

G.I.-30 SEPT. 1976

GEOCRES No. SOM12-228DIST. 6 REGION W.P. No. 185-94-01/02CONT. No. 97-30W. O. No. STR. SITE No. 427HWY. No. 37-0319LOCATION Dixon Rd. Overpass
Widening NBL & SBLNo. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO. 97-30



Ministry of
Transportation

Ontario

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

EXPLANATION OF TERMS USED IN REPORT

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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 (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	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

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 = $\frac{c_u}{\tau_r}$

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kn/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kn/m^3	UNIT WEIGHT OF WATER	s_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kn/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kn/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kn/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m^3	SEEPAGE FORCE
γ'	kn/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

Foundation Investigation Report
for
Highway 427 Overpass Widening at Dixon Road/Airport Road
W.P. 185-94-01/02, Site 37-0319
Central Region

The following report is a copy of the factual information from the Foundation Investigation and Design Report for WP 48-71-20/21, Contract 81-46. The foundation investigation report was prepared for the existing structures by MTO Foundations Unit and represents the subsurface conditions for the proposed widening of the existing Dixon Road/Airport Road structures at Highway 427

Imperial units of measure are used in the report and on the Record of Borehole sheets. The original ground elevations shown on the borehole logs may differ from present day elevations as a result of the construction of the existing structures.

This report contains the detailed subsurface conditions, the Record of Borehole sheets, and the Foundation Drawing. The Foundation Drawing was updated using the metric coordinate system and metric units of measure.



for

E. Bennett

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

FOUNDATION INVESTIGATION REPORT

For

Highway 427 Overpass at Dixon Road
W.P. 48-71-20/21, Site 37-319
Highway 427, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation at the above listed site. Fieldwork consisted of 6 sampled boreholes advanced during the period June 27th to July 9th, 1974 employing continuous flight augers. Bedrock was proven by the recovery of BXL size rock cores from 3 of the boreholes.

SITE DESCRIPTION

The site is located at the intersection of Highway 427 and Dixon Road in the City of Mississauga. This area is flat to gently undulating. Toronto International Airport lies to the south west with the remainder of the area employed for commercial or light industrial uses.

Physiographically this area is part of the region known as the "Peel Plain". Characteristically it is a ground moraine with deposits of silt and sand interbedded in the glacial till.

SUBSURFACE CONDITIONS

Subsoil General

Subsoil consists of up to 7 feet of fill underlain by a heterogeneous mixture of clayey silt sand and gravel (glacial till) about 30 feet in thickness. This deposit is in turn underlain by about 15 feet of dense sandy silt to silty sand which overlies grey shale bedrock.

Reference should be made to the Record of Borehole Sheets which show the boundaries between soil types as well as a summary of all field and laboratory tests performed.

Fill Material

Fill material ranging in depth from 4 to 7 feet was encountered at all boring locations. It consists of clayey silt with sand, traces of gravel and organics and has a consistency estimated to range from firm to very stiff.

Glacial Till

Underlying the fill is a glacial till deposit consisting of a heterogeneous mixture of clayey silt, sand and gravel. Occasional sandy silt layers are also found within the deposit. The consistency is very stiff to hard with Standard Penetration 'N' values ranging from 20 to in excess of 100 blows per foot. Results of Atterberg Limit Tests are presented in Figure 1 of the Appendix. They indicate the deposit is inorganic and of low plasticity. Typical grain size distribution curves are shown as an envelope in Figure 2.

Sandy Silt to Silty Sand

The cohesive glacial till layer is underlain by 12 to 15 feet of very dense sandy silt to silty sand. Standard Penetration 'N' values in this layer are in excess of 100 blows per foot.

Bedrock

Bedrock was encountered at elevations from 486 to 492 with the rock surface elevation increasing to the north. Detailed descriptions of the core samples are given on the Diamond Drill Record Sheets located in the Appendix.

Groundwater Conditions

Groundwater levels were observed in the open boreholes during the period of the field investigation. They varied from 534 to 539 some 1 to 7 feet below the ground surface.

APPENDIX

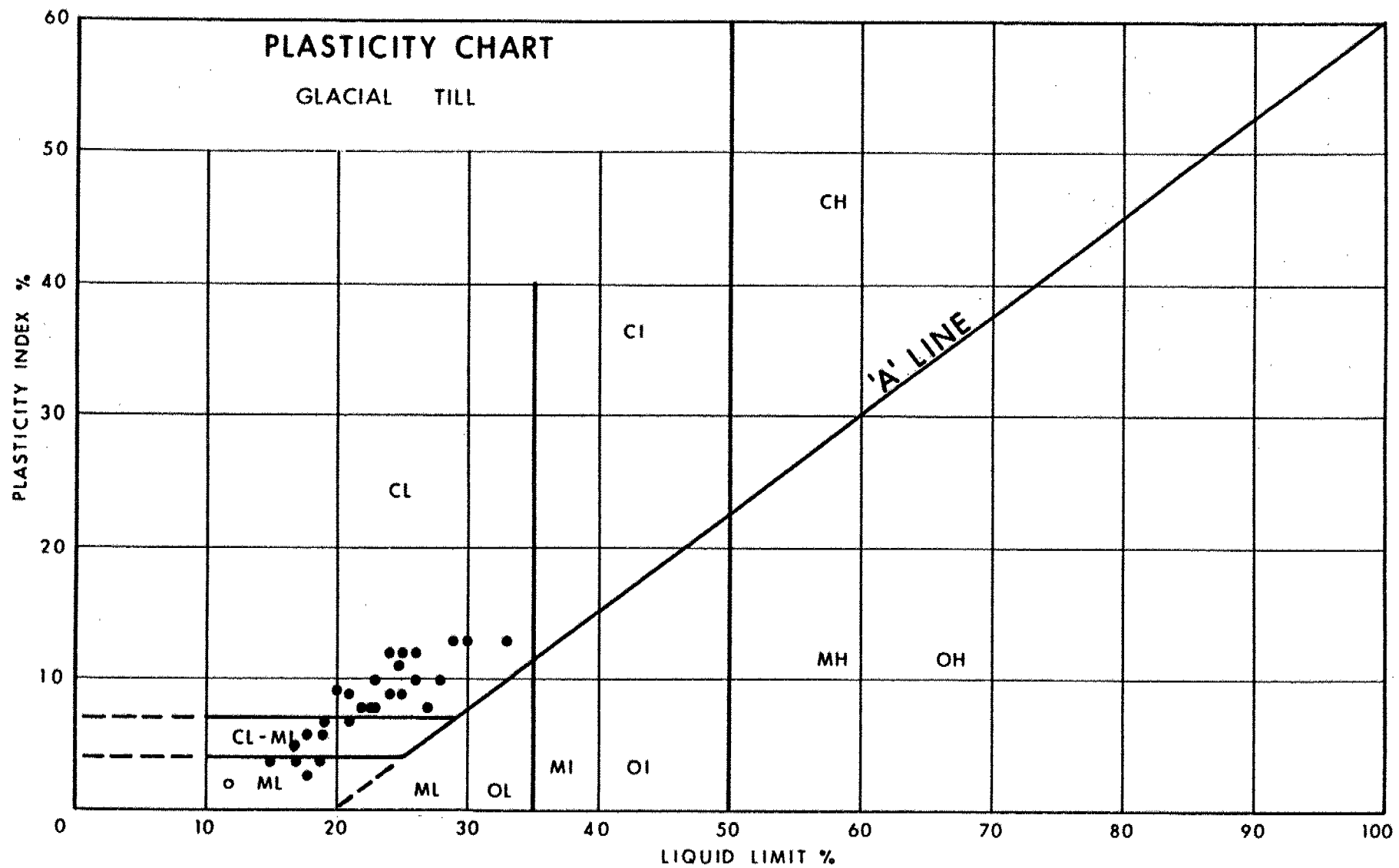


FIG. 1

W.P. 48-71-20 & 21

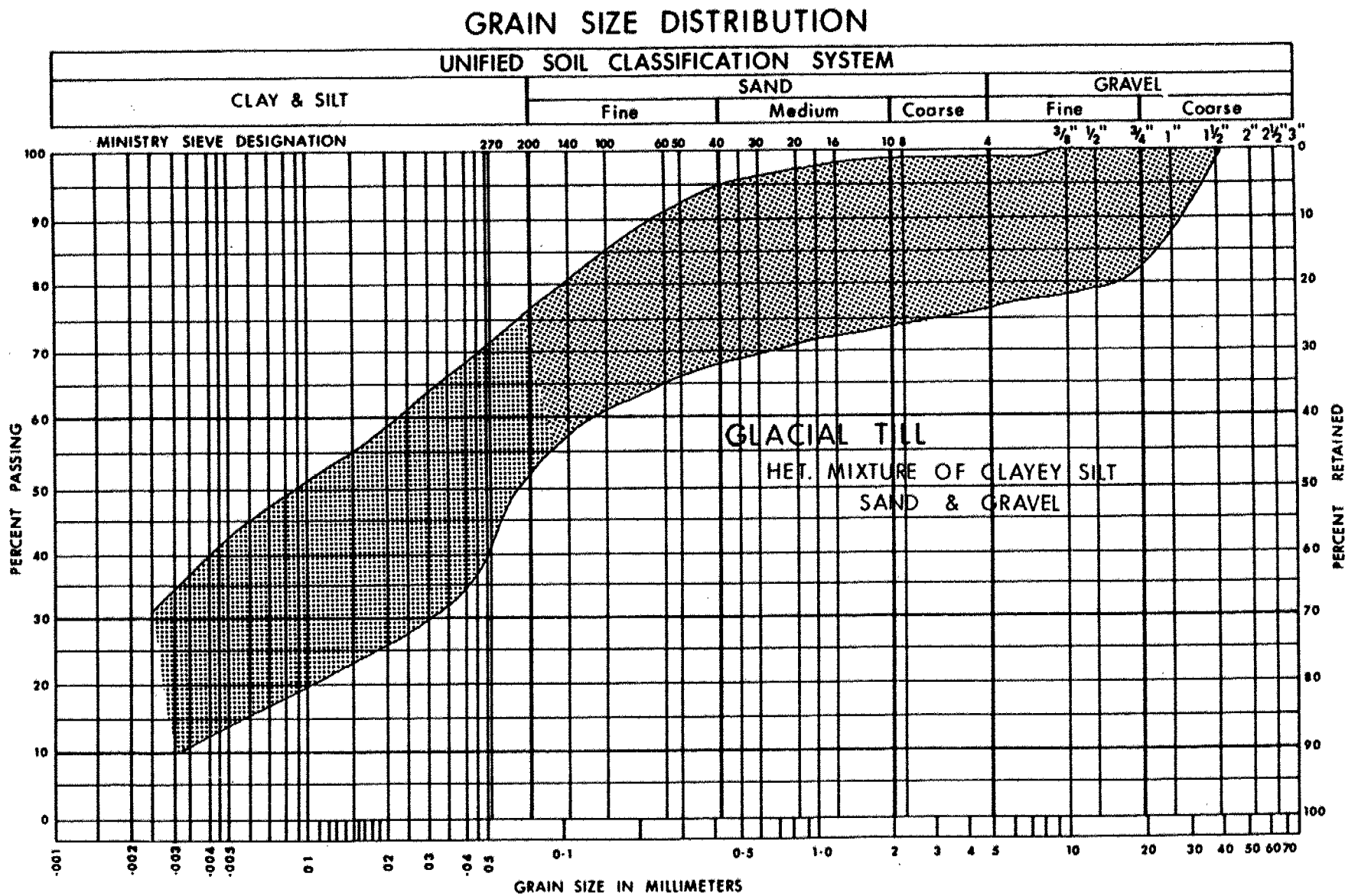


FIG. 2

W.P. 48-71-20&21

DEPARTMENT OF HIGHWAYS ONTARIO

DIAMOND DRILL RECORD

WOLE NO. 6, & 8 SHEET NO. 1

PROPERTY _____
LOCATION _____

LATITUDE _____
DEPARTURE _____
BEARING _____

[illegible]

ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____
 Z. Konluszy

FOOTAGE		FORMATION	SAMPLE NUMBER		REMARKS
FROM	TO				
		Hole #8 -			
54'5"	63'5"	Shale, grey, medium to soft with few very thin lenses of shaly limestone			core broken, partially ground
		Hole #8			
49'2"	49'8"	Shale, grey, soft-ground			
49'8"	49'10"	Limestone - silty grey medium hard			
49'10"	55'10"	Shale, grey, medium to soft with few very thin lenses of shaly limestone			core broken, partially ground
55'10"	56'7"	Limestone, shaly, silty, grey, medium hard			
56'7"	58'8"	Shale, grey, medium hard			

DATE OF EXAMINATION July 22, 1974

Z. Koniuszy

FORM OB-MT-113
JANUARY 1970

DEPARTMENT OF HIGHWAYS ONTARIO

DIAMOND DRILL RECORD

HOLE NO. 11 SHEET NO. 2

PROPERTY LOCATION _____

LATITUDE _____
DEPARTURE _____
BEARING _____

DIP _____

TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
		Hole #11 -				
44'5"	47'0"	Shale, grey, medium to soft				core ground, missing
47'0"	47'8"	Limestone - silty, shaly in places, grey, medium hard				core broken
47'8"	48'8"	Shale, grey, medium hard				core broken
48'8"	48'10"	Limestone - silty, shaly, grey, medium hard				
48'10"	53'9"	Shale, grey, medium hard				core broken
53'9"	53'11"	Limestone, silty, grey, medium hard				
53'11"	56'8"	Shale, dark grey, medium hard				core broken
56'8"	57'0"	Limestone, silty, shaly, grey, medium hard				core broken
57'0"	60'0"	Shale, dark grey, medium to soft				core broken, partially ground

DATE OF EXAMINATION July 22, 1974

Z. Koniuszy

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

RECORD OF BOREHOLE NO 6												
Co-ords: N 4 838 225.1; E 296 678.5												
WP 185-94-01/02		LOCATION		Co-ords. 15,873,442 N; 973,404 E		ORIGINATED BY HS						
W.P. 48-71-20 & 21		BORING DATE		July 8 & 9, 1974		COMPILED BY PP						
DATUM Geodetic		BOREHOLE TYPE		Cont. Flight Auger		CHECKED BY AP						
ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L	PLASTIC LIMIT w_p	WATER CONTENT w	BULK DENSITY γ	REMARKS
541.3	Ground Level											
0.0	Clayey silt with some sand, traces of gravel & organics		1	SS	8	540						6 24 56 14
536.3			2	SS	28							535.7'
5.0	Het. Mixture of clayey silt sand & gravel		3	SS	25							4 29 55 12
	V. Stiff to Hard		4	SS	22	530						
	Glacial Till		5	SS	48							
			6	SS	33							
	Brown		7	SS	22							
	Grey		8	SS	24	520						3 39 52 6
			9	SS	20							
			10	SS	45							
			11	SS	59							
			12	SS	89	510						
			13	SS	190							
505.3												
36.0	Sandy Silt to silty sand with traces of clay & gravel		14	SS	997"	500						7 38 46 9
	Grey											
	V. Dense		15	SS	207 1"							
488.5			16	SS	1207 1"	490						
52.8	Transition Zone		17	SS	1007 1"							
480.3												
55.0	Weathered Shale		18	RC	62%							
	Bedrock		19	RC	Rec							
	Grey		20	RC	64%	480						
			21	RC								
477.9	Sound		22	RC	90%							
63.4	End of Borehole					470						

20
15 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

RECORD OF BOREHOLE NO 7											
Co-ords: N 4838 240.3; E 296 658.2											
WP 185-94-01/02		LOCATION		Co-ords: 15,873,492 N; 973,288 E.		ORIGINATED BY RS					
W.P. 48-71-20 & 21		BORING DATE		July 5-8, 1974		COMPILED BY PP					
DATUM Geodetic		BOREHOLE TYPE		Cont. Flight Auger		CHECKED BY		AP			
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L		
						BLOWS / FOOT			PLASTIC LIMIT — w_p		
						20 40 60 80 100			WATER CONTENT — w		
						SHEAR STRENGTH P.S.F.			w_p — w — w_L		
						O UNCONFINED + FIELD VANE			WATER CONTENT %		
						● QUICK TRIAXIAL x LAB VANE			10 20 30		
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE				BULK DENSITY	REMARKS
541.9	Ground Level					540					
0.0	Clayey silt with sand, traces of gravel & organics		1	SS	18						539.5
534.9	V. Stiff to Stiff (Fill)		2	SS	9						
7.0	Het. Mixture of clayey silt sand & gravel		3	SS	20						4 26 53 17
	V. stiff Brown to hard Grey		4	SS	61	530					
	Glacial Till		5	SS	68		100/11"				5 27 50 18
			6	SS	43						
			7	SS	31						
			8	SS	30	520					
			9	SS	73						
	Occasional sandy silt layers		10	SS	126						
			11	SS	109	6"					21 22 40 14
			12	SS	100	510					
			13	SS	100	5"					
503.9	End of Borehole					500					
38.0											

