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CONT. No. 83-406

W. O. No.

STR. SITE No.

HWY. No. 401

LOCATION Truck Inspection Station

No. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 83 - 406

Ontario

Ministry of
Transportation and
Communications

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: 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 $\bar{N}$.

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. $\overline{CIU}$ = CONSOLIDATED ISOTROPIC UNDRAINED
TRIAXIAL WITH PORE PRESSURE MEASUREMENT
UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

S S	SPLIT SPOON
W S	WASH SAMPLE
S T	SLOTTED TUBE SAMPLE
B S	BLOCK SAMPLE
C S	CHUNK SAMPLE
T W	THINWALL OPEN
T P	THINWALL PISTON
O S	OSTERBERG SAMPLE
F S	FOIL SAMPLE
R C	ROCK CORE
P H	T.W. ADVANCED HYDRAULICALLY
P M	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
ω	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 = $w_L - w_p$
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{\%< 2\mu m \text{ Soil Fraction}}$
Om	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
$\sigma_1, \sigma_2, \sigma_3$	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:
ϕ' = 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
m_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
OCR	OVERCONSOLIDATION RATIO (OCR)

EXTENDED CASAGRANDE SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES

(EXCLUDING PARTICLES LARGER THAN 75 mm (3 INCHES) AND BASING FRACTIONS ON ESTIMATED MASS)

					GRP SYMP	TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS LARGER THAN 75 μm (No. 200 SIEVE SIZE)	GRAVELS (MORE THAN HALF OF COARSE FRACTION IS LARGER THAN 5 mm (NO. 4 SIEVE))	CLEAN GRAVELS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZE		GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
			PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES; LITTLE OR NO FINES
		GRAVEL WITH FINES (APPRECIABLE AMOUNT OF FINES)	NON-PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS (MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN 5 mm (NO. 4 SIEVE))	CLEAN SANDS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZES & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES		SW	WELL GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES
			PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING		SP	POORLY GRADED SANDS, GRAVELLY SANDS; LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	NON-PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS SMALLER THAN 75 μm (No. 200 SIEVE SIZE) (75 μm IS ABOUT THE SMALLEST PARTICLE VISIBLE TO THE NAKED EYE))	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN 425 μm (NO. 40 SIEVE SIZE)					
	SILTS AND CLAYS		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	
		LIQUID LIMIT LESS THAN 35%	NONE	QUICK	NONE	ML — INORGANIC SILTS & SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR
			MEDIUM TO HIGH	NONE TO VERY SLOW	MEDIUM	CL — CLAYEY SILTS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS
			SLIGHT TO MEDIUM	SLOW	SLIGHT	OL — ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS
		LIQUID LIMIT BETWEEN 35% AND 50%	NONE TO SLIGHT	SLOW TO QUICK	SLIGHT	MI — INORGANIC COMPRESSIBLE SILTS OR SILTY FINE SANDS WITH SOME CLAY OF MEDIUM PLASTICITY (BELOW A-LINE)
			HIGH	NONE	MEDIUM TO HIGH	CI — SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY
			SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	OI — ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY
		LIQUID LIMIT GREATER THAN 50%	SLIGHT TO MEDIUM	SLOW TO NONE	MEDIUM	MH — INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			HIGH TO VERY HIGH	NONE	HIGH	CH — CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS
			MEDIUM TO HIGH	NONE TO VERY SLOW	SLIGHT TO MEDIUM	OH — ORGANIC CLAYS OF HIGH PLASTICITY
HIGHLY ORGANIC SOILS			READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE			Pt — PEAT & OTHER HIGHLY ORGANIC SOILS

INFORMATION REQUIRED FOR DESCRIBING SOILS

GIVE TYPE, NAME, IF NECESSARY, INDICATE APPROX. % OF SAND & GRAVEL; MAX. SIZE; ANGULARITY, SURFACE CONDITION, & HARDNESS OF THE COARSE GRAINS; LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION, & SYMBOL IN PARENTHESIS.

FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITIONS & DRAINAGE CHARACTERISTICS.

GIVE TYPE, NAME, IF NECESSARY, INDICATE DEGREE & CHARACTER OF PLASTICITY, AMOUNT & MAXIMUM SIZE OF COARSE GRAINS, COLOUR IN WET CONDITION, ODOUR, IF ANY, LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION & SYMBOL IN PARENTHESIS.

FOR UNDISTURBED SOILS ADD INFORMATION ON STRUCTURE, STRATIFICATION, CONSISTENCY IN UNDISTURBED & REMOULDED STATES, MOISTURE & DRAINAGE CONDITIONS.

LABORATORY CLASSIFICATION CRITERIA

USE GRAIN SIZE CURVE IN IDENTIFYING THE FRACTIONS AS GIVEN UNDER FIELD IDENTIFICATION

DETERMINE PERCENTAGES OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75 μm (NO. 200 SIEVE)) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS:

LESS THAN 5% — GW, GP, SW, SP
MORE THAN 12% — GM, GC, SM, SC
5% TO 12% — BORDERLINE CASES REQ. USE OF DUAL SYMBOLS

$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4

$C_c = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN ONE AND 3

NOT MEETING ALL GRADATION REQUIREMENTS FOR GW

ATTERBERG LIMITS BELOW A-LINE, OR I_p LESS THAN 4 — ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS

ATTERBERG LIMITS ABOVE A-LINE WITH I_p GREATER THAN 7

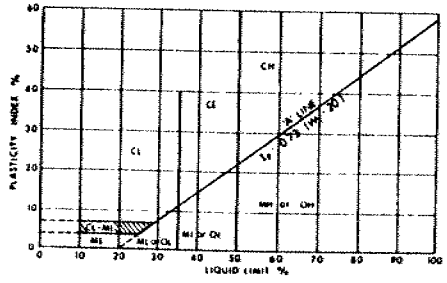
$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 6

$C_c = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN ONE AND 3

NOT MEETING ALL GRADATION REQUIREMENTS FOR SW

ATTERBERG LIMITS BELOW A-LINE OR I_p LESS THAN 4 — ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS

ATTERBERG LIMITS ABOVE A-LINE WITH I_p GREATER THAN 7



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS. FOR EXAMPLE GW-GC, WELL GRADED GRAVEL-SAND MIXTURE WITH CLAY BINDER

FOUNDATION INVESTIGATION REPORT

For

Truck Inspection Station
W.P. 2508-77-02, Hwy. 401 WBL
W.P. 2509-77-02, Hwy. 401 EBL
District 6, Toronto

INTRODUCTION

This report presents the subsurface conditions at the above mentioned site as revealed by our foundation investigation. Fieldwork was carried out on May 16 and 17, 1979 and consisted of six sampled boreholes put down by means of an auger machine which was equipped with 3¼" I.D. hollow stem augers. The depth of boring ranged from 20 feet to 35 feet below existing ground surface. Disturbed samples were obtained by means of a split spoon sampler which was driven into the ground in accordance with the specifications for Standard Penetration Test.

SITE AND GEOLOGY

The site is situated within the right-of-way of Hwy. 401, approximately halfway between Fifth Line and Sixth Line in the Regional Municipality of Halton.

At this location, Hwy. 401 is a four lane divided highway with a 50 foot wide median. At the time of investigation, the roadside ditches contained approximately one foot of water. The surrounding terrain is gently undulating with most of the land being used for farming purposes.

Physiographically, the site is in a region known as the Peel Plain. The underlying geological material in this region is a till containing large amounts of Palaeozoic shale and limestone. In places this has been modified by a veneer of clay.

SUBSURFACE CONDITIONS

General

The site is located in an area of bevelled till plain. Subsurface conditions across the site were found to be quite uniform. Underneath a thin veneer of topsoil, the overburden consists of an eight to 10 foot thick layer of very stiff silty clay which is followed by a stratum of very stiff to hard cohesive glacial till. The glacial till stratum was not fully penetrated but was investigated to a maximum depth of about 35 feet below ground surface.

The location and elevation of the borings are shown in Drawing No. 25087702-A which also includes two subsoil stratigraphical sections. A description of the subsoil and groundwater conditions is as follows.

Silty Clay

Underneath a one foot cover of topsoil is a layer of silty clay which has a thickness of about 8 to 10 feet. The silty clay is brown in colour with occasional rusty stains and partings and has atmost a trace of gravel. A typical grain size distribution curve of the silty clay is shown on Figure 1. The identity indices of this layer are summarized in the following tabular form.

Identity Indices		Range
Natural Moisture Content	(W%)	16-30
Plastic Limit	(W_P%)	16-30
Liquid Limit	(W_L%)	30-43

The results are also plotted on a Plasticity Chart, Figure 2, and indicate that the silty clay is inorganic and of intermediate plasticity. It is desiccated with a relatively low natural moisture content. Based on the 'N' values which range from 10 to 25 blows/foot, it is estimated that the silty clay has a very stiff consistency.

