76 feet) founded on six treated timber pile bents.

The structure inspection report (dated: 79 03 16) states the following:

"Streamward creep of approach slope and front slopes under the bridge has contributed to displacement and cracking of several piles, in various locations of the shore span bents. There is a possibility that some displaced piles are also broken."

In order to minimize the constant structure maintenance problems, the following alternate proposals are being considered:

- a) Repair existing structure
- b) Construct a new structure
- c) Construct a C.S.P. Culvert

Our foundation recommendations pertaining to each of the proposals are outlined as follows.

Existing Structure Repair

The performance of the existing structure may be improved by implementing the following measures:

1. Add 12 ft. long spans to each end.
2. Regrade existing forward slopes to not steeper than 2.5:1.
3. Provide rip-rap protection from H.W.L. to 10 feet in front of the embankment toe for the width of the structure plus 20 feet on each side.
4. Replate damaged piles with 30 ft. long No. 14 treated timber piles fitted with protective shoes.

New Structure Construction

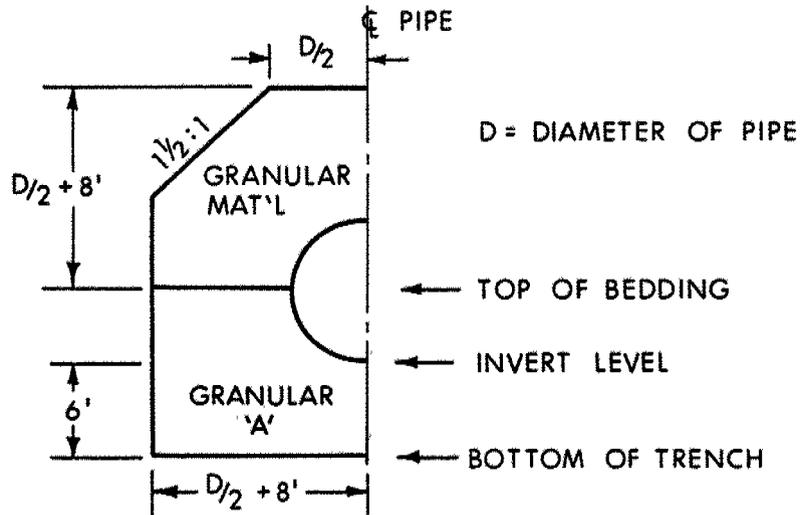
A new replacement structure can be supported on steel 'H'. For 12BP53 steel 'H' piles equipped with reinforced tips the permissible load is 50 tons per pile. The piles must be driven to or below el. 800±. The pile driving should be in accordance with M.T.C. standard 553-10 or 553-11. As an alternative to 'H' piles, No. 14 treated timber piles fitted with protective shoes and driven to el. 815± (east side) and to el. 820± (west side) may be used. The frost protection requirements in this area is 8 ft. of earth cover.

The forward slopes should be regraded to not steeper than 2.5:1. Rip-rap protection should be provided for the approach embankments from H.W.L. to 10 ft. in front of the embankment toe for the width of the structure plus 20 ft. on each side.

The fill material should not contain larger particles than 2 inches at location where piles have to be driven. If excavations for footings are below the prevailing water level, a dewatering scheme will be required to form the pile caps in dry.

C.S.P. Culvert Installation

The third option to cross Forde Creek is the erection of a C.S.P. culvert. The size (diameter) of such culvert is governed by hydrological considerations. In order to ensure the integrity and the future performance of a new culvert, it is recommended that the pertinent MTC Specifications and standards be followed. The bedding for this type of pipe is outlined on MTC Standard DD-808A. The minimum backfill and bedding requirements are as illustrated below.



MISCELLANEOUS

N. T. S.

The field work for this project was carried out under the supervision of Mr. H. Tipler, Soils Engineer of the Regional Geotechnical Section.

The equipment used was owned and operated by Atcost Soil Drilling Inc. This report was written by Mr. H. Tipler and Mr. P. Payer, and reviewed by Mr. K. G. Selby.



