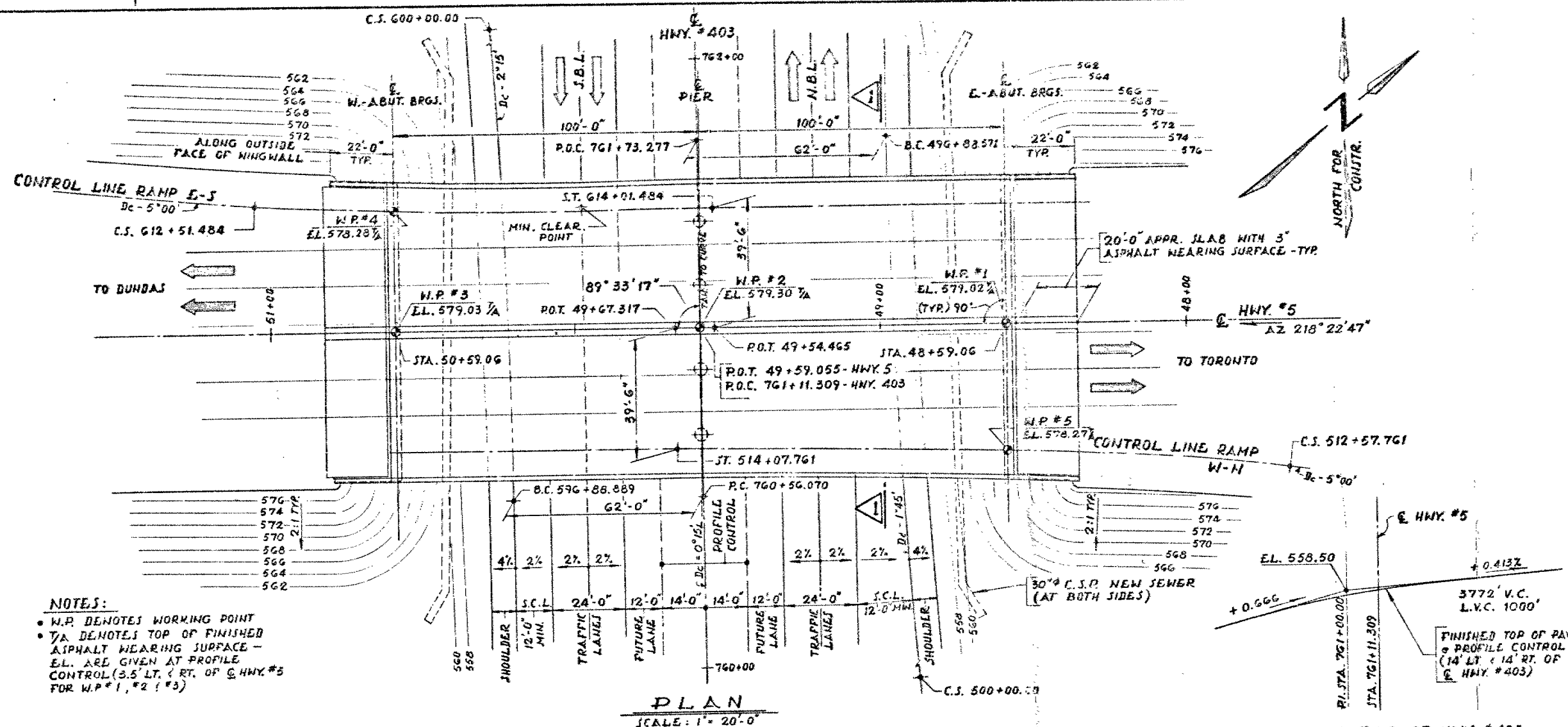


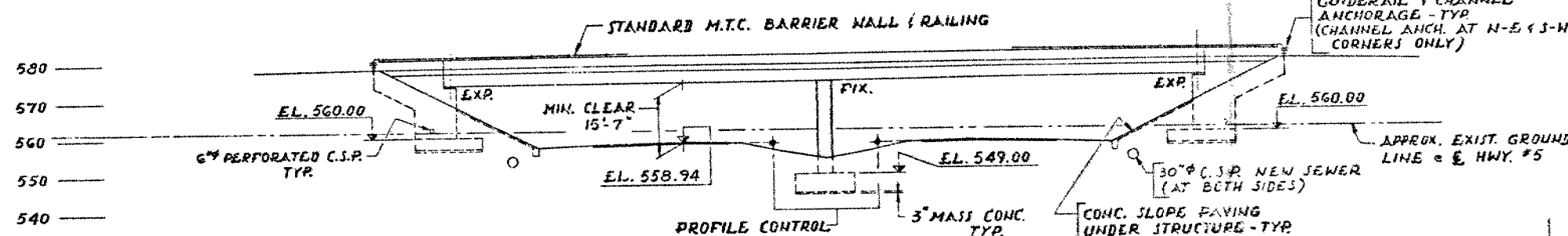
REMARKS:



NOTES:
 • W.P. DENOTES WORKING POINT
 • T/A DENOTES TOP OF FINISHED ASPHALT WEARING SURFACE - EL. ARE GIVEN AT PROFILE CONTROL (3.5' LT. & RT. OF E. HWY #5 FOR W.P. #1, #2, #3)