Glacial Till

Underlying the silty clay layer is a stratum of glacial till which is a heterogeneous mixture of clayey silt, some sand and gravel. This deposit was not fully penetrated but was explored to a depth of 35 feet below ground surface. Within this glacial till stratum, occasional sand seams and shale fragments were also encountered. A typical grain

size distribution curve of the glacial till is shown on Figure 1. Engineering identity indices of the glacial till are tabulated below.

Identity Indices		Range
Natural Moisture Content	(W%)	8-16
Plastic Limit	(W_P%)	10-12
Liquid Limit	(W_L%)	21-30

A plot of the Atterberg Limits on the Plasticity Chart indicates that the glacial till has a low plasticity. The 'N' values vary from 11 blows/foot to over 100 blows/foot, generally increasing with depth. Based on this it is inferred that the glacial till has a consistency which varies from very stiff to hard with depth.

Groundwater Conditions

The groundwater level was observed by measuring the water level in the open boreholes. The groundwater level was found to vary from two to 11 feet below ground surface corresponding to an approximate elevation of 637 and 626. The higher groundwater levels were believed to be due to infiltration of surface water into the boreholes and therefore are probably not representative.

Peter J. Stuart, P. Eng.
Foundations Engineer

M. Devata, P. Eng.
Senior Foundations Engineer

January 6, 1981.

RECORD OF BOREHOLE No 1

2508-77-02
W P 2509-77-02 LOCATION Coords. N 15 826 700; E 908 335 ORIGINATED BY BL
DIST 6 HWY 401 BOREHOLE TYPE 3¼" HSA COMPILED BY BL
DATUM Geodetic DATE May 16, 1979 CHECKED BY W.J.

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ 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
640.5	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	15		640		○ — ●		0 10 (90)
630.5											
10.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey, Very Stiff to Hard Occassional Sand Seams and Shale Fragments		2	SS	27		630				
			3	SS	11						
			4	SS	62		620		○ — ●		9 29 (62)
			5	SS	48						
			6	SS	48		610				
604.0			7	SS	60/3"						
36.5	End Note: The last 5 feet of the borehole was advanced with the use of water and a tri-cone. As a result, the ground-water level was not established.										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 662; E 908 325 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3¼" ϕ HSA COMPILED BY BL

DATUM Geodetic DATE May 16, 1979 CHECKED BY N.J.

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ 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
638.8	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	10	▼					
			2	SS	16						
630.3			3	SS	14		630				
8.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey, Very Stiff to Hard Occasional Shale Fragments and Sand Seams		4	SS	11						
			5	SS	35		620				
			6	SS	41						
612.3			7	SS	66						
26.5	End										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No 3

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 722 E 908 375 ORIGINATED BY BL
DIST 6 HWY 401 BOREHOLE TYPE 3¼" Hollow Stem Augers COMPILED BY BL
DATUM Geodetic DATE May 16, 1979 CHECKED BY W.D.J.

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
637.8	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	19						
629.8			2	SS	10						
			3	SS	15		630				
8.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel Grey, Very Stiff to Hard, Occasional Shale Fragments and Sand Seams		4	SS	21	▼					
			5	SS	23		620				
			6	SS	47						
621.3			7	SS	60						
26.5	End										

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 435; E 908 458 ORIGINATED BY BL
DIST 6 HWY 401 BOREHOLE TYPE 3¼" ϕ HSA COMPILED BY BL
DATUM Geodetic DATE May 17, 1979 CHECKED BY D.J.

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 (○ 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
636.5											
0.0	Silty Clay Brown Very Stiff		1	SS	21						
			2	SS	26		630				
629.8			3	SS	31						
8.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey Very Stiff to Hard Occasional Shale Fragments & Sand Seams		4	SS	20						
			5	SS	29		620				
615.0			6	SS	40/5"	5"					
21.5	End										
	Note: Borehole was in a ditch inundated with water. As a result, the ground-water level was not established.										

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 446; E 908 497 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3¼" ϕ HSA COMPILED BY BL

DATUM Geodetic DATE May 17, 1979 CHECKED BY e.l.

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT W_p / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
637.9	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	23		630				
627.9											
10.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey Very Stiff to Hard Occasional Shale Fragments and Sand Seams		2	SS	21				W		
			3	SS	40		620				
			4	SS	81						
			5	SS	55		610				
605.4			6	SS	90/4"						
31.5	End Note: The last 5 feet of the borehole was advanced with the use of water and a tri-cone. As a result, the groundwater level was not established.										

+3, ×5 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

W P 2508-77-02
2509-77-02
LOCATION Coords. N 15 826 493; E 908 498
ORIGINATED BY BL

DIST 6 HWY 401
BOREHOLE TYPE 3½" ϕ HSA
COMPILED BY BL

DATUM Geodetic
DATE May 17, 1979
CHECKED BY

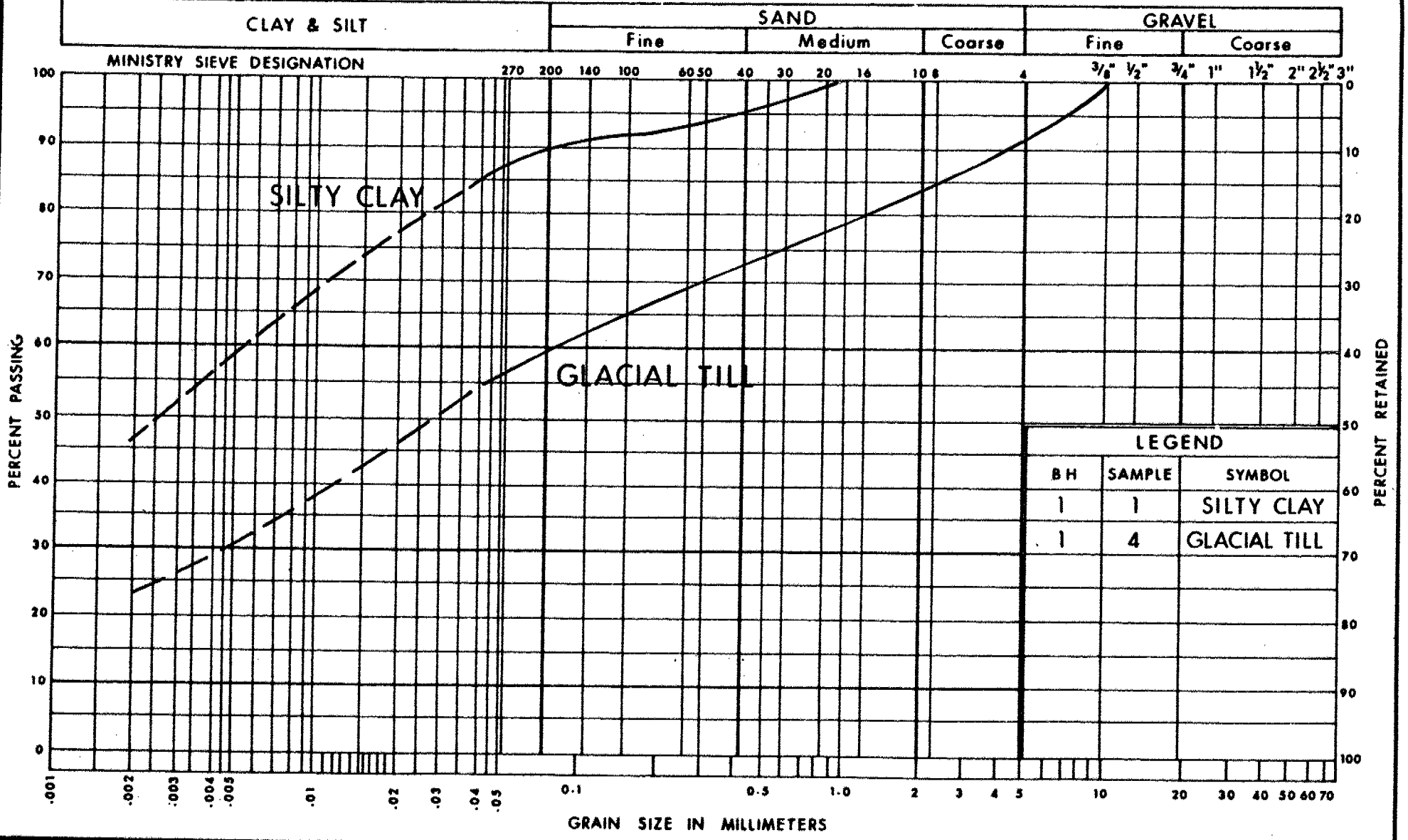
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
636.6	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	22	▼					
628.1			2	SS	23		630				
8.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey Very Stiff to Hard Occasional Sand Seams and Shale Fragments		3	SS	20						
615.1			4	SS	41		620				
			5	SS	51						
21.5	End										