OFFICE REPORT ON SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

RECORD OF BOREHOLE NO 8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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WP 185-94-01/02			LOCATION			Co-ords: 15,873,579 N; 973,329 E			ORIGINATED BY HS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT	20	40	60	80	100	W _L	W _P	W ₁	W ₂	W ₃	W ₄	W ₅	W ₆	W ₇	W ₈	W ₉	W ₁₀	W ₁₁	W ₁₂	W ₁₃	W ₁₄	W ₁₅	W ₁₆	W ₁₇	W ₁₈	W ₁₉	W ₂₀	W ₂₁	W ₂₂	W ₂₃	W ₂₄	W ₂₅	W ₂₆	W ₂₇	W ₂₈	W ₂₉	W ₃₀	W ₃₁	W ₃₂	W ₃₃	W ₃₄	W ₃₅	W ₃₆	W ₃₇	W ₃₈	W ₃₉	W ₄₀	W ₄₁	W ₄₂	W ₄₃	W ₄₄	W ₄₅	W ₄₆	W ₄₇	W ₄₈	W ₄₉	W ₅₀	W ₅₁	W ₅₂	W ₅₃	W ₅₄	W ₅₅	W ₅₆	W ₅₇	W ₅₈	W ₅₉	W ₆₀	W ₆₁	W ₆₂	W ₆₃	W ₆₄	W ₆₅	W ₆₆	W ₆₇	W ₆₈	W ₆₉	W ₇₀	W ₇₁	W ₇₂	W ₇₃	W ₇₄	W ₇₅	W ₇₆	W ₇₇	W ₇₈	W ₇₉	W ₈₀	W ₈₁	W ₈₂	W ₈₃	W ₈₄	W ₈₅	W ₈₆	W ₈₇	W ₈₈	W ₈₉	W ₉₀	W ₉₁	W ₉₂	W ₉₃	W ₉₄	W ₉₅	W ₉₆	W ₉₇	W ₉₈	W ₉₉	W ₁₀₀	W ₁₀₁	W ₁₀₂	W ₁₀₃	W ₁₀₄	W ₁₀₅	W ₁₀₆	W ₁₀₇	W ₁₀₈	W ₁₀₉	W ₁₁₀	W ₁₁₁	W ₁₁₂	W ₁₁₃	W ₁₁₄	W ₁₁₅	W ₁₁₆	W ₁₁₇	W ₁₁₈	W ₁₁₉	W ₁₂₀	W ₁₂₁	W ₁₂₂	W ₁₂₃	W ₁₂₄	W ₁₂₅	W ₁₂₆	W ₁₂₇	W ₁₂₈	W ₁₂₉	W ₁₃₀	W ₁₃₁	W ₁₃₂	W ₁₃₃	W ₁₃₄	W ₁₃₅	W ₁₃₆	W ₁₃₇	W ₁₃₈	W ₁₃₉	W ₁₄₀	W ₁₄₁	W ₁₄₂	W ₁₄₃	W ₁₄₄	W ₁₄₅	W ₁₄₆	W ₁₄₇	W ₁₄₈	W ₁₄₉	W ₁₅₀	W ₁₅₁	W ₁₅₂	W ₁₅₃	W ₁₅₄	W ₁₅₅	W ₁₅₆	W ₁₅₇	W ₁₅₈	W ₁₅₉	W ₁₆₀	W ₁₆₁	W ₁₆₂	W ₁₆₃	W ₁₆₄	W ₁₆₅	W ₁₆₆	W ₁₆₇	W ₁₆₈	W ₁₆₉	W ₁₇₀	W ₁₇₁	W ₁₇₂	W ₁₇₃	W ₁₇₄	W ₁₇₅	W ₁₇₆	W ₁₇₇	W ₁₇₈	W ₁₇₉	W ₁₈₀	W ₁₈₁	W ₁₈₂	W ₁₈₃	W ₁₈₄	W ₁₈₅	W ₁₈₆	W ₁₈₇	W ₁₈₈	W ₁₈₉	W ₁₉₀	W ₁₉₁	W ₁₉₂	W ₁₉₃	W ₁₉₄	W ₁₉₅	W ₁₉₆	W ₁₉₇	W ₁₉₈	W ₁₉₉	W ₂₀₀	W ₂₀₁	W ₂₀₂	W ₂₀₃	W ₂₀₄	W ₂₀₅	W ₂₀₆	W ₂₀₇	W ₂₀₈	W ₂₀₉	W ₂₁₀	W ₂₁₁	W ₂₁₂	W ₂₁₃	W ₂₁₄	W ₂₁₅	W ₂₁₆	W ₂₁₇	W ₂₁₈	W ₂₁₉	W ₂₂₀	W ₂₂₁	W ₂₂₂	W ₂₂₃	W ₂₂₄	W ₂₂₅	W ₂₂₆	W ₂₂₇	W ₂₂₈	W ₂₂₉	W ₂₃₀	W ₂₃₁	W ₂₃₂	W ₂₃₃	W ₂₃₄	W ₂₃₅	W ₂₃₆	W ₂₃₇	W ₂₃₈	W ₂₃₉	W ₂₄₀	W ₂₄₁	W ₂₄₂	W ₂₄₃	W ₂₄₄	W ₂₄₅	W ₂₄₆	W ₂₄₇	W ₂₄₈	W ₂₄₉	W ₂₅₀	W ₂₅₁	W ₂₅₂	W ₂₅₃	W ₂₅₄	W ₂₅₅	W ₂₅₆	W ₂₅₇	W ₂₅₈	W ₂₅₉	W ₂₆₀	W ₂₆₁	W ₂₆₂	W ₂₆₃	W ₂₆₄	W ₂₆₅	W ₂₆₆	W ₂₆₇	W ₂₆₈	W ₂₆₉	W ₂₇₀	W ₂₇₁	W ₂₇₂	W ₂₇₃	W ₂₇₄	W ₂₇₅	W ₂₇₆	W ₂₇₇	W ₂₇₈	W ₂₇₉	W ₂₈₀	W ₂₈₁	W ₂₈₂	W ₂₈₃	W ₂₈₄	W ₂₈₅	W ₂₈₆	W ₂₈₇	W ₂₈₈	W ₂₈₉	W ₂₉₀	W ₂₉₁	W ₂₉₂	W ₂₉₃	W ₂₉₄	W ₂₉₅	W ₂₉₆	W ₂₉₇	W ₂₉₈	W ₂₉₉	W ₃₀₀	W ₃₀₁	W ₃₀₂	W ₃₀₃	W ₃₀₄	W ₃₀₅	W ₃₀₆	W ₃₀₇	W ₃₀₈	W ₃₀₉	W ₃₁₀	W ₃₁₁	W ₃₁₂	W ₃₁₃	W ₃₁₄	W ₃₁₅	W ₃₁₆	W ₃₁₇	W ₃₁₈	W ₃₁₉	W ₃₂₀	W ₃₂₁	W ₃₂₂	W ₃₂₃	W ₃₂₄	W ₃₂₅	W ₃₂₆	W ₃₂₇	W ₃₂₈	W ₃₂₉	W ₃₃₀	W ₃₃₁	W ₃₃₂	W ₃₃₃	W ₃₃₄	W ₃₃₅	W ₃₃₆	W ₃₃₇	W ₃₃₈	W ₃₃₉	W ₃₄₀	W ₃₄₁	W ₃₄₂	W ₃₄₃	W ₃₄₄	W ₃₄₅	W ₃₄₆	W ₃₄₇	W ₃₄₈	W ₃₄₉	W ₃₅₀	W ₃₅₁	W ₃₅₂	W ₃₅₃	W ₃₅₄	W ₃₅₅	W ₃₅₆	W ₃₅₇	W ₃₅₈	W ₃₅₉	W ₃₆₀	W ₃₆₁	W ₃₆₂	W ₃₆₃	W ₃₆₄	W ₃₆₅	W ₃₆₆	W ₃₆₇	W ₃₆₈	W ₃₆₉	W ₃₇₀	W ₃₇₁	W ₃₇₂	W ₃₇₃	W ₃₇₄	W ₃₇₅	W ₃₇₆	W ₃₇₇	W ₃₇₈	W ₃₇₉	W ₃₈₀	W ₃₈₁	W ₃₈₂	W ₃₈₃	W ₃₈₄	W ₃₈₅	W ₃₈₆	W ₃₈₇	W ₃₈₈	W ₃₈₉	W ₃₉₀	W ₃₉₁	W ₃₉₂	W ₃₉₃	W ₃₉₄	W ₃₉₅	W ₃₉₆	W ₃₉₇	W ₃₉₈	W ₃₉₉	W ₄₀₀	W ₄₀₁	W ₄₀₂	W ₄₀₃	W ₄₀₄	W ₄₀₅	W ₄₀₆	W ₄₀₇	W ₄₀₈	W ₄₀₉	W ₄₁₀	W ₄₁₁	W ₄₁₂	W ₄₁₃	W ₄₁₄	W ₄₁₅	W ₄₁₆	W ₄₁₇	W ₄₁₈	W ₄₁₉	W ₄₂₀	W ₄₂₁	W ₄₂₂	W ₄₂₃	W ₄₂₄	W ₄₂₅	W ₄₂₆	W ₄₂₇	W ₄₂₈	W ₄₂₉	W ₄₃₀	W ₄₃₁	W ₄₃₂	W ₄₃₃	W ₄₃₄	W ₄₃₅	W ₄₃₆	W ₄₃₇	W ₄₃₈	W ₄₃₉	W ₄₄₀	W ₄₄₁	W ₄₄₂	W ₄₄₃	W ₄₄₄	W ₄₄₅	W ₄₄₆	W ₄₄₇	W ₄₄₈	W ₄₄₉	W ₄₅₀	W ₄₅₁	W ₄₅₂	W ₄₅₃	W ₄₅₄	W ₄₅₅	W ₄₅₆	W ₄₅₇	W ₄₅₈	W ₄₅₉	W ₄₆₀	W ₄₆₁	W ₄₆₂	W ₄₆₃	W ₄₆₄	W ₄₆₅	W ₄₆₆	W ₄₆₇	W ₄₆₈	W ₄₆₉	W ₄₇₀	W ₄₇₁	W ₄₇₂	W ₄₇₃	W ₄₇₄	W ₄₇₅	W ₄₇₆	W ₄₇₇	W ₄₇₈	W ₄₇₉	W ₄₈₀	W ₄₈₁	W ₄₈₂	W ₄₈₃	W ₄₈₄	W ₄₈₅	W ₄₈₆	W ₄₈₇	W ₄₈₈	W ₄₈₉	W ₄₉₀	W ₄₉₁	W ₄₉₂	W ₄₉₃	W ₄₉₄	W ₄₉₅	W ₄₉₆	W ₄₉₇	W ₄₉₈	W ₄₉₉	W ₅₀₀	W ₅₀₁	W ₅₀₂	W ₅₀₃	W ₅₀₄	W ₅₀₅	W ₅₀₆	W ₅₀₇	W ₅₀₈	W ₅₀₉	W ₅₁₀	W ₅₁₁	W ₅₁₂	W ₅₁₃	W ₅₁₄	W ₅₁₅	W ₅₁₆	W ₅₁₇	W ₅₁₈	W ₅₁₉	W ₅₂₀	W ₅₂₁	W ₅₂₂	W ₅₂₃	W ₅₂₄	W ₅₂₅	W ₅₂₆	W ₅₂₇	W ₅₂₈	W ₅₂₉	W ₅₃₀	W ₅₃₁	W ₅₃₂	W ₅₃₃	W ₅₃₄	W ₅₃₅	W ₅₃₆	W ₅₃₇	W ₅₃₈	W ₅₃₉	W ₅₄₀	W ₅₄₁	W ₅₄₂	W ₅₄₃	W ₅₄₄	W ₅₄₅	W ₅₄₆	W ₅₄₇	W ₅₄₈	W ₅₄₉	W ₅₅₀	W ₅₅₁	W ₅₅₂	W ₅₅₃	W ₅₅₄	W ₅₅₅	W ₅₅₆	W ₅₅₇	W ₅₅₈	W ₅₅₉	W ₅₆₀	W ₅₆₁	W ₅₆₂	W ₅₆₃	W ₅₆₄	W ₅₆₅	W ₅₆₆	W ₅₆₇	W ₅₆₈	W ₅₆₉	W ₅₇₀	W ₅₇₁	W ₅₇₂	W ₅₇₃	W ₅₇₄	W ₅₇₅	W ₅₇₆	W ₅₇₇	W ₅₇₈	W ₅₇₉	W ₅₈₀	W ₅₈₁	W ₅₈₂	W ₅₈₃	W ₅₈₄	W ₅₈₅	W ₅₈₆	W ₅₈₇	W ₅₈₈	W ₅₈₉	W ₅₉₀	W ₅₉₁	W ₅₉₂	W ₅₉₃	W ₅₉₄	W ₅₉₅	W ₅₉₆	W ₅₉₇	W ₅₉₈	W ₅₉₉	W ₆₀₀	W ₆₀₁	W ₆₀₂	W ₆₀₃	W ₆₀₄	W ₆₀₅	W ₆₀₆	W ₆₀₇	W ₆₀₈	W ₆₀₉	W ₆₁₀	W ₆₁₁	W ₆₁₂	W ₆₁₃	W ₆₁₄	W ₆₁₅	W ₆₁₆	W ₆₁₇	W ₆₁₈	W ₆₁₉	W ₆₂₀	W ₆₂₁	W ₆₂₂	W ₆₂₃	W ₆₂₄	W ₆₂₅	W ₆₂₆	W ₆₂₇	W ₆₂₈	W ₆₂₉	W ₆₃₀	W ₆₃₁	W ₆₃₂	W ₆₃₃	W ₆₃₄	W ₆₃₅	W ₆₃₆	W ₆₃₇	W ₆₃₈	W ₆₃₉	W ₆₄₀	W ₆₄₁	W ₆₄₂	W ₆₄₃	W ₆₄₄	W ₆₄₅	W ₆₄₆	W ₆₄₇	W ₆₄₈	W ₆₄₉	W ₆₅₀	W ₆₅₁	W ₆₅₂	W ₆₅₃	W ₆₅₄	W ₆₅₅	W ₆₅₆	W ₆₅₇	W ₆₅₈	W ₆₅₉	W ₆₆₀	W ₆₆₁	W ₆₆₂	W ₆₆₃	W ₆₆₄	W ₆₆₅	W ₆₆₆	W ₆₆₇	W ₆₆₈	W ₆₆₉	W ₆₇₀	W ₆₇₁	W ₆₇₂	W ₆₇₃	W ₆₇₄	W ₆₇₅	W ₆₇₆	W ₆₇₇	W ₆₇₈	W ₆₇₉	W ₆₈₀	W ₆₈₁	W ₆₈₂	W ₆₈₃	W ₆₈₄	W ₆₈₅	W ₆₈₆	W ₆₈₇	W ₆₈₈	W ₆₈₉	W ₆₉₀	W ₆₉₁	W ₆₉₂	W ₆₉₃	W ₆₉₄	W ₆₉₅	W ₆₉₆	W ₆₉₇	W ₆₉₈	W ₆₉₉	W ₇₀₀	W ₇₀₁	W ₇₀₂	W ₇₀₃	W ₇₀₄	W ₇₀₅	W ₇₀₆	W ₇₀₇	W ₇₀₈	W ₇₀₉	W ₇₁₀	W ₇₁₁	W ₇₁₂	W ₇₁₃	W ₇₁₄	W ₇₁₅	W ₇₁₆	W ₇₁₇	W ₇₁₈	W ₇₁₉	W ₇₂₀	W ₇₂₁	W ₇₂₂	W ₇₂₃	W ₇₂₄	W ₇₂₅	W ₇₂₆	W ₇₂₇	W ₇₂₈	W ₇₂₉	W ₇₃₀	W ₇₃₁	W ₇₃₂	W ₇₃₃	W ₇₃₄	W ₇₃₅	W ₇₃₆	W ₇₃₇	W ₇₃₈	W ₇₃₉	W ₇₄₀	W ₇₄₁	W ₇₄₂	W ₇₄₃	W ₇₄₄	W ₇₄₅	W ₇₄₆	W ₇₄₇	W ₇₄₈	W ₇₄₉	W ₇₅₀	W ₇₅₁	W ₇₅₂	W ₇₅₃	W ₇₅₄	W ₇₅₅	W ₇₅₆	W ₇₅₇	W ₇₅₈	W ₇₅₉	W ₇₆₀	W ₇₆₁	W ₇₆₂	W ₇₆₃	W ₇₆₄	W ₇₆₅	W ₇₆₆	W ₇₆₇	W ₇₆₈	W ₇₆₉	W ₇₇₀	W ₇₇₁	W ₇₇₂	W ₇₇₃	W ₇₇₄	W ₇₇₅	W ₇₇₆	W ₇₇₇	W ₇₇₈	W ₇₇₉	W ₇₈₀	W ₇₈₁	W ₇₈₂	W ₇₈₃	W ₇₈₄	W ₇₈₅	W ₇₈₆	W ₇₈₇	W ₇₈₈	W ₇₈₉	W ₇₉₀	W ₇₉₁	W ₇₉₂