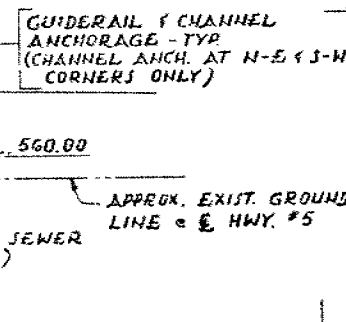
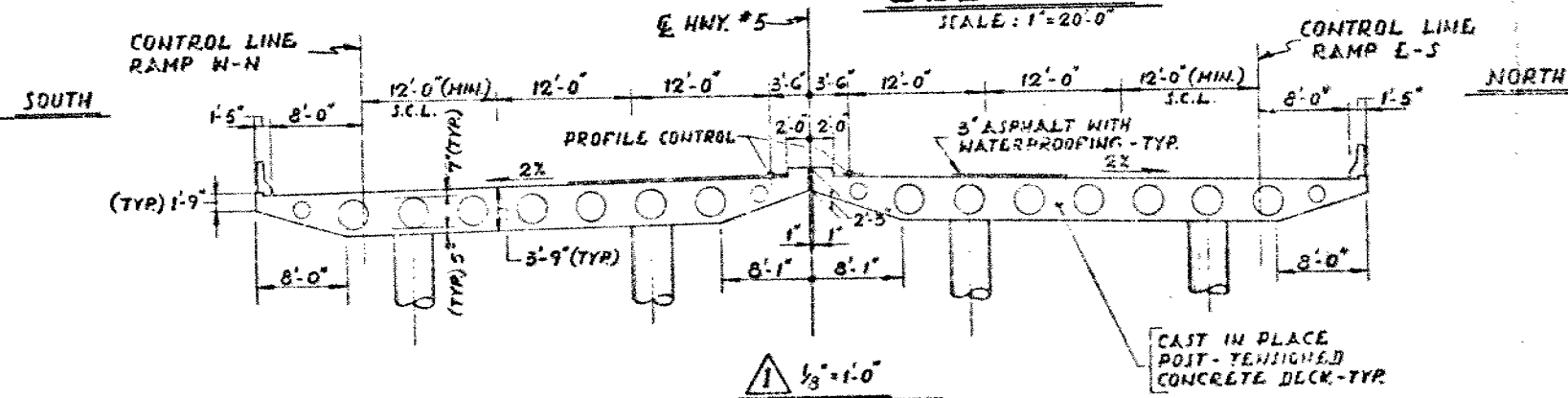
PLAN

SCALE: 1" = 20'-0"



ELEVATION

SCALE: 1" = 20'-0"



PROFILE OF HWY. #403

N.T.S.

PROFILE OF HWY. #5

N.T.S.

GENERAL NOTES

CLASS OF CONCRETE

DECK, MEDIAN & PIER COLUMNS	5000 P.S.I.
BARRIER WALLS	4000 P.S.I.
REMAINDER	3000 P.S.I.

REINFORCING STEEL GRADE

C.S.A. STANDARD G 30.12 - M 1977 GRADE 400 MPa REINFORCING BARS WITH DESIGNATION 'C' AT END OF BAR MARKS SHALL BE COATED BARS.

CLEAR COVER ON REINFORCING STEEL

FOOTINGS & ABUTMENTS	3"
PIER COLUMNS	2 1/2"
DECK TOP	2"
DECK BOTTOM	1 1/2"
APPROACH SLABS	2"

TO ACHIEVE THE MINIMUM CLEAR COVER OF 2" SPECIFIED, THE TOP LAYER REINFORCING SHALL BE PLACED PRIOR TO CONCRETING WITH A CLEAR COVER OF 2 1/2" ± 1/2" TOLERANCE.

CONSTRUCTION NOTES

THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8".

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, STRESSED AND GROUTED.

LIST OF DRAWINGS

- 1 - GENERAL PLAN
- 2 - BORE HOLE LOCATIONS & SOIL STRATA
- 3 - FOOTING DETAILS
- 4 - WEST ABUTMENT
- 5 - EAST ABUTMENT
- 6 - PIER DETAILS
- 7 - DECK DETAILS
- 8 - LONGIT. CABLE DETAILS
- 9 - TRANSVERSE CABLE DETAILS
- 10 - DECK REINFORCING I
- 11 - DECK REINFORCING II
- 12 - BARRIER WALL
- 13 - STEEL RAILING (SINGLE TUBE)
- 14 - 20 FT. APPROACH SLAB
- 15 - DETAILS OF CONC. SLOPE PAVING
- 16 - AS CONSTRUCTED ELEV. & DIM.
- 17 - STANDARD DETAILS I
- 18 - STANDARD DETAILS II
- 19 - STANDARD DETAILS III

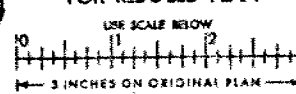
CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEMS:

1 - CONCRETE IN PIERS (5000 P.S.I.)	484 cu. yd.
ABUTMENTS AND WINGWALLS (3000 P.S.I.)	49 cu. yd.
2 - PRESTRESSED CONCRETE BRIDGE DECK	1977 cu. yd.
3 - CONCRETE IN BARRIER WALLS	40 cu. yd.
4 - CONCRETE IN APPROACH SLABS	126 cu. yd.
5 - CONCRETE IN SLOPE PAVING	81 cu. yd.