+3, ×5 : Numbers refer to Sensitivity

15 20/10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

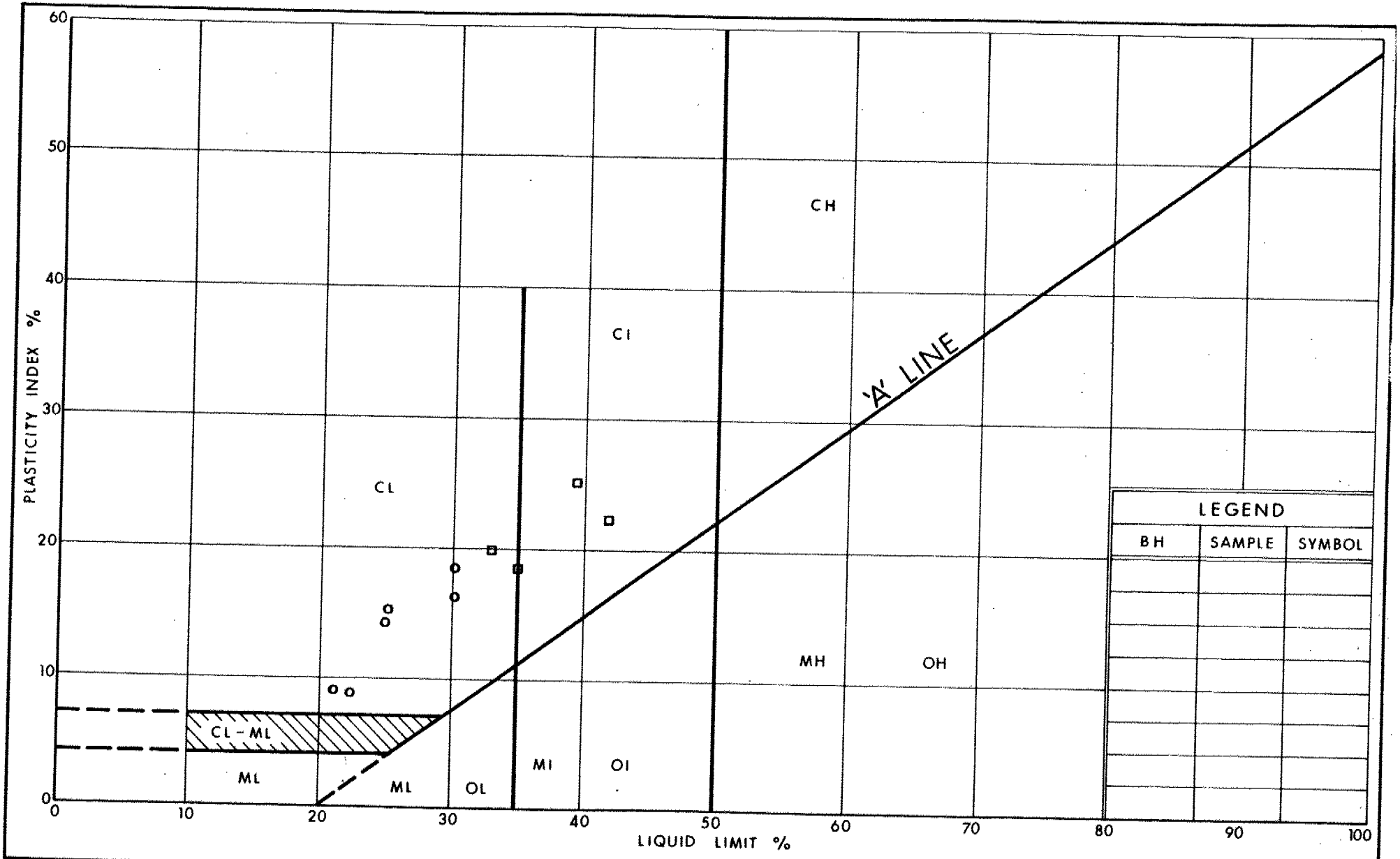
UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation and Communications
Ontario

GRAIN SIZE DISTRIBUTION
SILTY CLAY &
GLACIAL TILL

FIG No 1
W P 2508-77-02
2509-77-02



Ministry of Transportation and Communications
Ontario

PLASTICITY CHART

SILTY CLAY ▫
GLACIAL TILL o

FIG No 2
W P 2508-77-02
2509-77-02

CONT No
WP No 2508-77-01

GRADING, PAVING AND DRAINAGE

SHEET 6

CON VI
LOT 15

APPROX. LOCATION OF HEADER PIPE

3-4" STEEL PIPE FOR PROTECTION
FOR DETAILS SEE DWG.#9

3'x6'x4" CONCRETE PAD
FOR TWIN TELEPHONE BOOTHS
FOR DETAILS SEE DWG.#9

DD-602-L

DD-601-B

9" CONCRETE PAD

DD-905-A
DD-905-C

DD-701-A
T/G 643.09
INV. 638.09

DD-905-B
DD-905-C

143 A

EX-STING

CONCRETE BARRIER
FOR DETAILS SEE DWG.#9

EXISTING 24" STORM SEWER

DD-702-A 42" R.P. SEWER
T/G 643.20
INV. 638.21
143 B

PARKING

BUILDING SITE

DITCH

6' PERF

5+00

15+76 SCALE

AREA NOT TO BE PAVED

LEVELLING PAD

147 B
DD-702-A
T/G 641.70
INV. 636.25

DD-701-A
T/G 642.88
INV. 635.85
147 A

10'R.P. SEWER

20+00

10+00

9+25

21+25

50' PERIMETER

C.S.W.
80'

EXIST. NO. ELECTRICAL MANHOLE

DD-909-A

WESTBOUND

205+00

CAH 401

210+00

200+00

212+00

EASTBOUND

DD-909-A

EXIST. NO. ELECTRICAL MANHOLE

C.S.W.
80'

50' PERIMETER

9+50

21+50

10+00

AREA NOT TO BE PAVED
LEVELLING PAD

13+40

13+80

14+80

15+00

20+00

DITCH

6' PERF

PARKING

BUILDING SITE

DD-702-A
T/G 642.50
INV. 635.87

12" R.P. SEWER
24'

145 A

145 B

DD-701-A
T/G 644.74
INV. 635.75

DD-905-A
DD-905-C

DD-905-B
DD-905-C

74

9" CONCRETE PAD

DD-601-B

DD-602-L

3'x6'x4" CONCRETE PAD
FOR TWIN TELEPHONE BOOTHS
FOR DETAILS SEE DWG.#9

3-4" STEEL PIPE FOR PROTECTION
FOR DETAILS SEE DWG.#9

141 B
DD-701-A
T/G 644.38
INV. 637.74

141 A

DD-702-A
T/G 643.00
INV. 638.14

12" R.P. SEWER
80'

EXISTING 24" STORM SEWER

CONCRETE BARRIER
FOR DETAILS SEE DWG.#9

143 C
EXISTING

LOT 14
CON VI

644
14
10'

SCALE
20' 0 40'

Ontario

Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 2508-77-02
2509-77-02 DIST 6

HWY 401 STR SITE N/A

Truck Inspection Station

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SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	79 06 29	N.A
TUBES	—	—
ROCK CORES	—	—

Cont 83-406

GEOCRES 30M12-139

DATE JUN 05 1979

FOUNDATION INVESTIGATION REPORT

For

Truck Inspection Station
W.P. 2508-77-02, Hwy. 401 WBL
W.P. 2509-77-02, Hwy. 401 EBL
District 6, Toronto

INTRODUCTION

This report presents the subsurface conditions at the above mentioned site as revealed by our foundation investigation. Fieldwork was carried out on May 16, 1979 and May 17, 1979 consisting of six sampled boreholes put down by means of an auger machine which was equipped with 3¼" I.D. hollow stem augers. The depth of boring ranged from 20 feet to 35 feet below existing ground surface. Disturbed samples were obtained by means of a split spoon sampler which was driven into the ground in accordance with the specifications for Standard Penetration Test.

Also contained in this report are recommendations for the design and construction of the truck inspection stations.

SITE AND GEOLOGY

The site is situated within the right-of-way of Hwy. 401, approximately halfway between Fifth Line and Sixth Line in the Regional Municipality of Halton.