RECORD OF BOREHOLE NO 9												
Co-ords: N 4 838 295.0; E 296 625.0												
WP 185-94-01/02		LOCATION		Co-ords. 15,873,665 N; 973,179 E		ORIGINATED BY HS						
W.P. 48-71-20 & 21		BORING DATE		June 27, 1974		COMPILED BY HS						
DATUM Geodetic		BOREHOLE TYPE		Cont. Flight Auger		CHECKED BY AP						
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — W _L			
						BLOWS / FOOT			PLASTIC LIMIT — W _P			
						20 40 60 80 100			WATER CONTENT — W			
						SHEAR STRENGTH P.S.F.			W _p — W — W _L			
						O UNCONFINED + FIELD VANE			WATER CONTENT %			
						● QUICK TRIAXIAL x LAB VANE			10 20 30			
									P.C.F.			
									GR.SA.SI.CL.			
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE						
542.0	Ground Level					540						
0.0	Clayey silt with some sand, traces of gravel & organics		1	SS	8					0 16 59 25		
535.5	Firm Fill		2	SS	9					535.0		
6.5	Het. Mixture of Clayey silt Sand & Gravel		3	SS	34					7 22 50 21		
	V. Stiff to Hard		4	SS	37	530						
	Brown		5	SS	101		100/6"					
	Glacial Till Grey		6	SS	52					3 26 56 15		
			7	SS	26							
			8	SS	22	520				6 32 47 15		
	occasional sandy silt layers		9	SS	72							
			10	SS	100	510				6 32 51 11		
			11	SS	154							
503.5			12	SS	115	500						
38.5	End of Borehole											

OFFICE REPORT ON SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 10 Co-ords: N 4 838 217.6; E 296 653.9															
WP 185-94-01/02			LOCATION Co-ords. 15,873,680 N; 973,274 E.			ORIGINATED BY HS									
W.P. 48-71-20 & 21			BORING DATE July 3, 1974			COMPILED BY HS									
DATUM Geodetic			BOREHOLE TYPE Cont. Flight Auger			CHECKED BY AP									
SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		BLOWS/FOOT	BLOWS / FOOT 20 40 60 80 100					PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L			
536.1	Ground Level														
0.0	Clayey silt with some sand, traces of Gravel & organics		1	SS	12										
529.6	Stiff (Fill)		2	SS	11	530									
6.5	Het. Mixture of Clayey silt Brown sand & gravel		3	SS	71										
	V. Stiff to Grey		4	SS	90										
	Hard		5	SS	23										
	Glacial Till		6	SS	37	520									
			7	SS	17										
			8	SS	124										
			9	SS	122										
	occasional sandy silt layers		10	SS	100	510									
			11	SS	100	500									
497.1			12	SS	148										
39.0	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

 20
15 \diamond 5 % STRAIN AT FAILURE
10

RECORD OF BOREHOLE NO 11

Co-ords: N 4 838 309.5; E 296 647.5

WP 185-94-01/02

W.P. 48-71-20 & 21

LOCATION Co-ords. 15,873,719 N; 973,253 E

BORING DATE June 28, July 2, 1974.

ORIGINATED BY HS

COMPILED BY HS

DATUM Geodetic

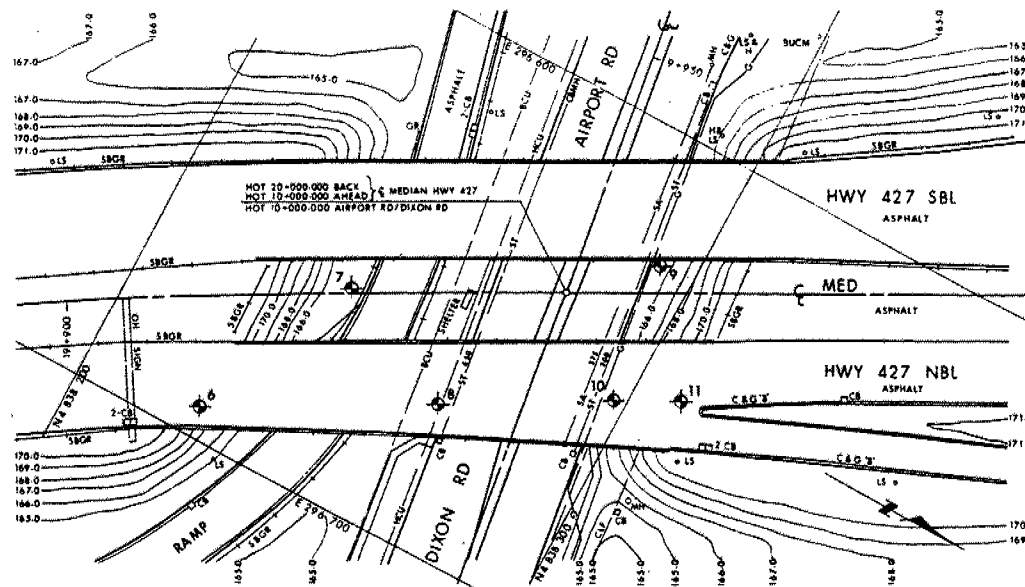
BOREHOLE TYPE Cont. Flight Auger

CHECKED BY AP

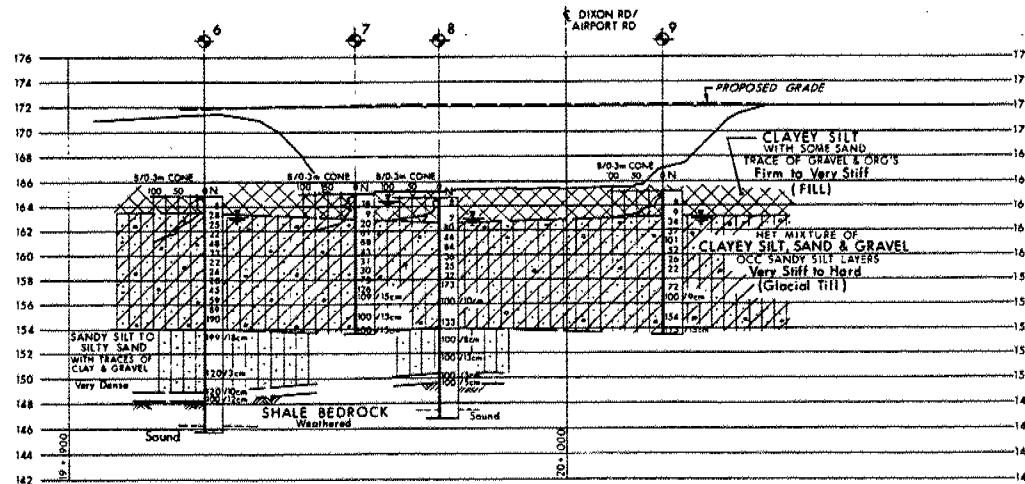
SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER TYPE					
536.1	Ground Level							
0.0	Clayey silt with sand, traces of gravel. Organics - Firm Fill		1 SS 10					534.1
532.1			2 SS 35	530				3 29 52 16
4.0	Het. Mixture of Clayey Silt Sand & Gravel		3 SS 78					
			4 SS 91					
	Brown		5 SS 39					5 30 46 19
	Grey		6 SS 25	520				1 23 61 15
	V. Stiff to Hard		7 SS 26					
			8 SS 125					4 31 48 17
	Glacial Till		9 SS 121	6"				
			10 SS 100	3/4"				
505.0			11 SS 100	3/2"				
31.1	Sandy Silt with Gravel & some clay		12 SS 100	500				33 23 32 12
	V. Dense Grey		13 SS 155	8"				
494.1	Transition Zone		14 RC 30%	490				
492.1			15 RC 25%					
44.0	Weathered Shale Bedrock Grey		16 RC 40%					
			17 RC 51%	480				
	Bedrock		18 RC 50%					
476.1	Sound		19 RC 100%					
60.0	End of Borehole			470				

OFFICE REPORT ON SOIL EXPLORATION

 20
15 ϕ 5 % STRAIN AT FAILURE
10



PLAN
SCALE
0 10m



Q PROFILE MED HWY 427

SCALE
0 10m Hor
4m 0 4m Vert

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

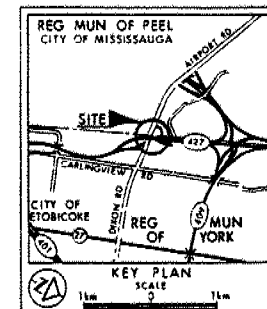
CONT No 97-30
WP No 185-94-01/02

DIXON RD/AIRPORT RD

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



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)
- W/L or time of investigation 1974 06 & 07

NOTE:
For Soil Details of
BH's 10 & 11 Refer
to Record of Borehole
Sheets

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
6	165.0	4 838 225.1	296 693.5
7	165.2	4 838 240.2	296 658.2
8	164.7	4 838 266.8	296 670.7
9	165.2	4 838 293.0	296 625.0
10	163.4	4 838 297.6	296 653.3
11	163.4	4 838 309.5	296 647.5

NOTES

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 the report and related documents is specifically excluded in accordance with the conditions of Section 2.01 of O.P.S. Contract

DATE	BY	DESCRIPTION
30M12-228		
HWY No 427		DIST CB
SUMMO R.A. [CHECKED]	DATE 1995 07 07	SITE 37-0319
DRAWN DT [CHECKED]	DATE 1995 07 07	DWG 185940102-3

Ref No E-80-427-8.1992.05

Foundation Investigation Report
for
Highway 427 Overpass Widening at Fasken Drive/Campus Road
W.P. 187-94-01/02, Site 37-0986
Central Region

The following report is a copy of the factual information from the Foundation Investigation and Design Report for WP 273-66-00, Contract 77-46. The foundation investigation report was prepared for the existing structures by MTO Foundations Unit and represents the subsurface conditions for the proposed widening of the existing structures at Highway 427.

Imperial units of measure are used in the report and on the Record of Borehole sheets. The original ground elevations shown on the borehole logs may differ from present day elevations as a result of the construction of the existing structures.

This report contains the detailed subsurface conditions, the Record of Borehole sheets, and the Foundation Drawing. The Foundation Drawing was updated using the metric coordinate system and metric units of measure.



for.

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

**Foundation Investigation Report
for
Proposed Structure at the Crossing of New Hwy 427 and Campus Road
District No. 6 (Toronto)
WO 72-11006 -- WP 273-66**

1. INTRODUCTION

The Foundation Office was requested to carry out a subsurface investigation at the crossing of new Hwy 427 and Campus Road, in the Borough of Etobicoke, York County. The request contained in a memo from the Central Regional Office dated December 29, 1971. Subsequently, an investigation was carried out by this office to determine the subsoil, bedrock and groundwater conditions at the site. The results of the investigation for the structure and approach fills and cuts are presented in this report.

2. DESCRIPTION OF THE SITE AND GEOLOGY

The site is located some 200 feet east of the junction of Campus Road and Indian Line Road, in the Borough of Etobicoke, Metropolitan Toronto. The terrain is gently undulating in relief between elevations 540 and 546. The area has been utilized for small industrial developments; many one and two storey factories and warehouses are located here.

The site is located in the physiographic region known as the Peel Plain. The characteristic deposit in this region is a ground moraine laid down during the Wisconsin Glacial age. In the vicinity of the area under investigation, the moraine is primarily composed of a cohesive, stoney glacial till whose thickness typically ranges between 72 and 88 feet. In this region, the Humber River and Etobicoke Creek have cut deep valleys into the overburden. There is, therefore, no large undrained depression, swamp or bog, although in many of the instream areas drainage is still imperfect.

The overburden is underlain by grey shale bedrock of the Meaford-Dundas formation, Ordovician Period. Available geologic information indicates that the surface of the bedrock varies somewhere between elevation 458 and 473.

3. FIELD AND LABORATORY WORK

A total of six boreholes, all of which were accompanied by a dynamic cone penetration test, was carried out at the site during the course of the field investigation. The boreholes and the cone penetration tests were advanced by means of a continuous flight auger machine or a diamond drill rig, both of which were adapted for soil sampling purposes.

Samples were obtained at required depths in a 2-inch O.D. split spoon sampler which was hammered into the soil. The method of driving the split spoon conformed to the specifications of the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Bedrock was proven at three of the boring locations by obtaining BX size rock core samples.