FOR REDUCED PLAN

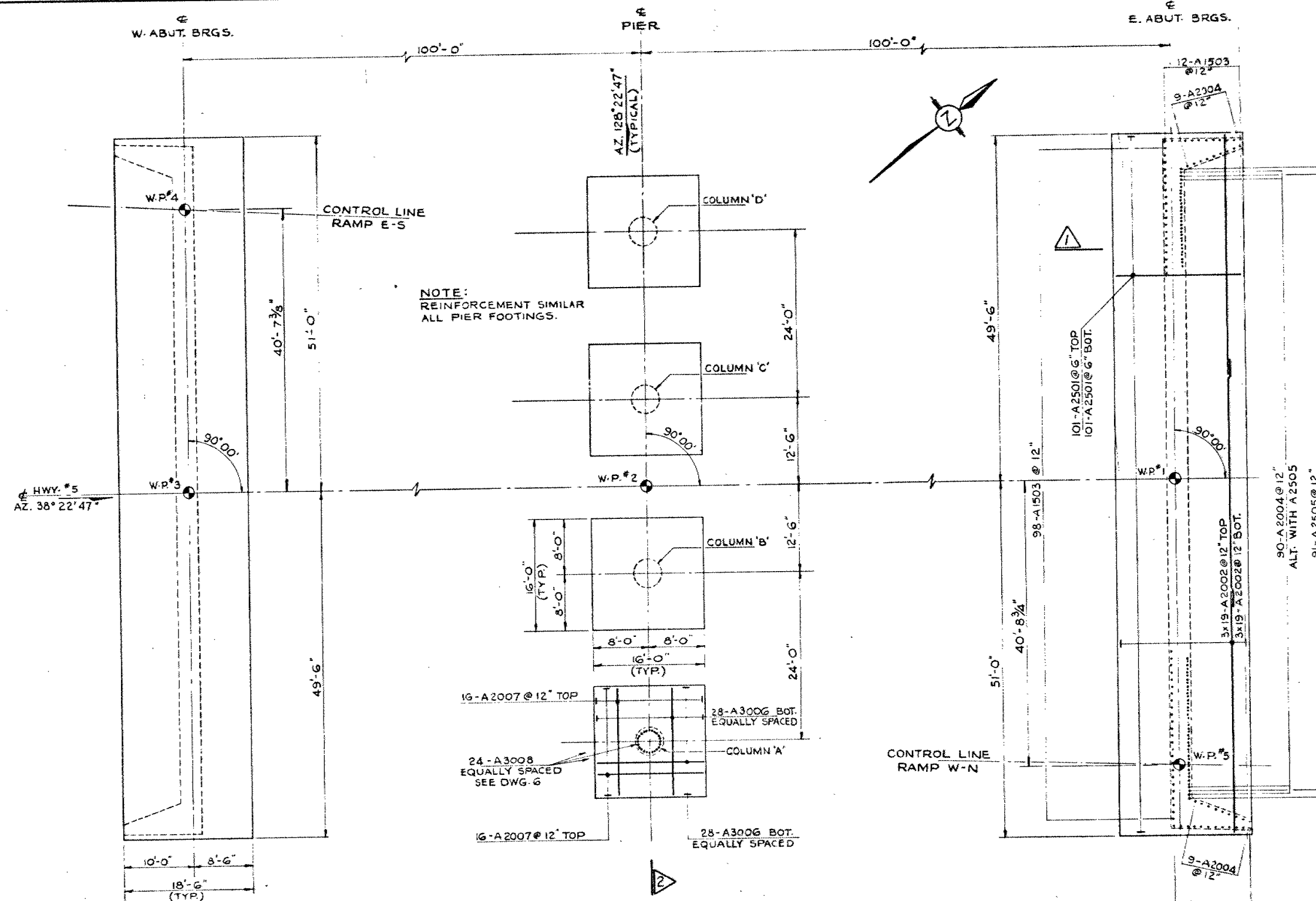


REVISION	DATE	BY	DESCRIPTION
DESIGNER'S CHECK	LOADING HS 20-44	DATE: 6-7	
DRAWING'S CHECK	REVISIT No 10-281	DATE: 1	

CONT No
WP No 153-75-03

HWY. 403 UPASS AT HWY. 5
(Approx. 0.3 Mi. East of Ninth Line Rd.)
FOOTING DETAILS