At this location, Hwy. 401 is a four lane divided highway with a 50 foot wide median. At the time of investigation, the roadside ditches were inundated under approximately one foot of water. The surrounding terrain is gently undulating with most of the land being used for farming purposes.

Physiographically, the site is in a region known as the Peel Plain. The underlying geological material is a till containing large amounts of Palaeozoic shale and limestone. In places this has been modified by a veneer of clay.

SUBSURFACE CONDITIONS

General

The site is located in a bevelled till plain. The subsurface conditions across the site were found to be quite uniform. Underneath a thin veneer of topsoil, the overburden consists of an eight to 10 foot thick layer of very stiff silty clay which is followed by a stratum of very stiff to hard glacial till. The glacial till stratum was not fully penetrated but was investigated to a maximum depth of about 35 feet below ground surface.

The location and elevation of the borings are shown in Drawing No. 25087702-A which also includes two subsoil stratigraphical sections. A description of the subsoil and groundwater conditions is as follows.

Silty Clay

Underneath a one foot cover of topsoil is a layer of silty clay which has a thickness of about eight to 10 feet. The silty clay is brown in colour with occasional rusty stains and partings and has at most a trace of gravel. A typical grain size distribution curve of the silty clay is shown on Figure 1. The identity indices of the cohesive subsoil are summarized in the following tabular form.

Identity Indices		Range
Natural Moisture Content	(W %)	16-30
Plastic Limit	(W_P %)	16-30
Liquid Limit	(W_L %)	30-43

The results are also plotted on a Plasticity Chart, Figure 2, which indicate that the silty clay is inorganic and of intermediate plasticity. The cohesive subsoil is desiccated with a relatively low natural moisture content. Based on the 'N' values which range from 10 to 25 blows/foot, it is estimated that the silty clay has a very stiff consistency.

Glacial Till

Underlying the silty clay layer is a stratum of glacial till which is a heterogeneous mixture of clayey silt, some sand and gravel.

This deposit was not fully penetrated but was explored to a depth of 35 feet below ground surface. Within this glacial till stratum, occasional sand seams and shale fragments were also encountered. A typical grain size distribution curve of the glacial till is shown on Figure 1. Engineering identity indices of the subsoil are tabulated below.

Identity Indices		Range
Natural Moisture Content	(W %)	8-16
Plastic Limit	(W_P%)	10-12
Liquid Limit	(W_L%)	21-30

A plot of the Atterberg Limits on the Plasticity Chart indicates that the glacial till has a slight to low plasticity. The 'N' values vary from 11 blows/foot to over 100 blows/foot, generally increasing with depth. Based on this it is inferred that the glacial till has a consistency which varies from very stiff to hard with depth.

Groundwater Conditions

The groundwater level was observed by measuring the water level in the open boreholes. The groundwater level was found to vary from two to 11 feet below ground surface corresponding to an approximate elevation of 637 and 626. The higher groundwater levels were believed to be due to infiltration of surface water into the boreholes, therefore, they were probably not representative.

RECOMMENDATIONS

It is proposed to construct two truck inspection stations, one for the WBL and one for the EBL. Each inspection complex will consist of a scale house, a scale pit and two 75 foot long approach slabs. According to the preliminary information, the approach slabs will be maintained at approximately the same elevation as the pavement of Hwy. 401. Further, the scale pit may be eight feet deep and the scalehouse may have a 10 foot deep basement. Our recommendations for the design and construction of the proposed inspection complex are as follows.

Approach Embankment

The elevation of the pavement of Hwy. 401 is at 644.5± and that of the general ground surface at the approach locations is at 637 or 638 approximately. Therefore, embankments in the order of 6 to 8 feet high will be required. Because the subsoil is competent and has been preconsolidated, the embankments can be constructed with standard 2:1 sideslopes and no appreciable post-construction settlements in the underlying subsoil are anticipated. Since the scale pit platform and the approaches must not deviate in elevation by more than 1/4", we recommend that the approach embankments be constructed with well compacted granular type of material which should be drained with a subdrain system. Further, all topsoil within the plan limits of the approaches should be completely removed prior to placing the granular fill.

Scale Pit

The scale pit should be founded at or below elevation 633. If necessary, mass concrete can be used to bring it up to the design formation level of the pit. A bearing pressure of up to 2 1/2 tsf can be assumed for design purposes. Due to the preconsolidated nature of the subsoil, settlements caused by the recommended design bearing pressure will be negligible and of a recompression nature. The earth pressure acting on the walls of the pit due to the compacted approach fills should be assumed to be equal to an equivalent fluid pressure of 65 psf/foot. It should be noted that no heavy vibratory compacting equipment shall be permitted

within 10 feet of the finished walls of the pit. Compaction in this area should be done with light, hand operated equipment.

Scale House

The scale house with a basement should also be founded at or below elevation 633 and can be designed with a bearing pressure of up to 2½ tsf. Since most of the basement will be situated in the cohesive subsoil, the earth pressure acting on the basement walls can be assumed to be equal to an equivalent fluid pressure of 35 psf/ft.

Other Considerations

If the approach embankments are constructed with granular material which is drained with a subdrain system, the approach slabs should not be subjected to frost heaves.

If the scale pits and the scale houses are founded at or below elevation 633, they will have sufficient cover for frost actions. Otherwise, a minimum four feet of earth cover should be provided for the scale pits and scale houses.

Because the subsoil is cohesive and relatively impervious, no major dewatering problems are anticipated. Any infiltration of water into the excavation can be removed by sump pump method.

B. Ly

REGISTERED PROFESSIONAL ENGINEER
B-L. LY
PROVINCE OF ONTARIO

B. Ly, P. Eng.
Senior Engineer

M. Devata

M. Devata, P. Eng.
Supervising Engineer

May, 1979

APPENDIX

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 700; E 908 335 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3½" HSA COMPILED BY BL

DATUM Geodetic DATE May 16, 1979 CHECKED BY W.J.

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 (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, x LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
640.5	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	15		640		o—⊢		0 10 (90)
630.6			2	SS	27		630				
10.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey, Very Stiff to Hard Occasional Sand Seams and Shale Fragments		3	SS	11						
			4	SS	62		620		o⊢		9 29 (62)
			5	SS	48						
			6	SS	48		610				
604.0			7	SS	60/3"						
36.5	End Note: The last 5 feet of the borehole was advanced with the use of water and a tri-cone. As a result, the ground-water level was not established.										

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to Sensitivity

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

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 662; E 908 325 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3½" ϕ HSA COMPILED BY BL

DATUM Geodetic DATE May 16, 1979 CHECKED BY N.J.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ 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						
638.8	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	10	▼					
			2	SS	16						
630.3			3	SS	14		630				
8.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey, Very Stiff to Hard Occasional Shale Fragments and Sand Seams		4	SS	11						
			5	SS	35		620				
			6	SS	41						
612.3			7	SS	66						
26.5	End										

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

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

W P 2508-77-02 / 2509-77-02 LOCATION Toronto N 15 826 722 E 908 375 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3¼" Hollow Stem Augers COMPILED BY BL

DATUM Geodetic DATE May 16, 1979 CHECKED BY W.J.

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 (○ 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
637.8	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	19						
			2	SS	10						
629.8							630				
8.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel Grey, Very Stiff to Hard, Occasional Shale Fragments and Sand Seams		3	SS	15	▼					
			4	SS	21						
			5	SS	23		620				
			6	SS	47						
611.3			7	SS	60						
26.5	End										

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 435; E 908 458 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3½" ϕ HSA COMPILED BY BL

DATUM Geodetic DATE May 17, 1979 CHECKED BY WJ.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — 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						
636.5											
0.0	Silty Clay Brown Very Stiff		1	SS	21						
			2	SS	26		630				
628.0 629.8			3	SS	31						
8.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey Very Stiff to Hard Occasional Shale Fragments & Sand Seams		4	SS	20						
			5	SS	29		620				
615.0			6	SS	40/ 5"						
21.5	End Note: Borehole was in a ditch inundated with water. As a result, the ground-water level was not established.										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

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

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

W P 2508-77-02 / 2509-77-02 LOCATION Coords. N 15 826 446; E 908 497 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3½" ϕ HSA COMPILED BY BL

DATUM Geodetic DATE May 17, 1979 CHECKED BY e.l.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (o 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						
637.9	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	23		630				
627.9											
10.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey Very Stiff to Hard Occasional Shale Fragments and Sand Seams		2	SS	21		620				
			3	SS	40						
			4	SS	81						
			5	SS	55		610				
606.4			6	SS	90/4"						
31.5	End Note: The last 5 feet of the borehole was advanced with the use of water and a tri-cone. As a result, the ground-water level was not established.										