P. Payer
P. Payer, P. Eng.
Foundations Engineer

K. G. Selby
K. G. Selby, P. Eng.
Senior Foundations Engineer

APPENDIX

RECORD OF BOREHOLE No 1

W P 37-79-00 LOCATION Sta. 1374+02 o/s 19' Rt. of Highway 11 ORIGINATED BY H. T.
 DIST 16 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY P. P.
 DATUM Assumed DATE April 29, 1980 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40					
837.0	Water Level													
0.0	Water													
834.5	Creek Bottom													
2.5	Probably silty clay													
831.0														
6.0	Probably (Glacial Till)													
823.5														
13.5	End of Cone Test													

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 2

W P 37-79-00 LOCATION Sta. 1373+83 o/s 15' Rt. of Highway 11 ORIGINATED BY H. T.
 DIST 16 HWY 11 BOREHOLE TYPE Cont. Flight Auger - Hollow Stem and Cone Test COMPILED BY E. P.
 DATUM Assumed DATE April 29, 1980 CHECKED BY EP.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH PSF							
							20	40	60	80	100				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				10 20 30				
							400	800	1200	1600	2000			PCF	GR SA SI CL
848.5	Bridge Deck Level														
0.0															
840.5	Ground Level														
8.0	(Fill Material)														
838.5	Gravelly Sand	X													
10.0	Organics	X	1	SS	8									Om2.2Z	7 48 43 2
	Silty Clay with sand and traces of gravel	X	2	SS	6	↓								125	
	Soft to Firm	X	3	TW	PH										
831.0		X													
17.5	Het. mixture of silty clay, sand and gravel	X	4	TW	PH										
	Stiff to Hard (Glacial Till)	X	5	SS	8										8 35 47 10
		X	6	SS	21										
		X													
		X	7	SS	49										4 32 52 12
		X													
		X	8	SS	84										
		X													
		X													
		X	9	SS	94										
812.0		X													
36.5	End of borehole														

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to Sensitivity 20
 15 5 (%) STRAIN AT FAILURE
 10

RECORD OF BOREHOLE No 3

W P 37-79-00 LOCATION Sta. 1374+12 o/s 59' Lt. of Highway 11 ORIGINATED BY H. T.
 DIST 16 HWY 11 BOREHOLE TYPE Cont. Flight Auger - Hollow Stem and Cone Test COMPILED BY P. P.
 DATUM Assumed DATE April 29, 1980 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
838.0	Ground Level											
0.0	Organic silt and clay Firm		1	TW	PM			10	20	30	127	0 0 (100)
			2	TW	PH							
			3	SS	-							
			4	TW	PH							
831.0	Het. mixture of silty clay, sand and gravel Very stiff to Hard (Glacial Till)		5	SS	24							12 38 38 12
7.0			6	SS	118	9"						
826.5	End of Borehole											
11.5												

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to Sensitivity
 20
 15 10-5 (%) STRAIN AT FAILURE
 10

RECORD OF BOREHOLE No 4

W P 37-79-00 LOCATION Sta. 1374+02 o/s 59' Lt. of Highway 11 ORIGINATED BY H. T.
 DIST 16 HWY 11 BOREHOLE TYPE Cont. Flight Auger - Hollow Stem COMPILED BY P. P.
 DATUM Assumed DATE April 30, 1980 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
837.0	Water Level																
0.0	Water																
835.0	Creek Bottom																
2.0	Organic silt and clay		1	SS	2											14 47 33 6	
	Very soft		2	AS	-											Om 13.2%	
830.5																	
6.5																	
829.0	(Glacial Till)*		3	SS	20											2 37 46 15	
8.0	End of Borehole																
	*Het. mixture of silty clay, sand and gravel																
	Very Stiff																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity 20
15 - 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 5

W P 37-79-00 LOCATION Sta. 1374+21 o/s 20' Lt. of Highway 11 ORIGINATED BY H. T.
 DIST 16 HWY 11 BOREHOLE TYPE Cont. Flight Auger - Hollow Stem COMPILED BY P. P.
 DATUM Assumed DATE April 30, 1980 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						SHEAR STRENGTH PSF	
842.0	Ground Level																		
0.0	Gravelly sand some silt, Traces of clay - Compact (Fill Material)	[X]	1	SS	16												26 53 19 2		
838.5																			
3.5	Silty Clay Some Sand Traces of Gravel Firm	[X]	2	SS	7														
																			114
831.5			3	TW	PH														
10.5	Het. mixture of silty clay, sand and gravel Very Stiff to Hard (Glacial Till)	[X]	4	SS	31														
																			2 20 67 11
					5	SS	27												
824.0			6	SS	159													6 81 (13)	
18.0	End of Borehole																		