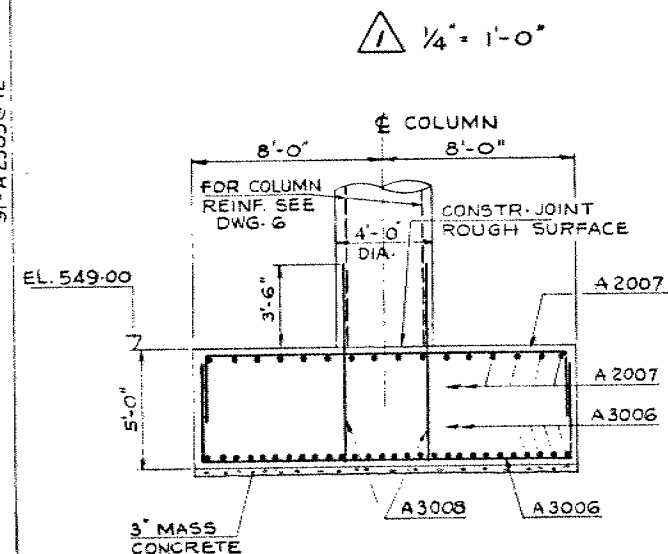
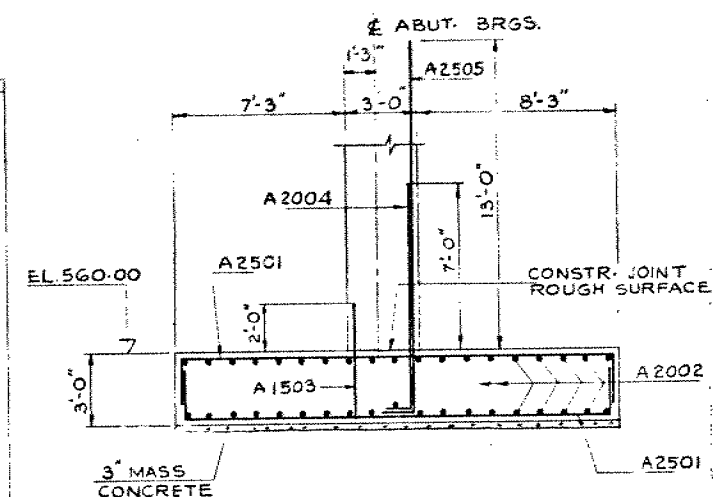
SHEET



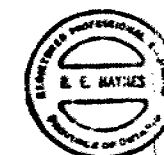
CO-ORDINATES			
POINT	STATION	NORTH	EAST
W.P. 1	48+59.06	810.96-03	948755.23
W.P. 2	49+59.06	810117.64	948693.15
W.P. 3	50+59.06	810039.25	948631.06
W.P. 4	51+29.49	810064.46	948599.22
W.P. 5	51+29.49	810170.74	948787.16
COLUMN A	49+59.06	810094.98	948721.76
COLUMN B	49+59.06	810109.88	948702.34
COLUMN C	49+59.06	810125.40	948683.35
COLUMN D	49+59.06	810140.30	948664.53

NOTE:
REINFORCEMENT SIMILAR
BOTH ABUTMENT FOOTINGS.

PLAN
1/8" = 1'-0"



NOTE:
MASS CONCRETE TO BE PLACED WITHIN 24 HOURS
AFTER FOOTING EXCAVATION IS COMPLETED.



FOR REDUCED PLAN



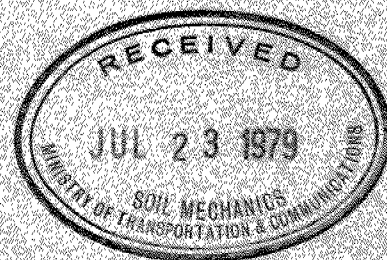
REVISION	DATE	BY	DESCRIPTION
DESIGN	LEH	CHECK	LOADING HS 30-40 DATE AUG 3
DRAWING	3	CHECK	REH SITE No 10-231 DWG 3

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 79-31



Ministry of
Transportation and
Communications



1

INDEX

<u>Page No.</u>	<u>Description</u>
1	Index
2	Abbreviations & Symbols
3- 28	Foundation Investigation Reports For W.P. 159-75-03 Hwy. 403 Underpass at Hwy. 5 W.P. 158- 75 -04 Burnhamthorpe Road Underpass

NOTE: For purposes of the contract these reports supercede all other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.

EXPLANATION OF TERMS USED IN REPORT

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

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

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE
 w SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_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 = $\frac{w - w_p}{p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{2.4 \mu m \text{ Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ 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

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_c OVERCONSOLIDATION RATIO (OCR)

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

FOUNDATION INVESTIGATION REPORT

For

Hwy. 403 Underpass at Hwy. 5
W.P. 159-75-03, Site 10-281
Hwy. 403, District 4, Hamilton

INTRODUCTION

This report contains the results of a foundation investigation performed by the Soil Mechanics Section at the site of the above mentioned project. Fieldwork was carried out during July 18 to July 20, 1977 using 3½" diameter hollow stem continuous flight augers and rock coring techniques to advance six boreholes to depths ranging from 25 to 31 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located on Hwy. 5 about one mile west of Winston Churchill Blvd., in the Town of Oakville and the City of Mississauga. The land adjacent to the site has a gently rolling topography, generally sloping down to the southeast toward Lake Ontario.

Hwy. 5 is in a 7 to 10 foot cut at the top of a very gently sloped hill. To the west of the site, the ground slopes down for half a mile to the valley of Joshua's Creek which meanders within a steep sided valley with a flood plain about 100 feet wide.

Numerous ponds dot the surrounding area. Water can also be seen lying in depressions in the adjacent ground surface.

The land in the area is used primarily for wheat and grazing with some residential development.

The site lies within the South Slope physiographic region. This region is characterized by glacially deposited overburden overlying shale bedrock of the Queenston and Dundas Formations of the Upper Ordovician Age.

SUBSURFACE CONDITIONS

General

At this site a mostly non-cohesive glacio-fluvial deposit was found immediately below a very thin layer of topsoil. This was underlain by a cohesive glacial till deposit in most locations, followed by shale bedrock.