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6

W P 2508-77-[illegible] / 2509-77-[illegible] LOCATION Coords. N 15 826 493; E 908 498 ORIGINATED BY BL

DIST 6 HWY 401 BOREHOLE TYPE 3¼" ϕ HSA COMPILED BY BL

DATUM Geodetic DATE May 17, 1979 CHECKED BY [illegible]

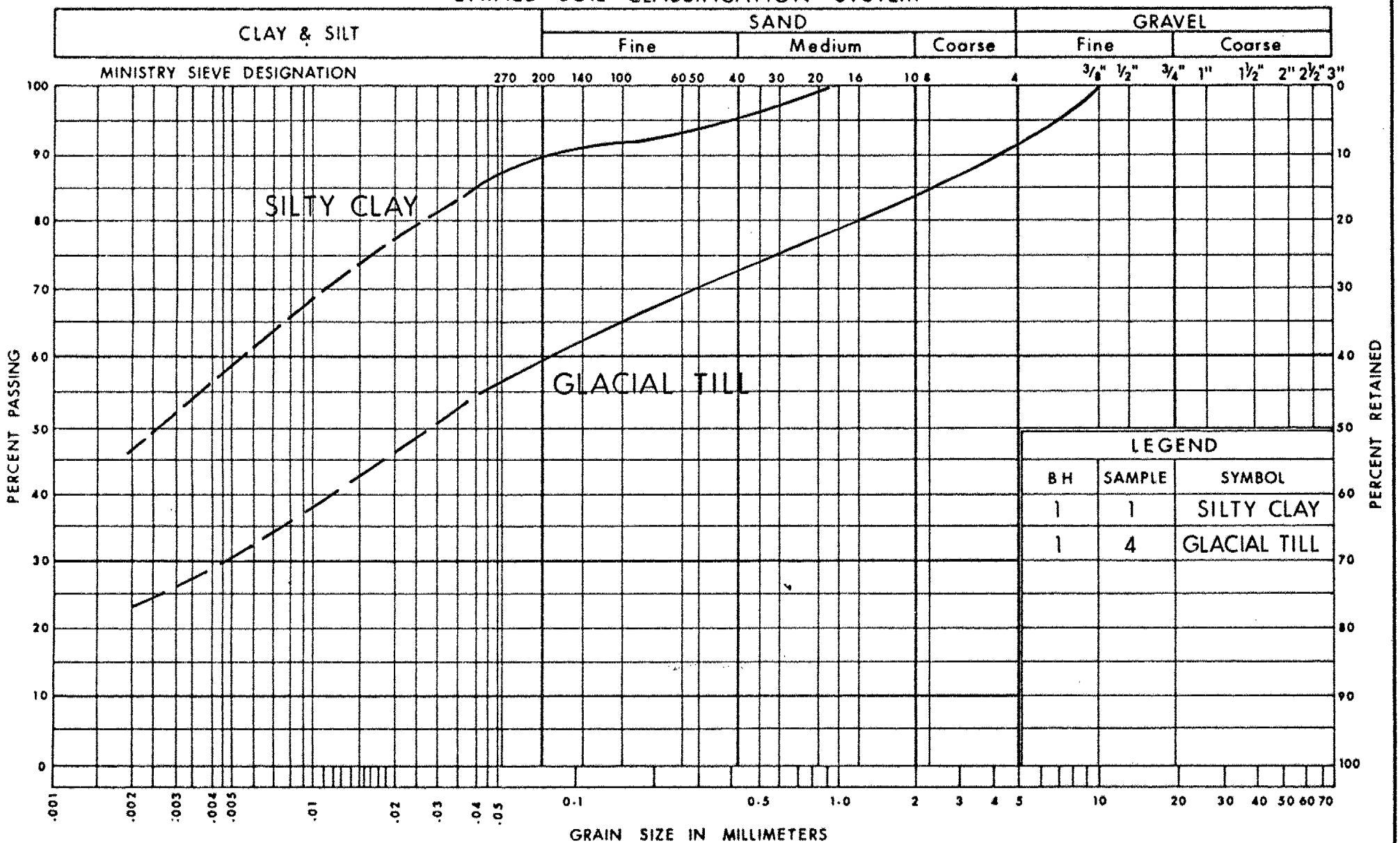
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
636.6	Ground Surface										
0.0	Silty Clay Brown Very Stiff		1	SS	22	▼					
			2	SS	25		630				
628.1											
8.5	Glacial Till Heterogeneous Mixture of Clayey Silt, Some Sand and Gravel, Grey Very Stiff to Hard Occasional Sand Seams and Shale Fragments		3	SS	20						
			4	SS	41		620				
615.1			5	SS	51						
21.5	End										

+³, ×⁵ : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM

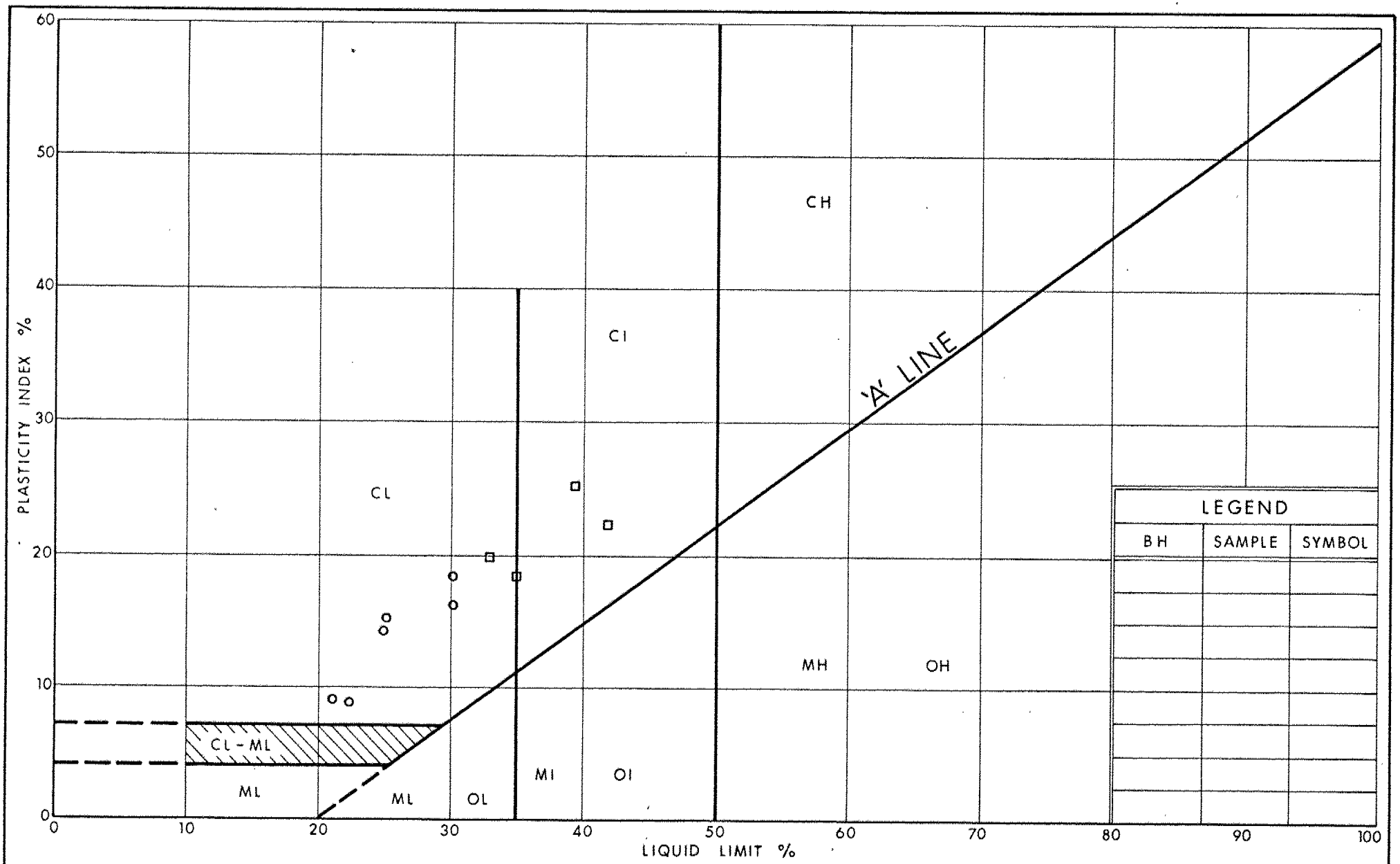


LEGEND		
BH	SAMPLE	SYMBOL
1	1	SILTY CLAY
1	4	GLACIAL TILL

Ministry of Transportation and Communications
Ontario

GRAIN SIZE DISTRIBUTION
SILTY CLAY &
GLACIAL TILL

FIG No 1
W P 2508-77-02
2509-77-02



Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

PLASTICITY CHART

SILTY CLAY ▫
GLACIAL TILL o

FIG No 2
W P 2508-77-02
2509-77-02

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 $\overline{N}$.