During sampling and drilling operations, detailed logs of the borings were made; these logs

contain a record of drilling and sampling techniques used, together with the soil types and bedrock encountered.

The location and elevation of all the boreholes are shown on Drawing No. 1879401/02-A, together with a number of estimated stratigraphical sections across the site. Surveying of the site was carried out by the personnel from the Engineering Surveys Section, Central Region. The elevations shown in this report are referred to a geodetic datum.

All samples were subjected to a careful visual examination in the field, and subsequently in the laboratory. Following this examination, laboratory testing was carried out on selected representative samples to determine the following physical properties of the overburden:

Natural Moisture Content

Atterberg Limits

Grain Size Distribution

The results of these tests are plotted on the Record of Borehole sheets as well as the figures located in the Appendix.

4. SUBSOIL AND BEDROCK CONDITIONS

4.1 General

The predominant stratum across the site is composed of a very stiff to hard cohesive glacial till with a thickness ranging from 71 feet to 85 feet. This glacial deposit is covered in certain areas by fill material composed of clayey silt with sand and gravel; the fill was up to 8 feet thick. Underlying the glacial till is shale bedrock.

From ground surface downward the soil types and bedrock encountered are as follows:

4.2 Fill

On the south side of Campus Road, a fill has been placed over the parent subsoil. The fill material is composed of a clayey silt with sand and gravel. The depth of fill, at BH's 4 and 5, was found to be 8 feet.

Standard Penetration Tests, carried out within the cohesive fill are plotted on the Record of Borehole sheets. This testing gave 'N' values in the order of 11 to 12 blows per foot. Based on these values it is estimated that the fill has been subjected to a moderate degree of compaction.

4.3 Glacial Till (Heterogeneous Mixture of Clayey Silt, Sand and Gravel)

Directly under a thin cover of topsoil or under the fill, is the predominant stratum across the site which is of glacial origin. This glacial till is composed of a heterogeneous mixture of clayey silt, sand and gravel. The thickness of this cohesive stratum varies from 71 feet at BH's 1 and 3, to 85 feet in BH 2. Grain size distribution curves for representative samples of this cohesive deposit are plotted in envelope form on Figure No. 1.

Atterberg limit tests were carried out on samples obtained from the cohesive glacial till. The results of this testing is summarized in tabular form as follows:

Liquid Limit (w_L %)	16 - 39
Plastic Limit (w_p %)	12 - 20
Natural Moisture Content (w %)	6 - 18

Based on these values, it is estimated that the cohesive deposit has a matrix, which is inorganic and of low plasticity.

The Standard Penetration Tests, carried out within this glacial till stratum, are plotted on the Record of Borehole sheets. This testing gave 'N' values which ranged from 16 blows/foot to 100 blows for 1 inch. Based on this testing it is estimated that the consistency of this deposit varies from very stiff to hard.

4.4 Shale Bedrock

The cohesive parent glacial till is directly underlain by bedrock, which was proven in 3 of the boreholes by obtaining up to 16 feet of BX size rock core samples. Over the site the bedrock surface was found to vary between elevations 473 and 458 which corresponds to depths below ground surface ranging from 71 to 85 feet. The bedrock is composed of a grey shale; the upper 6 to 8 feet of which is in a weathered state. Below this zone the bedrock is in a sound condition, as evidenced by the high percentage of core recovered.

The bedrock core samples were examined by Mr. K.W. Ingham, Geologist, Department of Transportation and Communications. Mr. K.W. Ingham presented the results of his bedrock examination in a memo to this office, dated February 29, 1972; this letter is appended to this report.

5. Groundwater Conditions

Groundwater level observations have been carried out, during the period of the investigation, in the open boreholes. These observations indicate that the groundwater level varies between elevations 540 and 542, which correspond to depths below ground surface of from 3 to 10 feet.

6. Miscellaneous

The field work, performed during the period of January 6 to January 10, 1972, was carried out under the immediate supervision of Mr. V. Korlu, Project Foundation Engineer.

The drilling equipment was owned and operated by Master Soil Investigations Ltd., Toronto.

This report was prepared by Mr. S. Ahmad, Project Foundation Engineer. This project was under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

March 3, 1972

APPENDIX

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

23

MEMORANDUM

TO: Mr. M. Devata,
Sup. Foundation Engr.

FROM: K. W. Ingham

ATTENTION:

DATE: March 10, 1972

OUR FILE REF.

IN REPLY TO:

SUBJECT:

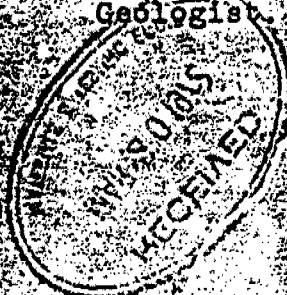
Foundation Investigation 72-11006;
Bridge Footing; Highway 427

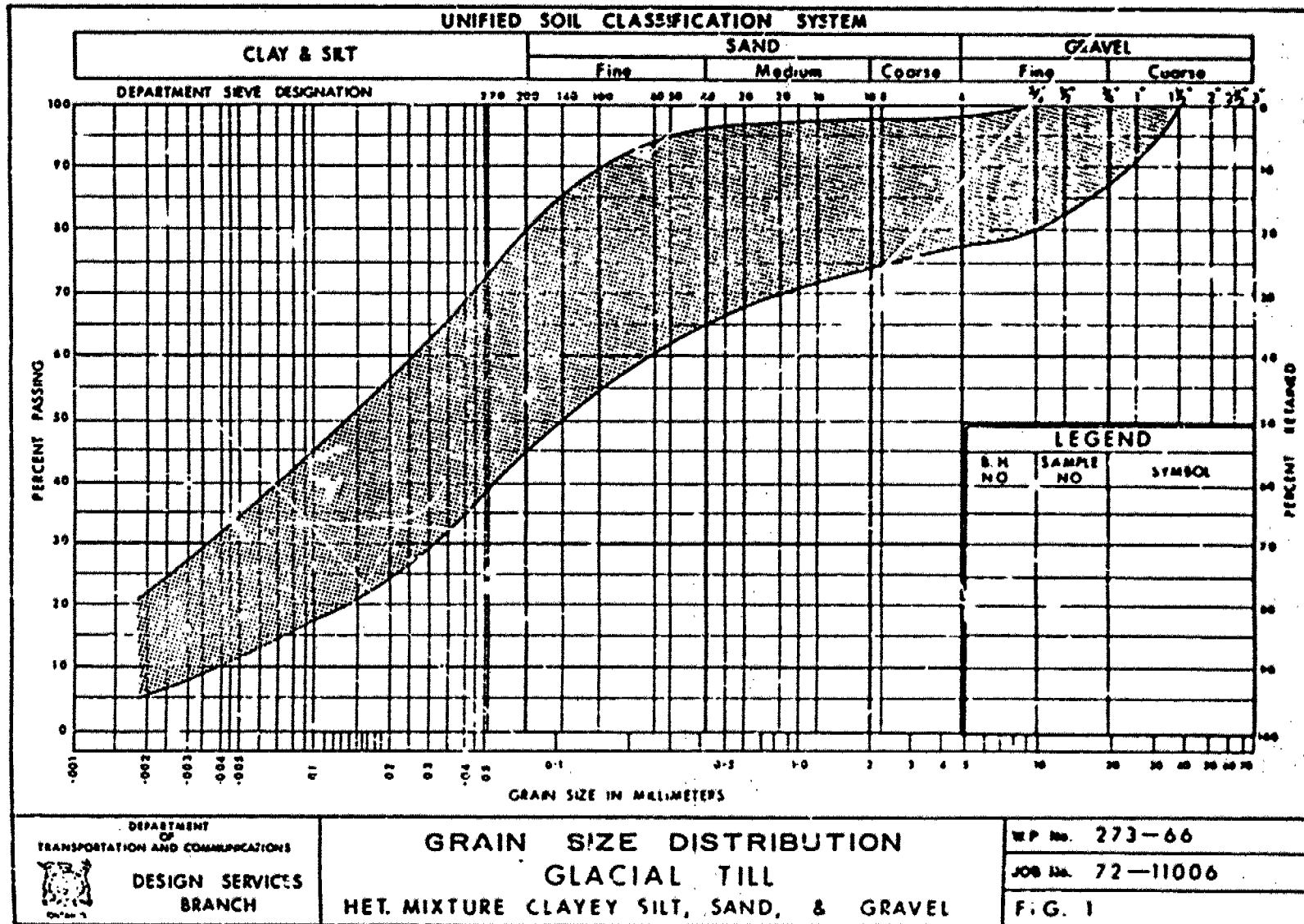
Three boreholes, Nos. 1, 2 and 3 intersected bedrock at the site. The rock is a dark grey shale with thin bands of calcareous shale and beds of limestone and siltstone. A small amount of till was recovered at the top of each hole and this appears to be underlain by 2.0 to 8.0 ft. of moderately fractured bedrock and then the undisturbed shale. The depth to bedrock and corresponding elevation for each hole is given below.

Hole No.	Depth to Bedrock - ft.	Bedrock Elevation - ft.
1	85.6	458.4
2	77.0	467.1
3	75.5	469.8

KWI:mv

K. W. Ingham,
Geologist





WP 187-94-01/02

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING OFFICE				RECORD OF BOREHOLE No. 2				FOUNDATION SECTION							
JOB 72-11006				LOCATION Co-ORDE: N 4888 594.83 E 296 468.0 Comps: 15,874,655 N; 972,665 E.				ORIGINATED BY VK							
W.P. 273-66				BORING DATE Jan. 6 & 7, 1972				CO-APPROVED BY TS							
DATUM Geodetic				BOREHOLE TYPE Penn Drill and Diamond J-111				CHECKED BY CLK							
ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. NOT.	SAMPLE		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT PLASTIC LIMIT WATER CONTENT				BULK DENSITY	REMARKS
			NUMBER	TYPE		BLOWS/100	20	60	100	10	20	30			
Sub. 0	Ground Level														
0.0	Ret. mix. of clayey silt, sand & trace of gravel.		1	SS	30	590									Feb. 4/72 539.5 4 31 49 18
	occ. clayey silt sand.		2	SS	10										
	Glacial Till		3	SS	62										
	Very Stiff to Hard		4	SS	50	530									
	Brown		5	SS	29										
	Grey		6	SS	37	520									
			7	SS	72										
			8	SS	40	510									
			9	SS	50										
			10	SS	160	500									5.27 50 18
			11	SS	1000 3"										
			12	SS	106 4"	490									
			13	SS	111										
			14	SS	100 76"	480									
			15	SS	107 71"	470									
458.9			16	SS	100 76"	460									5.43 45 7
85.5	Shale Bedrock														
454.0	Sound														
90.0	End of Borehole														

20
15-5 % STRAIN AT FAILURE
10

WP 187-94-01/02

DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE No. 3		FOUNDATION SECTION	
MATERIALS & TESTING OFFICE		Co-ords: N 4838 593.0, E 296 497.9		ORIGINATED BY <u>VR</u>	
JOB 72-11006	LOCATION	Co-ords. 15,874,649 N; 972,762 E.		COMPILED BY <u>TT</u>	
W.P. 273-66	BORING DATE Jan. 5, 1972			CHECKED BY <u>VR</u>	
DATUM Quodette	BOREHOLE TYPE Penn Drill and Diamond Drill				