The upper 6 to 10 feet of the non-cohesive deposit is composed of silt with a trace of sand and clay. Below this silt layer fine sand extends to between 11 and 20 feet.

At the southwestern portion of the site only, the fine sand layer is underlain by a five foot thick deposit of well graded sand extending to bedrock at 25 feet. No cohesive glacial till was found at this location.

Underlying the fine sand layer in all other locations is a glacial till deposit of predominantly clayey silt with a trace of sand and occasional gravel.

Red shale bedrock was found below the glacial till at depths ranging from 23 to 28 feet.

Detailed descriptions of the various soil and rock types encountered in each borehole are given on the Record of Borehole Sheets. The location and elevation of the boreholes, together with three stratigraphical sections, are shown in Drawing 10-281-2.

A description of the subsurface conditions is given in the following paragraphs.

Silt, Trace of Sand and Clay

This stratum is 6 to 10 feet thick extending from below a very thin topsoil layer (less than six inches). The material consists of silt with a trace of sand and a trace to some clay. Typical grain size distribution curves of the material in this stratum are shown in Figure 1. Standard Penetration Test 'N' values ranging

from 31 to 98 blows/foot indicate a relative density of dense to very dense in this layer. This fine grained non-cohesive material is susceptible to boiling if subjected to unbalanced hydrostatic pressure.

Sand With Some Silt

This material underlies the silt layer and extends to depths below ground surface between 11 and 20 feet (elevation 549 and 540). Its composition varies from sand with some silt to sandy silt in some locations. Typical grain size distribution curves of this material are shown in Figure 2. The relative density of this material is generally dense to very dense but was found to be compact at one location in the northwestern portion of the site at a depth of 10 feet (elev. 550).

Sand (Southwest Portion of the Site)

At the southwest portion of the site only, a five foot thick sand deposit was found to underly the fine sand layer and extend to bedrock at 25 feet. This material is well graded sand with a trace of silt and gravel and is in a very dense condition.

Glacial Till

In all other locations the fine sand deposit is underlain by glacial till of predominantly clayey silt, with a trace of sand and occasional gravel. This deposit has a thickness of up to 15 feet and is underlain by bedrock at elevation 532 to 537. The consistency of this till is hard and its plasticity is in the low range.

The engineering properties of the cohesive glacial till as determined by laboratory testing are summarized below:

<u>Identity Tests</u>		<u>Range (%)</u>	<u>Average (%)</u>
Liquid Limit	(W_L)	27-30	28
Plastic Limit	(W_P)	14-16	15
Natural Moisture Content	(W)	14-19	17
Plasticity Index	(I_L)	12-15	13

Typical grain size distribution curves for this material are shown in Figure 3.

Shale Bedrock

Red Queenston shale bedrock with occasional thin limestone layers and gray shale pockets was found at depths between 23 and 28 feet (elev. 532 to 537). The surface of the bedrock is relatively flat. Its upper 1 to 3 feet are weathered.

The shale is quite soft as observed during field examinations, therefore, although high RQD values were recorded, the quality of the bedrock is assessed as poor to medium.

Groundwater Conditions

The groundwater table in the cut for Hwy. 5 was found to be at elevation 556.5 and that in the area south of Hwy. 5 was found to be at elevation 565. Water was also observed lying in ground surface depressions and ponds throughout the area. Since the site was at the top of a gentle hill, these observations indicate relatively poor downward drainage, resulting in perched water conditions at the ground surface.

B. Ly

B. Ly, P. Eng.
Senior Engineer



M. Devata

M. Devata, P. Eng.
Supervising Engineer

APPENDIX



RECORD OF BOREHOLE No 11

8

W P 159-75-03 LOCATION Co-ords N 15,810,069: E 948,600 ORIGINATED BY J.R.W.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
DATUM Geodetic DATE July 19, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
560.0	Ground Level																
0.0	Silt trace of sand and clay Dense																
554.0			1	SS	35												0 5 84 11
6.0	Fine sand with silt Compact																
549.4			2	SS	17		550										
10.6	Silt some clay traces of sand																
546.0																	
14.0	Glacial Till Het. mixture of clayey silt, some sand occasional gravel		3	SS	72												39 28 26 7
			4	SS	53												
			5	SS	38		540										0 5 66 29
			6	SS	88												
	Hard		7	SS	110												
533.5			8	SS	131												
537.8	Shale Bedrock																
28.1	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 12

9

W P 159-75-03 LOCATION Co-ords N 15,810,147: E 948,662 ORIGINATED BY J.R.W.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger- BXL Rock Core COMPILED BY J.R.W.
DATUM Geodetic DATE July 18, 1977 CHECKED BY 425

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT Wp	NATURAL MOISTURE CONTENT W	LIQUID LIMIT Wl	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH					WATER CONTENT (%)						
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE								
559.1	Ground Level																		
0.0	Silt trace of sand and clay Dense		1	SS	31														
554.1			2	SS	52														
5.0	Fine sand with silt Very Dense		3	SS	60												0 59 (41)		
548.1			4	SS	69														
11.0	Silt with sand Very Dense		5	SS	106/6												0 35 (65)		
544.1			6	SS	70/6														
15.0	Glacial Till Hard		7	SS	64/6														
535.1	Net. mixture of clayey silt, some sand occasional gravel		8	SS	98/6														
24.0	Bedrock red soft shale some limestone layers and grey shale pockets		10	RC	-														
529.5			12	RC	95%												RQD 87%		
29.6	End of Borehole																		