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. $\overline{CIU}$ = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT

UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

S S	SPLIT SPOON
W S	WASH SAMPLE
S T	SLOTTED TUBE SAMPLE
B S	BLOCK SAMPLE
C S	CHUNK SAMPLE
T W	THINWALL OPEN
T P	THINWALL PISTON
O S	OSTERBERG SAMPLE
F S	FOIL SAMPLE
R C	ROCK CORE
P H	T.W. ADVANCED HYDRAULICALLY
P M	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
ω	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 = $w_L - w_p$
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{\%\text{ of } 2\mu m \text{ Soil Fraction}}$
Om	ORGANIC MATTER CONTENT
S_r	DEGREE OF SATURATION
S	SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

$\varnothing$	ANGLE OF SHEARING RESISTANCE
τ_f	PEAK SHEAR STRENGTH
τ_R	RESIDUAL SHEAR STRENGTH
c	COHESION INTERCEPT
$\sigma_1, \sigma_2, \sigma_3$	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: $\varnothing'$ = EFFECTIVE ANGLE OF SHEARING RESISTANCE; σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

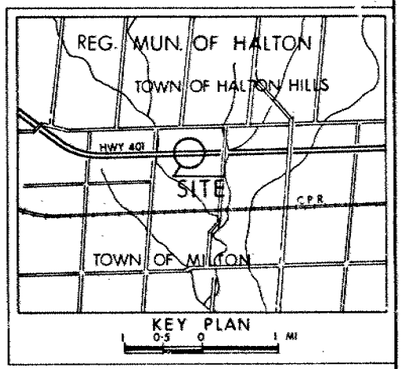
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
j	SEEPAGE FORCE PER UNIT VOLUME
η	COEFFICIENT OF VISCOSITY
k	COEFFICIENT OF HYDRAULIC CONDUCTIVITY
k_h	k IN HORIZONTAL DIRECTION
k_v	k IN VERTICAL DIRECTION
m_v	COEFFICIENT OF VOLUME CHANGE
c_v	COEFFICIENT OF CONSOLIDATION
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)

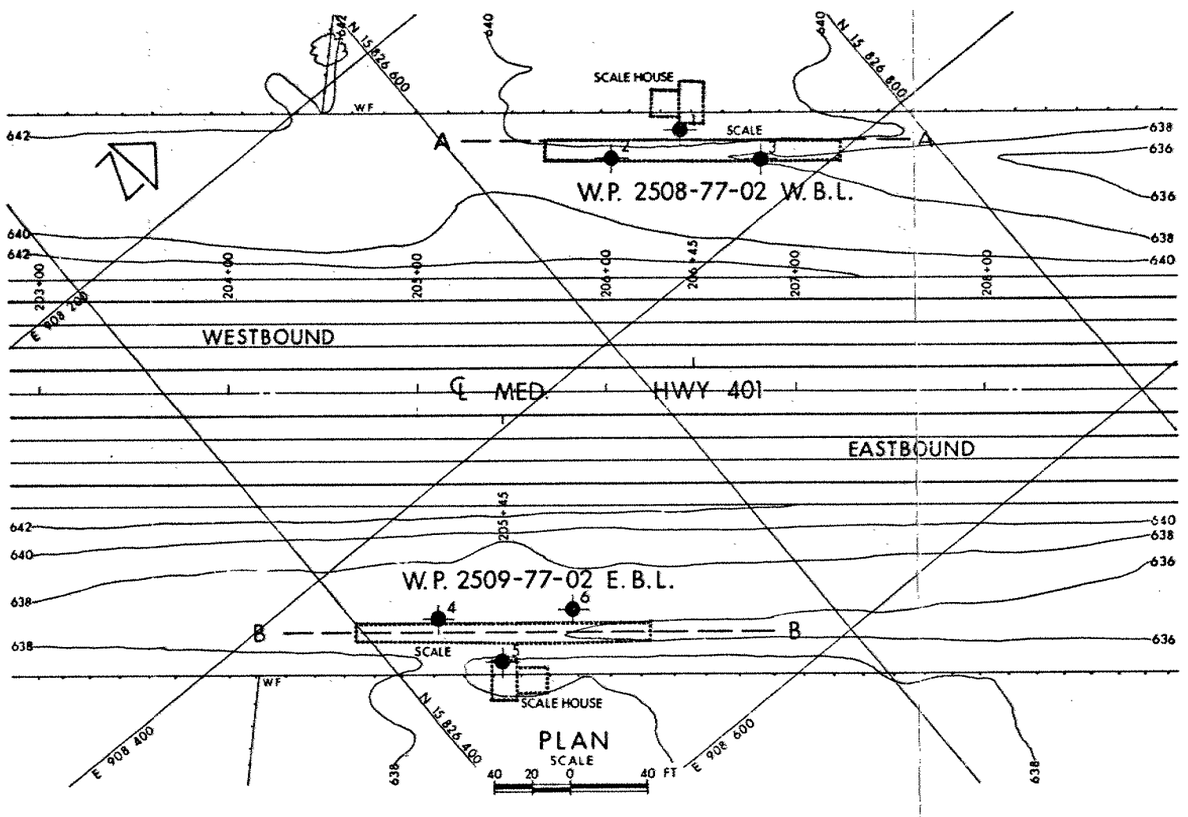
CONT No
WP No 2508-77-02

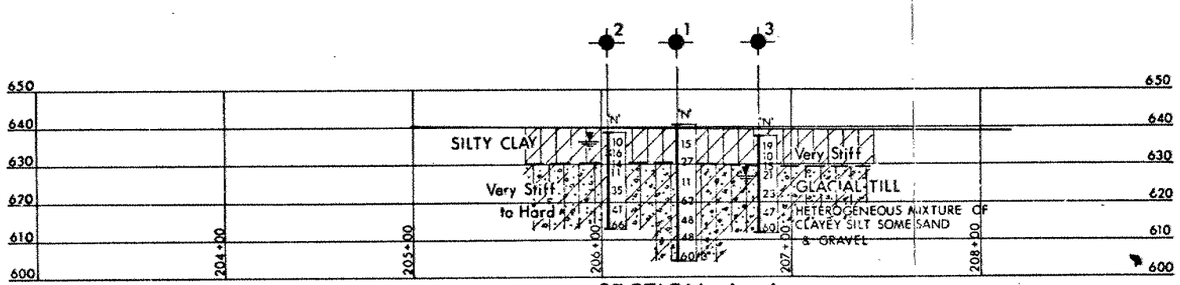
INSPECTION STATIONS

BORE HOLE LOCATIONS & SOIL STRATA

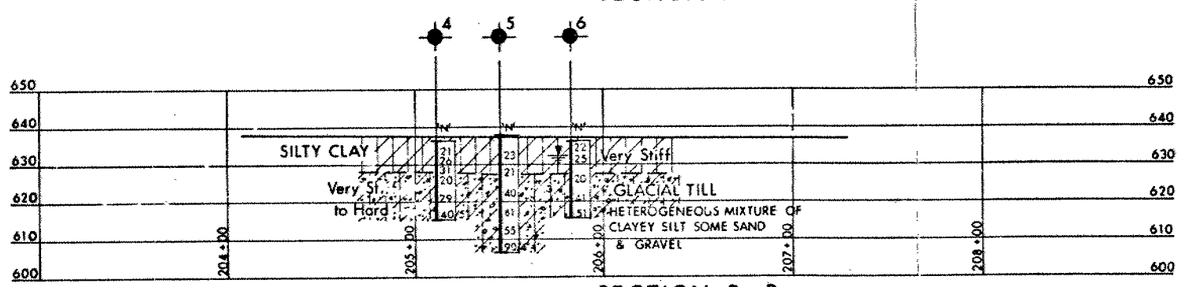
SHEET







SECTION A-A



SECTION B-B

SCALE
HOR 40 20 0 40 FT
VERT 20 10 0 20

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation MAY 1979
  NO WL Established BH No 1, 4, 5

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	640·5	15 826 700	908 335
2	638·8	15 826 662	908 325
3	637·8	15 826 722	908 375
4	636·5	15 826 435	908 458
5	637·9	15 826 446	908 497
6	636·6	15 826 493	908 498