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to Sensitivity 20
15-5 (% STRAIN AT FAILURE)
10

RECORD OF BOREHOLE No 6

W P 37-79-00 LOCATION Sta. 1374+30 o/s 69' Rt. of Highway 11 ORIGINATED BY H. T.
 DIST 16 HWY 11 BOREHOLE TYPE Cont. Flight Auger - Hollow Stem COMPILED BY P. E.
 DATUM Assumed DATE April 30, 1980 CHECKED BY [Signature]

SOIL PROFILE		STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	N' VALUES			20	40	60	80	100					
838.5	Ground Level																
0.0	Silty clay Some sand, Traces of Organics Soft					▽											
834.0			1	SS	5		835									Om0.67%	
4.5			2	SS	8											27 26 36 11	
	Het. mixture of silty clay, sand and gravel		3	SS	11		830									4 36 48 12	
	Firm to Very Stiff (Glacial Till)		4	SS	6												
			5	SS	16		825									13 30 45 12	
			6	SS	32		820									8 28 51 13	
817.0																	
21.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to Sensitivity 20
 15 5 (%) STRAIN AT FAILURE
 10

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N.

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

S _u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAxIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. CIU = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

SS SPLIT SPOON
 WS WASH SAMPLE
 ST SLOTTED TUBE SAMPLE
 BS BLOCK SAMPLE
 CS CHUNK SAMPLE
 TW THINWALL OPEN
 TP THINWALL PISTON
 OS OSTERBERG SAMPLE
 FS FOIL SAMPLE
 RC ROCK CORE
 FH T.W. ADVANCED HYDRAULICALLY
 FM T.W. ADVANCED MANUALLY

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE 
 w SLOPE ANGLE-BACKFACE OF WALL 
 β ANGLE OF SLOPE 
 N_γ, N_q, N_c BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_o INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_p PLASTIC LIMIT
 w_s SHRINKAGE LIMIT
 I_p PLASTICITY INDEX = $w - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{\% \text{ of } \mu m \text{ Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

φ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 σ₁, σ₂, σ₃ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_e EXCESS u
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ε LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS
 NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 σ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 α_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 O_r OVERCONSOLIDATION RATIO (OCR)