+3, x5: Numbers refer to
Sensitivity

20
15
10
5
0
5
10
15
20
(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 13

10

W P 159-75-03 LOCATION Co-ords N 15,810,217: E 948,715 ORIGINATED BY J.R.W.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
DATUM Geodetic DATE July 19, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
560.1	Ground Level						560										
0.0	Silt traces of sand and clay Dense		1	SS	89									0			0 4 85 11
552.6																	
7.5	Sand traces of silt Very Dense		2	SS	65		550										
546.6																	
13.5	Glacial Till Hard		3	SS	140												
	Het. mixture of clayey silt, some sand occasional gravel		4	SS	78/6		540										
537.1			5	SS	145												
535.0	Shale Bedrock		6	SS	182												
24.5	End of Borehole																
	Note: Water level not established																

+3, x5: Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 14

11

W P 159-75-03 LOCATION Co-ords N 15,810,017; E 948,664 ORIGINATED BY J.R.W.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger - BXL Rock Core COMPILED BY J.R.W.
DATUM Geodetic DATE July 18, 1977 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
559.8	Ground Level																
0.0	Silt trace of sand Very Dense		1	SS	84		550							o			0 12 (88)
550.8			2	SS	98												
9.0	Sand with silt Very Dense		3	SS	92												
544.3																	
15.5	Silt trace of sand Very Dense		4	SS	97									o			7 76 (17)
540.3			5	SS	-		540							o			17 64 (19)
19.5	Sand trace of silt and gravel Very Dense		6	SS	99												7 27 48 18
535.3																	
24.5	Weathered Shale with limestone chips		7	SS	98/5												
26.8	Shale bedrock with limestone layers		8	SS	107/5												
529.2			9	RC	100%		530										RQD 98%
30.6	End of Borehole																

12

W P 159-75-03 LOCATION Co-ord N 15.810.097 E 948.726 ORIGINATED BY J.R.W.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
DATUM Geodetic DATE July 19, 1977 CHECKED BY RS

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to Sensitivity

20
15 \diamond 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 16

13

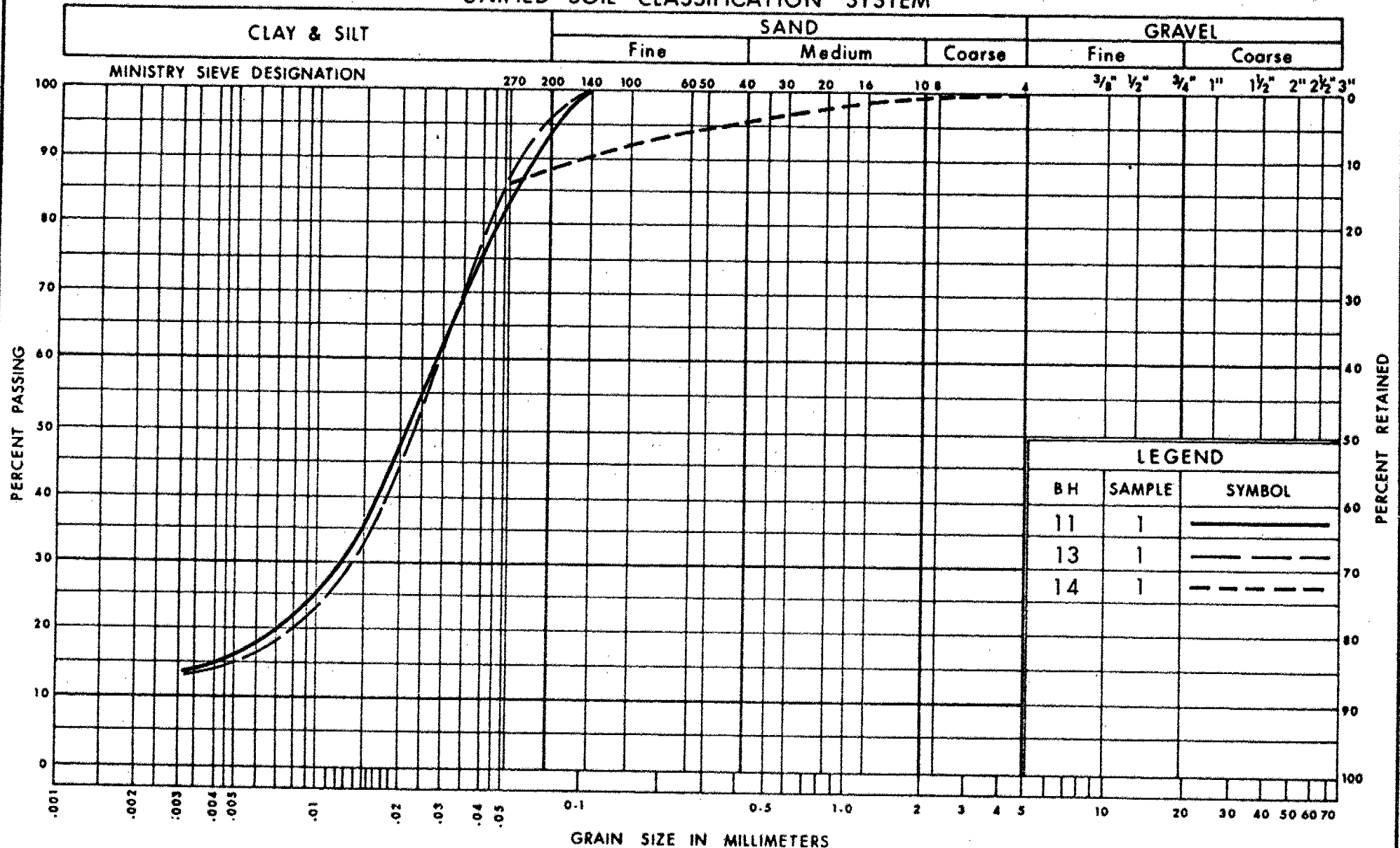
W P 159-75-03 LOCATION Co-ords N 15,810,175; E 948,789 ORIGINATED BY J.R.W.
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
DATUM Geodetic DATE July 20, 1977 CHECKED BY R