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — %		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT NO.	NUMBER	TYPE	BLWS/FOOT	20	40	60	80	100	WATER CONTENT %	
545.1	Ground Level											
0.0	Net. mix. of clayey silt, sand & gravel		1	SS	5							52.3
	Glacial Till		2	SS	28							52.3
	Occ. clayey silt seems Very Stiff to Hard		3	SS	62							52.3
	Brown		4	SS	73							52.3
	Grey		5	SS	12							52.3
			6	SS	50							52.3
			7	SS	34							52.3
			8	SS	27							52.3
			9	SS	70							52.3
			10	SS	7							52.3
			11	SS	95							52.3
			12	SS	86							52.3
			13	SS	100/60							52.3
472.3												
73.0	Shale Bedrock		14	EX	15%							
66.3	weathered		15	EX	25%							
61.0	sound		16	EX	95%							
457.8			17	EX	100%							
87.5	End of Borehole											

20
15-3 % STRAIN AT FAILURE
10

WP 187-94-01/02

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING OFFICE				RECORD OF BOREHOLE No. 4				FOUNDATION SECTION						
JOB 72-11006		LOCATION Co-ords: 15,876,689 N; 972,766 E.		ORIGINATED BY VE		COMPILED BY		CHECKED BY						
W.P. 713-66		BORING DATE Jan. 6, 1977												
DATUM Geodetic		BOREHOLE TYPE Pen Drill & Cone												
ELEV. DEPTH	SOIL PROFILE DESCRIPTION	SAMPLING POINT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT % PLASTIC LIMIT % WATER CONTENT %	BULK DENSITY	REMARKS	
			NUMBER	TYPE		BLOWS/FOOT	BLOWS/FOOT	BLOWS/FOOT	BLOWS/FOOT	BLOWS/FOOT				
529.2	Ground Level													
0.0	Fill		1	SS	17									23 27 30-1
521.7	Stiff to Very Stiff		2	SS	17									522.2
7.5	Glacial Till		3	SS	15									Feb. 1/72
	Brown		4	SS	12									
	Gray		5	SS	51									
	Glacial Till		6	SS	12									
	Mst. mix. of clayey silt, sand & gravel		7	SS	120/9									
	Hard		8	SS	100/3									
			9	SS	61									
			10	SS	77									
			11	SS	95									
			12	SS	95									
528.8			13	SS	100/5									
50.4	End of Borehole													

20
15-5 % STRAIN AT FAILURE
10

WP 187-94-01/02

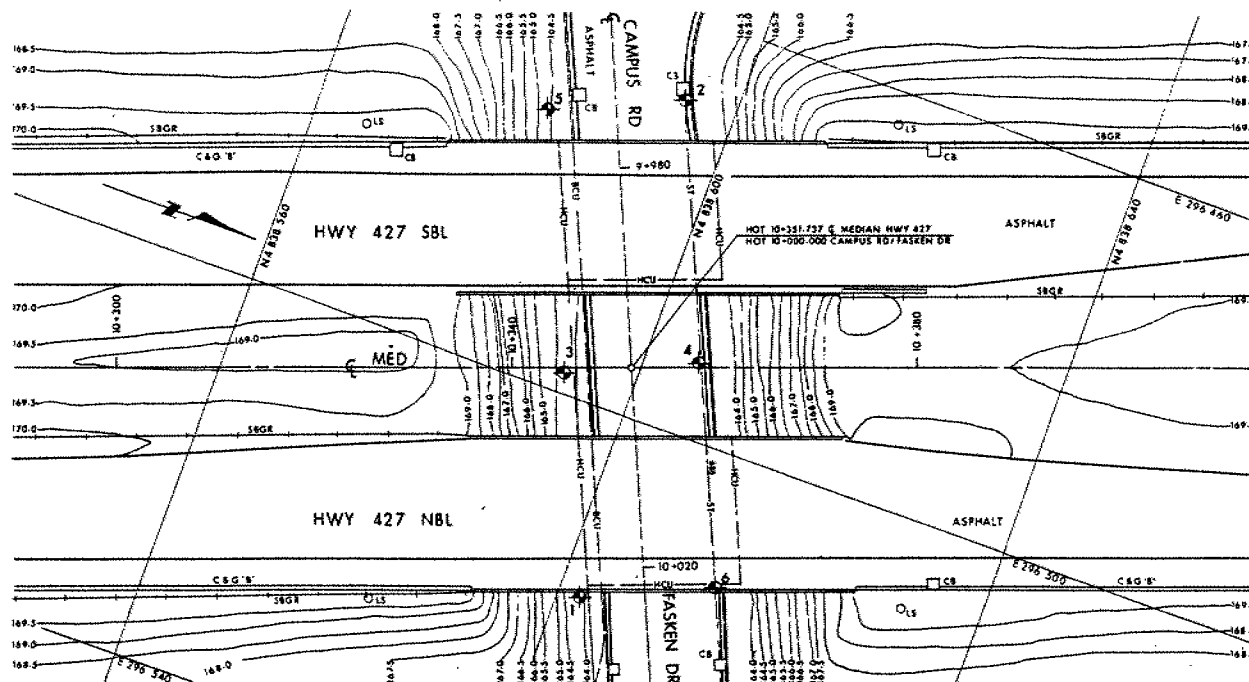
DEPARTMENT OF HIGHWAYS - ALABAMA			RECORD OF BOREHOLE No. 5			FOUNDATION SECTION					
MATERIALS & TESTING OFFICE			Co-ords: N 4838 582.3; E 296 478.5			ORIGINATED BY: <u>YE</u>					
JOB: <u>72-11026</u>			LOCATION: <u>Co-ords. 15, 476, 614 N; 972, 682 E.</u>			COMPILED BY: <u>72</u>					
WP: <u>72-16</u>			BORING DATE: <u>Jan. 5, 1972</u>			CHECKED BY: <u>[Signature]</u>					
DATUM: <u>Original</u>			BOREHOLE TYPE: <u>For Drill & Core</u>								
F. EX DEPTH	SOIL PROFILE DESCRIPTION	SAMPLING NUMBER TYPE BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT PLASTIC LIMIT WATER CONTENT	BULK DENSITY	REMARKS
				BLOWS/FOOT	20	40	60	80			
0.0	Ground level										
0.0	Met. mix. of clayey silt, sand & gravel. Very Stiff to Hard	1 35 11	95								4.27 51.18
		2 35 22									539.5
		3 35 22									Feb. 4/72
	Brn. Grey	4 35 51	500								
		5 35 32									
		6 35 31									
	Glacial Till	7 35 18	520								
		8 35 21									
		9 35 18									
		10 35 102	510								
		11 35 77									
	acc. silt came	12 35 100	500								
122.5		13 35 111	490								
51.5	End of Borehole										

20
15-25 % STRAIN AT FAILURE
10

WP 187-94-01/02

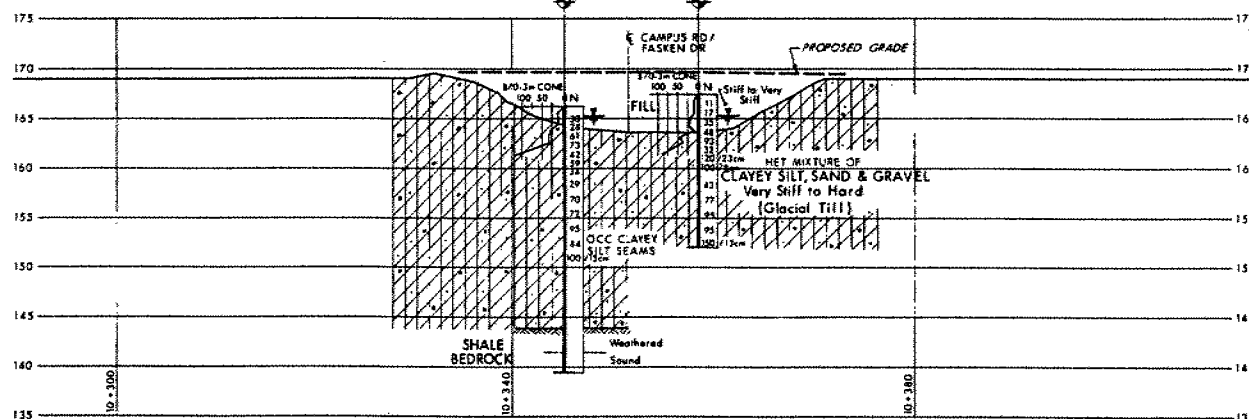
DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE No. 6		FOUNDATION SECTION												
MATERIALS & TESTING OFFICE		Co-ORDS: N 4858 614.3; E 296 513.1		ORIGINATED BY <u>TE</u>												
JOB <u>72-11006</u>		LOCATION <u>Co-ORDS. 15,876,719 N; 272,812 E.</u>		COMPILED BY <u>TT</u>												
W.P. <u>271-66</u>		BORING DATE <u>Jan. 4, 1972</u>		CHECKED BY <u>TT</u>												
DATUM <u>Canadian</u>		BOREHOLE TYPE <u>Pen Drill & Core</u>														
SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — %		PLASTIC LIMIT — %		WATER CONTENT — %		BULK DENSITY		REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. NO.	NUMBER	TYPE	MCWS/FOOT	ELEV. SCALE	BLOWS/FOOT	70	80	90	100	WATER CONTENT %	10	20	30	
529.1	Ground Level															
0.0	Fill		1	SS	12											8-35 h3 1h
521.5	Stiff to Very Stiff		2	SS	16											7-52.1
7.5			3	SS	16	540										Feb. 1/72
			4	SS	18											
			5	SS	67											
	Brown Gray		6	SS	46	530										
			7	SS	31											
			8	SS	27											
	Glacial Till		9	SS	39	520										
	Not mix. of clayey silt, sand & gravel.		10	SS	51											
	Very Stiff to Hard		11	SS	50	510										
			12	SS	57											
			13	SS	103/6"	500										
492.6			14	SS	172	490										
56.9	End of Borehole															

20
15-3 % STRAIN AT FAILURE
in



PLAN

SCALE
0 5m



PROFILE MED HWY 427

SCALE
0 5m

METRIC

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

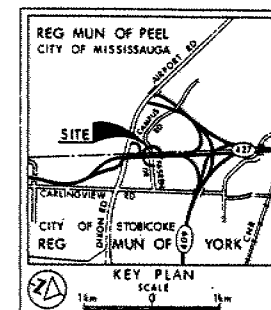
CONT No 97-30
WP No 187-94-01/02

FASKEN DR/CAMPUS RD

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



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)
- W.L. at time of investigation 1972.01

NOTE:
For Soil Details of
BH's 1, 2, 5 & 6 Refer
to Record of Borehole
Sheets

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	165.8	4 838 602.1	296 518.6
2	165.8	4 838 594.8	296 468.0
3	166.2	4 838 595.0	296 497.9
4	167.4	4 838 605.2	296 492.4
5	163.8	4 838 582.3	296 473.5
6	167.4	4 838 614.3	296 513.1

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 GC 2.01 of OPS Gen Cond.

DATE	BY	DESCRIPTION
1995 07 08	BY	DATE
1995 07 08	BY	DATE
1995 07 08	BY	DATE

Geocres No 30M12-227

HWY No 427

SUBMIT K.A. CHECKED

DRAWN BY CHECKED #2

DATE 1995 07 08

DATE 1995 07 08

DATE 1995 07 08

DATE 1995 07 08

Ref No E-80-427-9, 1992 05

FOUNDATION INVESTIGATION REPORT
For
High Mast Lighting
Hwy 427, From Hwy 401 to Campus Rd./Fasken Dr
W.P. 609-89-00
Hwy. 427, Central Region

INTRODUCTION

This report presents soil information for the proposed eight high mast lights (P1 through P8) at the above mentioned site. Soil information was obtained from previous subsurface investigations in the area (Geocres 30M11-43, 30M11-48 and 30M12-52). This report is produced at the request of Central Region Structural Section.