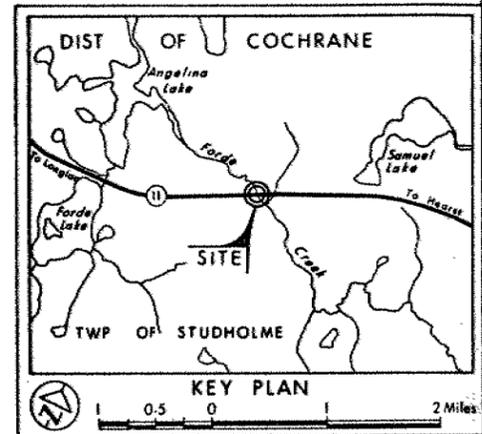
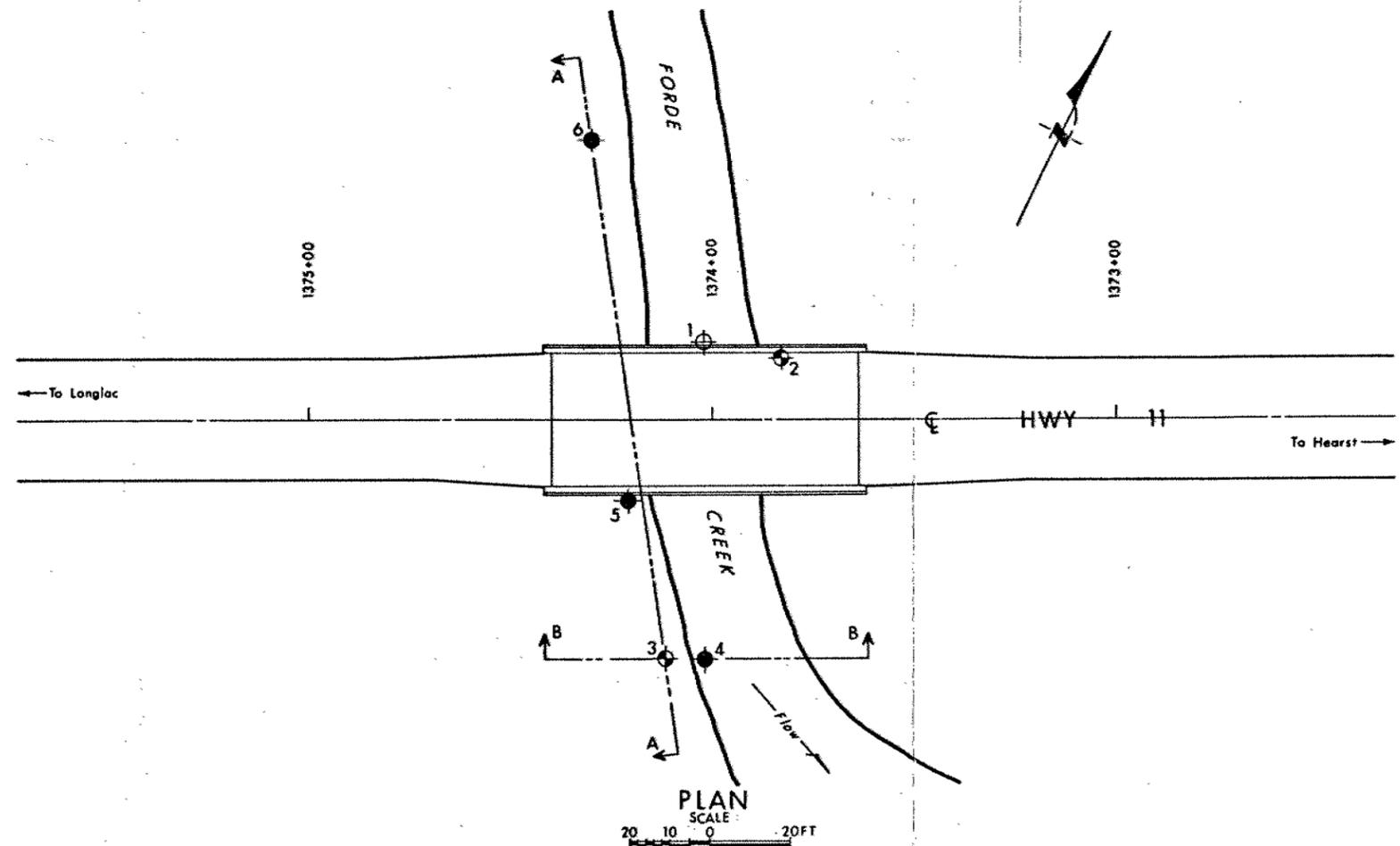
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO PR-D-606 (Form 08-MT-308 7-5-10)