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
559.7	Ground Level																
0.0	Silt trace of sand occasional cobbles																
550.7																	
9.0	Fine Sand some silt Very Dense		1	SS	142		550										0 74 (26)
546.7																	
13.0	Silt some clay and sand		2	SS	111												
544.2	Hard																
15.5	Glacial Till																
	Het. mixture of clayey silt, some sand occasional gravel		3	SS	115		540										1 12 60 27
535.2	Hard		4	SS	123												
24.5	Weathered Shale		5	SS	103												1 31 50 18
531.7	Shale Bedrock		6	SS	139/6												
28.0	End of Borehole																
	Note: Water level not established																

+3, x5: Numbers refer to
Sensitivity

20
15 ± 5 (%) STRAIN AT FAILURE
10

UNIFIED SOIL CLASSIFICATION SYSTEM



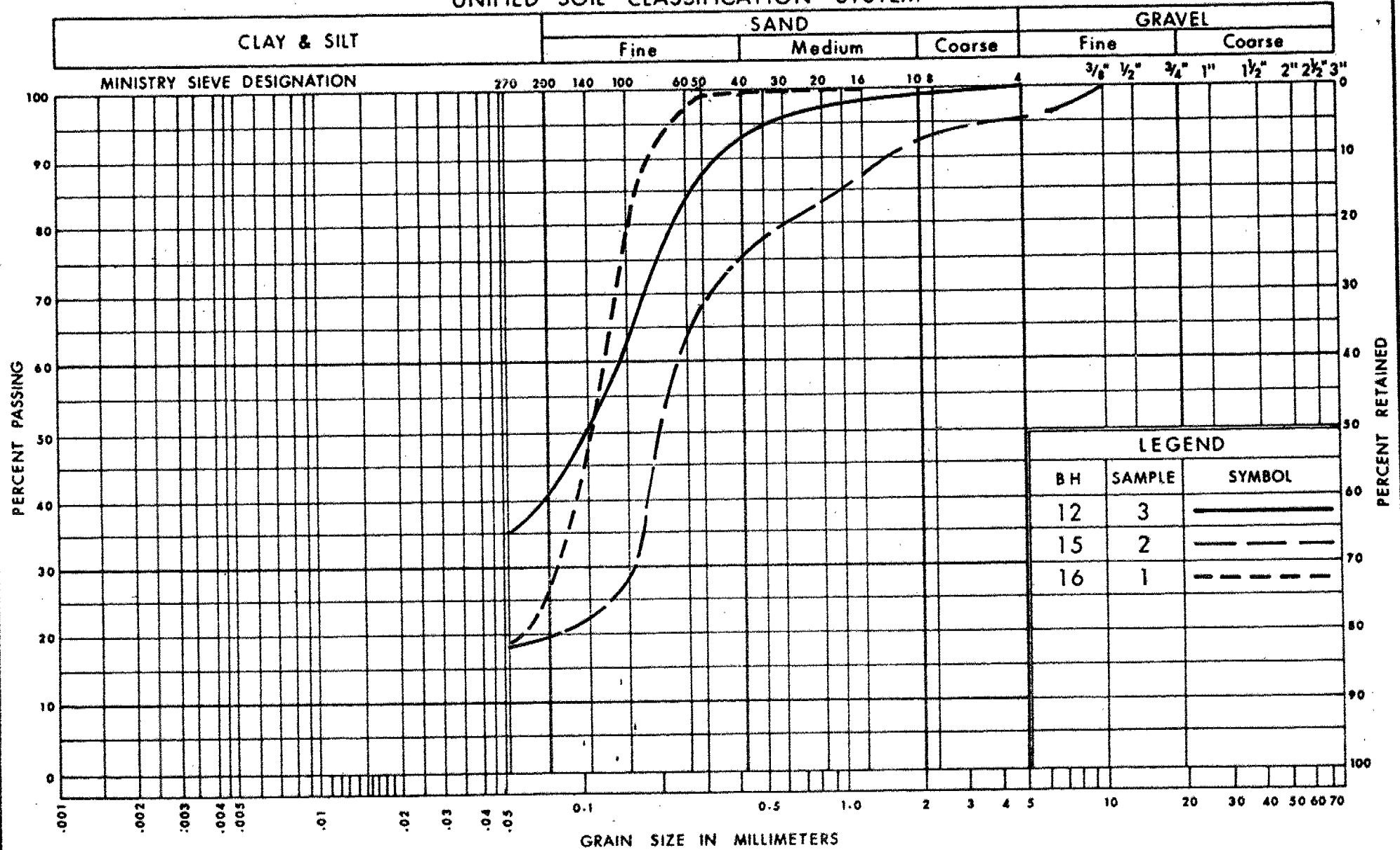
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GRAIN SIZE DISTRIBUTION
SILT
TRACE OF SAND & CLAY