-NOTE-

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

B-L LY

REVISIONS

DATE	BY	DESCRIPTION

HWY No 401			DIST 6
SUBMD B L	CHECKED R L	DATE 79 05 29	SITE
DRAWN OL J	CHECKED / APPROVED		DWG 25087702-A

WEST BOUND – WEIGH SCALE

RECORD OF BOREHOLE No 1

W P 2508-77-02 LOCATION Co-ords. N 15,826,790 E 908,398 ORIGINATED BY DW

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (HS) COMPILED BY JC

DATUM Geodetic DATE 84 08 28 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
645.0	Pavement Level						
0.0	Asphalt						
1.0	Layers of Silty Clay, Silt Sand and Gravel Very Stiff/Dense Fill Material		1	SS	34		640
			2	SS	23		
639.4			3	SS	21		
5.6			4	SS	13		
	Silty Clay traces of sand and gravel Firm to Stiff		5	SS	7		
			6	TW	PH		
630.5			7	SS	16		630
14.5	Heterogeneous Mixture of Gravel, Sand, Silt and Clay Very Stiff to Hard Glacial Till		8	SS	21		
			9	SS	17		
			10	SS	17		620
			11	SS	24		
			12	SS	22		
			13	SS	34	▼	
			14	SS	50		
611.0			15	SS	46		610
34.0	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT — 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

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

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

OFFICE REPORT ON SOIL EXPLORATION

WEST BOUND - SORTER SCALE

RECORD OF BOREHOLE No 2

W P 2508-77-02 LOCATION Co-ords. N 15,827,377 E 908,919 ORIGINATED BY DW

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (HS) COMPILED BY JC

DATUM Geodetic DATE 84 08 29 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
638.4	Pavement Level						
0.0	Asphalt						
1.0	Layers of Silty Clay, Silt, Sand and Gravel Very Stiff/Dense Fill Material		1	SS	43		
			2	SS	23		
632.9			3	SS	34		
5.5	Silty Clay traces of sand and gravel Stiff		4	SS	21		
			5	SS	13		630
			6	SS	13		
			7	SS	11		
622.9							
15.5	Heterogeneous Mixture of Gravel, Sand Silt and Clay Very Stiff to Hard		8	SS	17		620
			9	SS	43		
			10	SS	50		
	Glacial Till						
609.4			11	SS	80		610
29.0	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT — 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

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

20
15 ⊹ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

WEST BOUND - SORTER SCALE

RECORD OF BOREHOLE No 3

W P 2508-77-02 LOCATION Co-ords. N 15,827,307 E 908,845 ORIGINATED BY DW

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (HS) COMPILED BY JC

DATUM Geodetic DATE 84 08 29 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
639.0	Pavement Level						
0.0	Asphalt					*	
1.0	Layers of Silty Clay Silt, Sand and Gravel Stiff/Dense		1	SS	44		
			2	SS	22		
	Fill Material		3	SS	10		
632.0							
7.0	Silty Clay traces of sand and gravel Stiff		4	SS	15		630
			5	SS	14		
			6	SS	9		
624.5							
14.5	Heterogeneous Mixture of Gravel, Sand, Silt and Clay Firm to Hard Glacial Till		7	SS	8		
			8	SS	12		620
			9	TW	PH		
			10	SS	48		
610.0			11	SS	60		
29.0	End of Borehole						610

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

* Water Level Not Observed

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

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

OFFICE REPORT ON SOIL EXPLORATION

WEST BOUND – WEIGH SCALE

RECORD OF BOREHOLE No 4

W P 2508-77-02 LOCATION Co-ords. N 15,826,686 E 908,316 ORIGINATED BY DW

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (HS) COMPILED BY JC

DATUM Geodetic DATE 84 08 29 & 84 08 30 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
645.0	Ground Level						
0.0	Layers of Silty Clay, Silt, Sand and Gravel Stiff/Compact Fill Material		1	SS	16		
			2	SS	18		
			3	SS	22		640
638.5							
6.5	Silty Clay traces of sand and gravel Firm		4	SS	6		
			5	SS	9	▼	
			6	SS	7		
630.5							630
14.5	Heterogeneous Mixture of Gravel, Sand, Silt and Clay Very Stiff to Hard		7	SS	37		
			8	SS	19		
			9	SS	27		
			10	SS	28		620
			11	SS	47		
	Glacial Till		12	SS	91		
611.0			13	SS	64		
34.0	End of Borehole						610

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT W_P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

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

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

OFFICE REPORT ON SOIL EXPLORATION

EAST BOUND - WEIGH SCALE

RECORD OF BOREHOLE No 5

W P 2509-77-02 LOCATION Co-ords. N 15,826,482 E 908,529 ORIGINATED BY DW

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (HS) COMPILED BY JC

DATUM Geodetic DATE 84 08 30 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
645.0	Ground Level						
0.0	Layers of Silty Clay Silt, Sand and Gravel Stiff/Compact		1	SS	16	*	640
			2	SS	16		
			3	SS	15		
			4	SS	21		
	traces of organics		5	SS	11		
635.5	Fill Material						
9.5	Silty Clay traces of sand and gravel Stiff to Very Stiff		6	SS	12		630
			7	SS	25		
			8	SS	22		
			9	SS	15		
625.5							
19.5	Heterogeneous Mixture of Gravel, Sand Silt and Clay Very Stiff to Hard Glacial Till		10	SS	16		620
			11	SS	28		
			12	SS	43		
			13	SS	47		
611.0			14	SS	86/ 11 in.		
34.0	End of Borehole * Water Level Not Observed						610

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT Wp | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

OFFICE REPORT ON SOIL EXPLORATION

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

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

EAST BOUND - WEIGH SCALE

RECORD OF BOREHOLE No 6

W P 2509-77-02 LOCATION Co-ords. N 15,826,363 E 908,431 ORIGINATED BY TM

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (S.S.) COMPILED BY JC

DATUM Geodetic DATE 84 08 30 CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
645.0	*Pavement Level						
0.0	Layers of Silty Clay Silt, Sand and Gravel Stiff/Dense		1	SS	57	**	
			2	SS	47		
			3	SS	71		
			4	SS	40		640
	trace of organics		5	SS	13		
635.5	Fill Material						
9.5	Silty Clay traces of sand and gravel Very Stiff to Hard		6	SS	19		
			7	SS	21		
			8	SS	38		630
628.0							
17.0	Heterogeneous Mixture of Gravel, Sand, Silt and Clay Hard Glacial Till		9	SS	43		
			10	SS	32		
			11	SS	33		
			12	SS	70		620
616.5			13	SS	63/5 in.		
28.5	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT Wp | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

* 3" of Asphalt

** Water Level Not Observed

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

20
15 ⊹ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

EAST BOUND - SORTER SCALE

RECORD OF BOREHOLE No 7

W P 2509-77-02 LOCATION Co-ords. N 15,825,836 E 907,975 ORIGINATED BY TM

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (SS) COMPILED BY JC

DATUM Geodetic DATE 84 08 31 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
647.5	Ground Level						
0.0	Fill Material Layers (Zones) of Silty Clay, Silt, Sand and Gravel Very Stiff/Dense		1	SS	35	*	
			2	SS	18		
			3	SS	30		
			4	SS	69		
	Mixture of Asphalt Sand & Gravel						
639.5			5	SS	60/ 5 in.		640
8.0	Silty Clay traces of sand and gravel Very Stiff to Hard		6	SS	29		
			7	SS	32		
			8	SS	30		
			9	SS	30		630
628.0							
19.5	Heterogeneous Mixture of Gravel, Sand, Silt and Clay Hard Glacial Till		10	SS	42		
			11	SS	47		
			12	SS	92/11 in.		620
616.2			13	SS	120/10 in.		
31.3	End of Borehole						
	* Water Level Not Observed						610

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT W_P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

OFFICE REPORT ON SOIL EXPLORATION

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

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

EAST BOUND - SORTER SCALE

RECORD OF BOREHOLE No 8

W P 2509-77-02 LOCATION Co-ords. N 15,825,770 E 907,899 ORIGINATED BY DW

DIST 4 HWY 401 BOREHOLE TYPE Cont. Flight Auger (HS & SS) COMPILED BY JC

DATUM Geodetic DATE 84 08 31 CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS
649.0	Pavement Level					
0.0	Asphalt					
0.5	Layers of Silty Clay, Silt, Sand and Gravel Very Stiff/Dense Fill Material		1	SS	27	*
			2	SS	33	
			3	SS	24	
641.5	Asphalt		4	SS	65/ 9 in.	
7.5	Silty Clay traces of sand and gravel Stiff to Very Stiff		5	SS	13	
			6	SS	25	
			7	SS	29	
629.0						
20.0	Heterogeneous Mixture of Gravel, Sand, Silt and Clay Hard Glacial Till		8	SS	46	
622.5			9	SS	62	
26.5	End of Borehole * Water Level Not Observed					

ELEVATION SCALE: 640, 630, 620

DYNAMIC CONE PENETRATION RESISTANCE PLOT — 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT W_P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

OFFICE REPORT ON SOIL EXPLORATION

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

20
15 ⊹ 5 (%) STRAIN AT FAILURE
10

April 28, 1982

E. Shedler
Special Services Officer
Central Region

Re: WP - G2508-77-01
Hwy. 401 and Trafalgar Road T.I.S.