CONT No
WP No 37-79-00



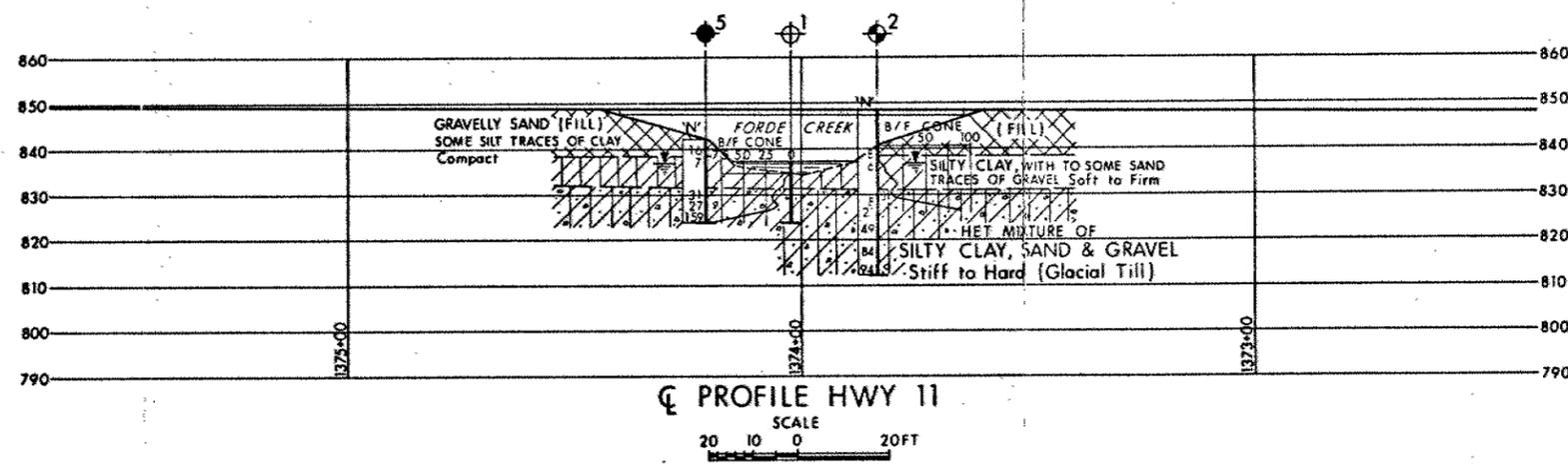
FORDE CREEK
(3.2 Miles West of Hwy 663)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

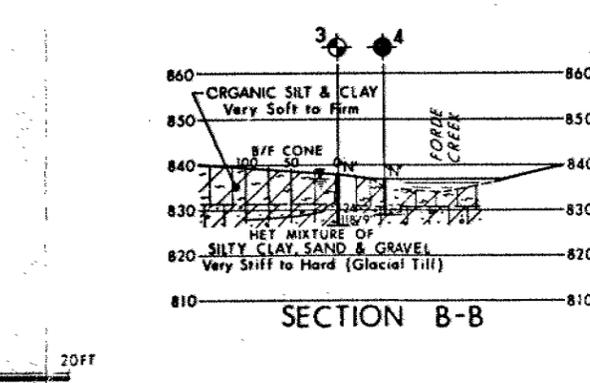
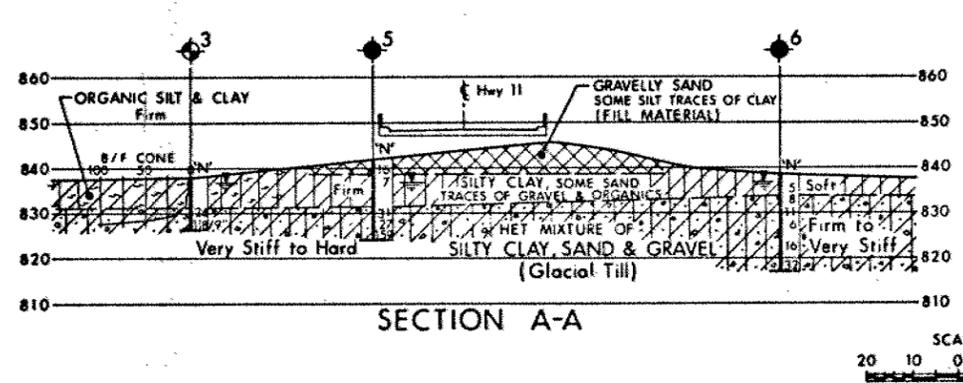


LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- ↓ WL at time of investigation April 1980



No	ELEVATION	STATION	OFFSET
1	837.0	1374+02	19' RT
2	848.5	1373+83	15' RT
3	838.0	1374+12	59' LT
4	837.0	1374+02	59' LT
5	842.0	1374+21	20' LT
6	838.5	1374+30	69' RT



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



REVISIONS	DATE	BY	DESCRIPTION

Geocres No 42F-11
 HWY No 11 DIST 16
 SUBM'D P.P. [CHECKED] DATE Jan 27, 1982 SITE 39W-8
 DRAWN [CHECKED] APPROVED DWG 377900-A