SUBSURFACE CONDITIONS

The appended three Record of Borehole sheets have been selected from previous projects to represent the soil conditions for this project. The native soil in general is a competent cohesive and non cohesive soil basically of glacial origin. The consistency of the material in general is very dense or hard (N-values ranging from 15 blows to more than 100 blows/0.3m, with average N-value of 30 to 60 blows/0.3m. The closest boreholes (listed below) should be referred for the soil condition at the HML locations.

<u>Boreholes</u>	<u>Co-ordinates</u>	<u>Geocres No</u>
BH 1	N 4,836,388.1; E 297,405.6	30M11-43
BH 3	N 4,838,593.0; E 296,497.8	30M12-52
BH 7	N 4,837,170.8; E 297,337.3	30M11-48

The location of the boreholes are shown on Drawings 6098900-A and 6098900-B.

Miscellaneous

The soil information for this project was obtained from previous foundation investigations in this area (Geocres 30M11-43, 30M11-48, and 30M12-52). This report was prepared by K.S.Q. Ahmad, Foundation Engineer, reviewed and approved by D. Dundas, Senior Foundation Engineer.

*for**E. Bennett*

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

APPENDIX

GEOCRES 30M11-43

CO-ORD. N 4,836,388.1; E 297,405.6 (METRIC)

GEOTECHNICAL DATA SHEET FOR BOREHOLE...!

OUR REFERENCE NO. 7-1-14
Your Ref. NO. WP 201-G2-2

CLIENT D.H.O.

PROJECT HWY. 27 RICHVIEW EXPR. WAY & RENFORTH DR. INTERCHANGE

LOCATION 867,415 N ; 975,740 E

DATUM ELEVATION G.S.C.

METHOD OF BORING AUGERING

DIAMETER OF BOREHOLE 4"

DATE FEB 13, 1967

ENCLOSURE NO.

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	Advisory of Sampler	2,0	4,0	6,0	8,0	10,0	PL	W	LI	
528.3	0	GROUND SURFACE													
525	5	Very Dense CLAYEY above EI 525 II.		1	S.S.	59									
520	10	Brown to Grey SILT with some fine sand and a trace of clay.		2	S.S.	89									
518.3	12.0			3	S.S.	139									
515	15	Very Dense Grey GRAVELLY SAND with some silt		4	S.S.	78/6									
510	20			5	S.S.	94									
505	23.0			6	S.S.	70/3									
500	30	Hard, Grey CLAYEY SILT with some sand and a trace of gravel and embedded shale fragments.		7	S.S.	100/25									
495	35			8	S.S.	100/2									
490	38.0			9	S.S.	90/2									
485	45	Grey, Soft WEATHERED SHALE		10	S.S.	100/2									
480	50	END OF BOREHOLE			S.S.	80/0									
475															

VERTICAL SCALE 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE: D. A. M. CHD

5/12

CO-ORDS: N 4,837,170.8; E 297,337.3 (MET) GEOCRES 30M11-48

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 69-F-28 LOCATION Co-ord. 869,983 N; 975,516 E. ORIGINATED BY GA
W.P. 400-65-3 BORING DATE April 9 & 10, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — %			BULK DENSITY Y P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	20	40	60	80	100	W _p	W _p	W _p		
542.0	Ground Level														
0.0	Clayey silt with sand & some gravel (Fill) Very Stiff		1	SS	15										2 25 51 22
			2	SS	24										
			3	SS	25										
			4	SS	31										
			5	SS	21										
523.5															522.8
19.5	Clayey silt with sand & traces gravel. Hard		6	SS	36										2 43 45 10
			7	SS	51										
			8	SS	70/3"										
			9	SS	70/2 1/2"										
			10	SS	bouncing										
509.2															
32.8	End of Borehole														

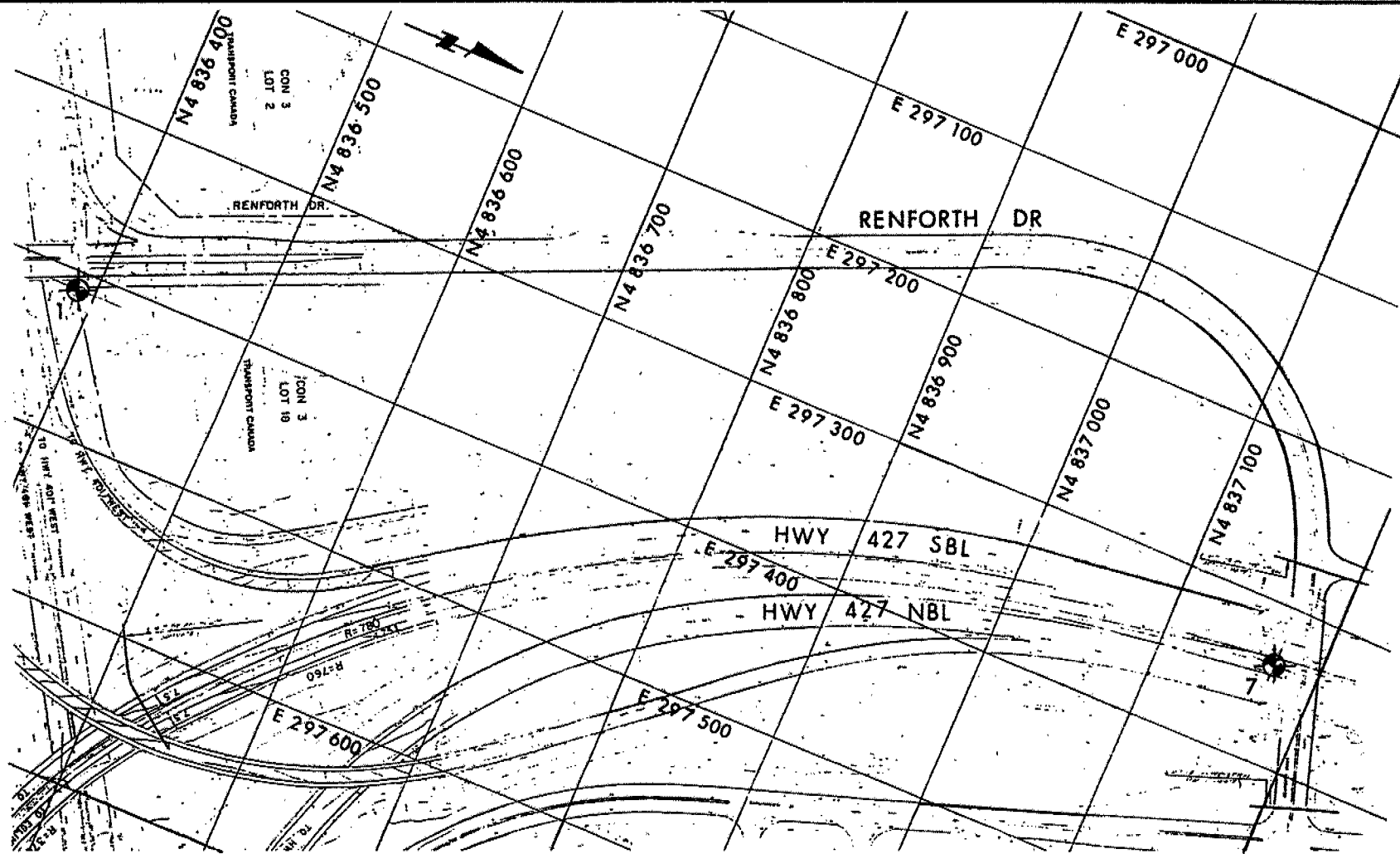
GEOCRES 30M12-52

DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & TESTING OFFICE
 JOB 72-11006 LOCATION CO-ORDS. N. 4838 593.0, E. 296 497.8
 W.P. 273-66 BORING DATE Jan. 5, 1972
 DATUM Geodetic BOREHOLE TYPE Penn Drill and Diamond Drill

RECORD OF BOREHOLE No. 3
 FOUNDATION SECTION
 ORIGINATED BY VK
 COMPILED BY TT
 CHECKED BY *JK*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION	STRAT. NO.	NUMBER	TYPE		BLOWS / FOOT			SHEAR STRENGTH P.S.F.					WATER CONTENT %		
						20	40	60	80	100	UNCONFINED			FIELD VANE	QUICK TRIAXIAL	LAB. VANE
515.3	Ground Level															
0.0	Het. mix. of clayey silt, sand & gravel		1	SS	30											
	Glacial Till		2	SS	28											
	occ. clayey silt seams		3	SS	61											
	Very Stiff to Hard		4	SS	72											
	Brown		5	SS	42											
	Gray		6	SS	59											
			7	SS	31											
			8	SS	29											
			9	SS	70											
			10	SS	72											
			11	SS	95											
			12	SS	84											
			13	SS	100/26*											
472.3																
73.0	Shale Bedrock		14	BX	15%											
464.3	weathered		15	BX	25%											
81.0	sound		16	BX	95%											
457.8			17	BX	100%											
87.5	End of Borehole															

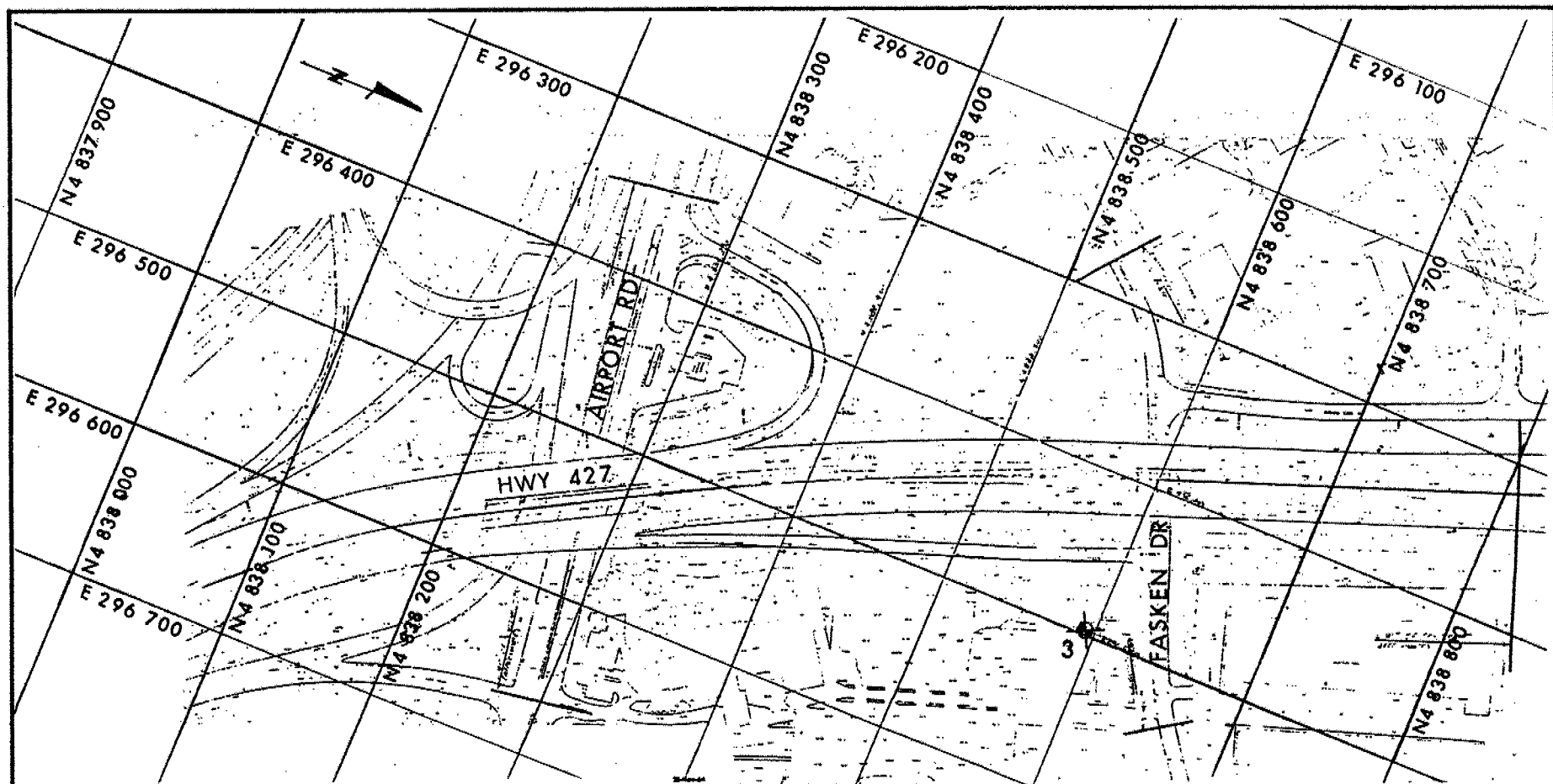
20
 15-5 % STRAIN AT FAILURE
 10



Borehole No	Co-ordinates	
	North	East
1	4 836 388.1	297 405.6
7	4 837 170.8	297 337.3