M. Devata, Supervisory Engineer, Pavement and Foundation Design Section, confirms the necessity of insulating the scale pit walls and base slab with styrofoam to validate the penultimate paragraph of his foundation report.

B. Davis
Special Assignment Engineer

MEMORANDUM (1)

G. C. E. BUCKHEIT
HEAD, STRUCTURAL SECTION
CENTRAL REGION
5000, YONGE ST.

F. D. S.

DATE:

LT. M. D. REALMUND

TRUCK INSPECTION STATIONS
HWY. #401 AND TRAFALGAR ROAD
W.P. 2508-77-02
W.P. 2509-77-02

IT IS PROPOSED TO CONSTRUCT TRUCK INSPECTION STATIONS ALONG HWY. #401 (EAST AND WEST BOUND LANES) WEST OF TRAFALGAR ROAD. EACH STATION WILL CONSIST OF A SCALE (WEIGHING) BOOTH, A STATIC SCALE AND TWO WEIGHING RAMPS.

OUR FOUNDATION INVESTIGATIONS, MOSTLY WORK-SHOP OUT AT EACH SITE, REVEALED THE FOLLOWING SUBSOIL CONDITIONS:

a.) FILL MATERIAL: RANDOM LAYERS OR ZONES OF SILTY CLAY, SILT, SAND, GRAVEL, BRICK AND OCCASIONAL ORGANIC MATERIAL. THE THICKNESS RANGES FROM 5.5 TO 9.5 FT. THE STANDARD

PENETRATION TEST 'N' VALUES VARIED RANDOMLY BETWEEN 10 TO 71 BLOWS PER FOOT.

SILTY CLAY:

THE THICKNESS OF THE STRATA VARIES FROM 7.5 TO 12.5 FT. IN ADDITION TO THE SILTY CLAY MATERIAL TRACES OF SAND, GRAVEL AND OCCASIONAL SMALL STONES WERE ALSO ENCOUNTERED. THE UNDRAINED SHEAR STRENGTH RANGES RANDOMLY FROM ABOUT 1000 PSF TO 4000 PSF.

GLACIAL TILL:

A HETEROGENEOUS MIXTURE OF GRAVEL, SAND, SILT AND CLAY DEPOSIT WAS ENCOUNTERED BELOW THE SILTY CLAY STRATUM. IN GENERAL, THE STANDARD PENETRATION TEST 'N' VALUES INCREASED WITH DEPTH.

THE GROUNDWATER LEVEL WAS FOUND TO BE BETWEEN EL. 647 AND EL. 637 AT THE TIME OF THE FIELD INVESTIGATION (AUG. 1984).

THE PROPOSED STATIC SCALE RAMP IS 138.74 FT. LONG, WITH A GAP OF 78.74 FT.) AND THE CARTER SCALE IS 130 FT. LONG WITH A GAP OF APPROXIMATELY 3 FT. FOR ACCURATE OPERATION OF THE SCALE IT IS ESSENTIAL THAT THE MAGNITUDE OF THE DIFFERENTIAL SETTLEMENTS BE NO MORE THAN 10mm BETWEEN ANY ONE CORNER AND ANY OF THE OTHER THREE CORNERS. IN OUR OPINION, THIS 10mm DIFFERENTIAL SETTLEMENT CAN ONLY BE ACHIEVED IF THE FOOTINGS ARE PLACED ON COMPLETELY UNYIELDING FOUNDATION MATERIAL SUCH AS SOUND BEDROCK. AT THESE LOCATIONS HOWEVER, NO BEDROCK WAS ENCOUNTERED FOR A DEPTH OF ABOUT 34 FT. BELOW THE FINISHED GROUND LEVEL. IF SPREAD FOOTING TYPE FOUNDATIONS ARE CONSTRUCTED WITHIN THE NATIVE SILICOL USING* BEARING PRESSURES OF 1.0 TSF THE DIFFERENTIAL SETTLEMENT MAY EXCEED 1.0 INCH. IT IS BELIEVED, THAT PILED FOUNDATIONS WILL SETTLE LESS THAN THE ABOVE QUOTED 1.0 INCH

LONGITUDINAL MOVEMENT. SHOULD THIS TYPE OF SUPPORT BE ADOPTED THE FOLLOWING DESIGN VALUES SHOULD BE USED:

PILE TYPE: STEEL 'H' PILES (HP 12x53) EQUIPPED WITH DRIVING SHOES

DESIGN LOAD: NOT MORE THAN 25 TONS PER PILE, THE PILES TO BE DRIVEN IN ACCORDANCE WITH STANDARD SS 103-10 OR SS 103-11 USING AN ULTIMATE CAPACITY OF 75 TONS PER PILE BUT MUST BE DRIVEN BELOW THE FOLLOWING ELEVATIONS:

WEST BOUND SORTER SCALE: EL. 605
WEST BOUND WEIGH SCALE: EL. 605

EAST BOUND SORTER SCALE: EL. 615
EAST BOUND WEIGH SCALE: EL. 615

THE PILE CAPS SHOULD BE PROTECTED AGAINST FROST ACTION WITH A MINIMUM OF 4.0 FT. OF EARTH COVER. IT IS RECOMMENDED

ALL PILES SHOULD BE PRE-AUGERED FOR A MINIMUM DEPTH OF 10 FT.

FOR PURPOSES OF O.H.B.D.C. THE FOLLOWING VALUES MAY BE USED:

EXPECTED CAPACITY AT U.L.S: 45 TONS

CAPACITY AT SERVICEABILITY LIMIT STATES TYPE II:
WILL NOT APPLY.

* THE DRIVING ENERGY SHOULD NOT BE LESS THAN 40 000 FOOT-POUNDS.

P. PAYER
FOUNDATIONS ENGINEER

In our opinion, this 10 mm differential settlement can only be achieved if the footings are placed on completely unyielding foundation material such as sound bedrock. At these locations, however, no bedrock was encountered for a depth of about 34 ft. below the finished ground level. If spread footing type foundations are constructed within the native subsoil using a bearing pressure of 1.0 TSF the differential settlement may exceed 1.0 inch. It is believed as specified below that piled foundations will settle somewhat less than the above quoted 1.0 inch but we would hesitate to guarantee that the 10 mm differential movement figure would not be exceeded. Should this type of support be adopted, the following design values may be used:

Pile Type: Steel 'H' piles (HP 12 x 53) equipped with driving shoes

Design Load: Not more than 25 tons per pile. The piles to be driven in accordance with Standard SS 103-10 or SS 103-11 using an ultimate capacity of 75 tons per pile but must be driven below the following elevations:

Westbound Sorter Scale: El. 605
Westbound Weight Scale: El. 605

Eastbound Sorter Scale: El. 615
Westbound Weight Scale: El. 615

The driving energy should not be less than 40000 foot-pounds.

The pile caps should be protected against frost action with a minimum of 4.0 ft. of earth cover. It is recommended all piles should be pre-augered for a minimum depth of 10 ft.

For purposes of O.H.B.D.C. the following values may be used:

Factored Capacity at U.L.S.: 45 Tons

Capacity at Serviceability Limit States Type II: will not apply

Brian Peck

for P. Payer, P. Eng.
Foundations Engineer

PP/mmj

c.c. V. Mitrovic

Marshall Macklin Monaghan Limited
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July 12, 1984
File: 16-83003

Ministry of Transportation & Communications
Central Region
5000 Yonge Street
Willowdale, Ontario
M2N 6E9

Attention: **Mr. V. Mitranic**

Dear Sirs

Subject: **Trafalgar Truck Inspection Station**
Contract No. 84-400

Further to our recent telephone conversations, we have reviewed the construction tolerances for differential settlement on weigh scale approach slabs.

Based on conversations with the scale manufacturer, differential settlements of 10 mm or less are necessary in order to maintain the scale's required accuracy. That is, there must be no more than 10 mm elevation difference between any one corner and any of the other three corners.

We would like to apologize for the delay in providing this information and trust that the enclosed meets your requirements. If, however, you have any further questions or comments, please do not hesitate to contact us.

Yours very truly

MARSHALL MACKLIN MONAGHAN LIMITED

G.T. Murray, P. Eng.
Transportation Engineer
for: L.H. Woods, P. Eng.
Project Manager
Transportation Engineering

LHW:GTM:pb
Enclosure

cc: Mr. L. Politano