PLAN
SCALE
50m 0 50m

Geocres No 30M12-225
WP 609-89-00
Dist C.R.
Dwg No 6098900-A



Borehole No	Co-ordinates	
	North	East
3	4 837 170.8	297 337.3

PLAN
SCALE
50m 0 50m

Geocres No 30M12-225
WP 609-89-00
Dist C. R.
Dwg No 6098900-B

memorandum



To: G. Al-Bazi
Head, Design Section
Structural Office

February 20, 1997

From: Pavements and Foundations Section
Room 315 Central Building

Phone: 235-3731

Re: Hwy 427 Widening at Dixon Road Overpass, NBL and SBL
W.P.609-89-00, Central Region

It is proposed to use temporary supports to replace the existing three piers at the southbound structure of the Dixon Road Overpass at Highway 427.

Based on the largest loading on each girder, 850 kN at SLS, the design proposed is acceptable from a foundations point of view provided that the mudsill is continuous across all of the supports. We understand that for design, serviceability limit state controls. A granular pad of 1.0 m thickness is preferred, however, a pad of 500 mm minimum is acceptable if necessary. A bearing resistance of 130 kPa at SLS should be provided on the drawings.

It is recommended that movements of the temporary support system be monitored on a daily basis. Settlements of up to 25 mm may be expected and a mechanism should be in place to jack the supports if movements exceed 25 mm.

Pre-augering of 2.0 m below the existing footings was recommended in the Foundations memo dated 94 08 18, to minimize disturbance to the existing footings. Because of the proximity of the driving to the existing footings, 2.0 m of pre-augering is preferred over 3.0 m for the pair of piles driven adjacent the existing footings. It is felt that this would minimize the possibility of undermining that may occur within the augered space. Pre-augering to 3.0 m may be carried out at the remaining four piles of each pile cap. The head space required for conventional pile driving equipment is 6.0 m. As discussed over the phone, if additional head room is required for the piles driven closest to the existing structures, then excavation to the elevation of the base of the proposed pile cap can be carried out to accommodate the construction equipment.

Soils parameters for roadway protection requirements at the northbound and southbound structures were provided in the original recommendations and are appended for your information.

The issue with the gas mains is still unclear at this time. If there are any foundations considerations, they will be forwarded to you.

If there are any questions regarding the above, please advise.

A handwritten signature in dark ink, appearing to read "Betty Bennett".

Betty Bennett, P.Eng.
Foundation Engineer

From: Has Shah
To: KellyTe
Date: 1997/02/18 7:46pm
Subject: Hwy. 427 at Airport/Dixon Rd.; utility relocation; W.P.
609-89-00

Ted:

Re the relocation proposal for the Consumers Gas main, which you provided to us on 97 02 12, A. Ortlieb of Giffels has the following comments:

1. J. Lam to ensure that sufficient working clearance is provided from footing of the northbound structure.
2. Ensure that potential conflicts do not exist with other relocation proposals in this area (i.e. Rogers Cable, etc.)
3. Is this relocation going to be undertaken prior to the contractor being on site?

Due to tight time frame by which we have to complete this whole Hwy. 427 widening project, and to avoid constructor issues, I believe that it is best to complete all relocations prior to contractor coming to site.

Has Shah

cc. A. Ortlieb - Giffels

CC: Lam

MEMORANDUM



To: V. Boehnke, P.Eng.
Head, Structural Section
Central Region

Date: August 18, 1994

Attn: J. Lam, P.Eng
Sr. Structural Engineer

From: Foundation Design Section Tel: (416) 235-3731
Room 315, Central Bldg. Fax: (416) 235-5240

Re: Preliminary Foundation Recommendations for Dixon Road Overpass
Hwy 427 Widening from Highway 401 to S. of Hwy 409
G.W.P. 609-89-00, District 6, Toronto

It is proposed to widen the existing Highway 427 between Highway 401 and Highway 409. This will be achieved by incorporating the existing median that separates the northbound and southbound lanes, a width of approximately 16.3 m in the vicinity of Dixon Road. At present, Highway 427 crosses over Dixon Road via two open-type structures. The widening of Highway 427 will require that an additional structure adjoin the existing bridges.

This memo outlines the general subsurface conditions encountered at this site and the preliminary foundation recommendations for the proposed structure widening. Final recommendations will be provided once the proposed structure design and E-plan for this site become available..

General Site and Subsurface Conditions

The site is located just north of Highway 427 and Highway 401, in the City of Etobicoke. The area is highly developed with industrial and commercial land use. The terrain is gently undulating in relief.

The site falls within the physiographic region known as the Peel Plain which is glacial in origin. The characteristic deposit of this region is a ground moraine composed of cohesive glacial till that extends for a depth of approximately 25 m. The overburden is underlain by shale bedrock of the Dundas-Meaford Formation.

Subsurface information obtained from a subsurface investigation carried out in July 1974 for the existing structures provides sufficient data for the proposed widening. The investigation consisted of six boreholes advanced at the abutments for the northbound structure and within the median. The subsurface material consists largely of very stiff to hard glacial till comprised of a heterogeneous mixture of clayey silt, sand and gravel. A blanket of clayey silt fill material was encountered across the site with a thickness of up to 2.1 m. The glacial till deposit extends for a thickness of up to 9.4 m from beneath the fill to approximate El. 154.0. It is underlain by a stratum of sandy silt to silty sand that varies in thickness from 3.4 to 5.2 m. This granular deposit overlies the bedrock which

was proven at three locations. It was encountered at depths of 13.4 to 16.8 m, between elevations 148.2 to 145.0 m.

Groundwater levels recorded at the time of the investigation were measured between El. 162.8 and 164.4.

Discussion and Recommendations

Twin two-span structures carry the northbound lanes and southbound lanes of Highway 427 over Dixon Road. The southbound structure is the original bridge and was constructed in 1962. It is supported on spread footings, the base of which are estimated to be at El 163.0 m +/- . In 1981, rather than constructing a single replacement structure, the original structure was jacked up to provide additional vertical clearance, and became the southbound structure. No changes were recommended to the foundations at that time. The northbound structure was also constructed in 1981. This structure is founded on piles driven into the glacial till deposit. Shallow foundations were not considered feasible as the recommended footing elevations would place the footings approximately 1.5 m below the existing southbound structure footings. For similar reasons, shallow foundations are not recommended for the proposed structure widening.

The following recommendations assume that widening will occur in the median and that there will be no significant changes to the profile grades. These recommendations will be finalized once the design details, such as the proposed structural connections and the need for retaining walls, are provided.

Structure Foundations

The structure widening may be founded on pile foundations or caissons.

Pile Foundations

End-bearing steel H-piles may be used at the abutments and centre pier.. Piles shall be driven in accordance with the Hiley Formula as outlined in SS 103-11 or SS 103-10, using an ultimate capacity of 3 450 kN per pile. For estimating purposes, it is anticipated that the piles will terminate in the glacial till deposit between El. 155 and El. 157 m. The following design values for HP 310x110 piles apply at both the north and south abutments, as well as the centre pier:

Factored Axial Resistance at ULS	1 600 kN
Axial Resistance at SLS	1 600 kN

To minimize the disturbance to the existing footings caused by pile driving, it is recommended that pre-augering be carried out to a depth of 2.0 m below the base of the existing footings. It is expected that the pre-augered holes will not require a liner.

No dewatering concerns are anticipated during the excavations for the pile caps. It is expected that any seepage into the excavation can be relieved by sump pumping techniques. It is recommended that the pile caps be founded at EL 163.0 m or higher so as not to disturb the southbound structure footings. If this is not feasible, this Section should be contacted to discuss alternatives.

Because of the nature of the subsurface material, the Contractor should be made aware that cobbles/boulders may be encountered during excavation and driving.

Caisson Foundations

To minimize the requirement for excavation, caisson foundations may be considered. The caissons will be founded in the hard cohesive glacial till deposit. A base elevation of 155.4 m is estimated for each of the footing locations. The caissons should have a minimum diameter of 900 mm to allow for down-the-hole cleaning and inspection. The following design values apply:

Factored Axial Bearing Resistance at ULS	1 500 kPa
Axial Bearing Resistance at SLS	1 500 kPa

Caissons should be installed with liners since there is a possibility that wet seams of silty sand may be intersected. It is expected that dewatering of the caissons can be achieved with the use of sump pumping techniques.

Caisson caps should be constructed at or above the existing footing/pile cap elevations. Again, the Contractor should be aware that cobbles/boulders may be encountered during installation of the caissons and excavation for the caisson caps.

A NSSP for caisson installation, developed by the Foundation Design Section, should be included in the Contract.

General Recommendations

Roadway Protection

Excavations adjacent to the existing structures may require temporary shoring. The soil parameters for the calculation of earth pressures are as follows:

	ϕ	γ
<u>North Abutment</u>		
El. 172.0 +/- to 163.0 Fill - local borrow assumed	28°	20.0 kN/m ³
Below El. 163.0 Cohesive glacial till	32°	21.5 kN/m ³
<u>Centre Pier</u>		
El. 166.0 +/- to 162.5 Fill - local borrow assumed	28°	20.0 kN/m ³
Below El. 162.5 Cohesive glacial till	32°	21.5 kN/m ³
<u>South Abutment</u>		
El. 172.0 +/- to 163.0 Fill - local borrow assumed	28°	20.0 kN/m ³
Below El. 163.0 Cohesive glacial till	32°	21.5 kN/m ³

An at-rest condition applies.

Lateral Earth Pressure

Backfill to the abutments should consist of granular material in accordance with MTO Standard Special Provision 109F03. Computation of earth pressures should be carried out as per Section 6-7.4.5 of the OHBDC, 3rd Ed.. Design parameters of the acceptable granular backfill are as follows.

	<u>Granular "A"</u>	<u>Granular "B"</u>
Angle of Internal Friction (ϕ)	35°	30°
Unit Weight (kN/m ³)	22.8	21.2

If caissons are used then the at-rest condition should be assumed. An active condition may be assumed if soil movement behind the wall is permitted.

Frost Protection

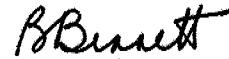
A 1.2 m earth cover is required for footings.

Slope Stability

Temporary excavations carried out for the footings may be constructed at 1H:1V or flatter to a maximum depth of 6.0 m. Excavations deeper than 6.0 m require a 2.0m mid-height bench.

At the approaches to the structure widening, topsoil and organic material should be removed for the plan limits of the approaches before placing the required fill.

If there any questions or comments regarding these recommendations, please advise.



Betty Bennett, P.Eng.
Sr. Foundation Eng. (Acting)