FIG No 1

W P 159-75-03

UNIFIED SOIL CLASSIFICATION SYSTEM



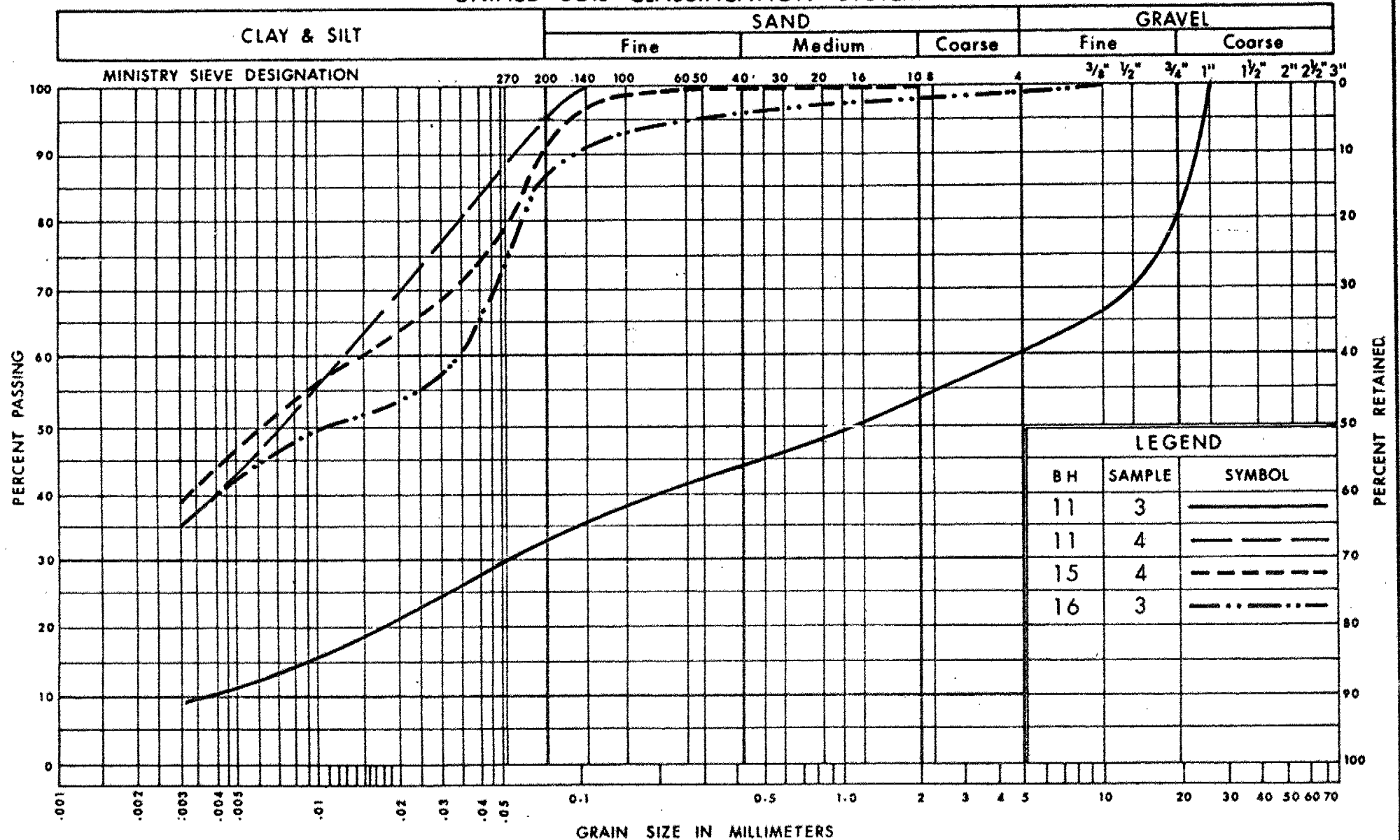
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GRAIN SIZE DISTRIBUTION
SAND
SOME SILT

FIG No 2

WP 159 - 75 - 03

UNIFIED SOIL CLASSIFICATION SYSTEM



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Communications

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIX OF CLAYEY SILT, SOME SAND, OCC GRAVEL

FIG No 3

W P 159-75-03

FOUNDATION INVESTIGATION REPORT

For

Burnhamthorpe Road Underpass
W.P. 158-75-04, Site 10-280
Hwy. 403, District 4, Hamilton

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the periods of June, 1976 and August 11-12, 1977. The fieldwork consisted of six sampled boreholes advanced by means of an auger machine equipped with 3½" I.D. hollow stem continuous flight augers.

The boreholes ranged in depth from 17.0 feet to 61.0 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located some 350 feet east of 9th Line and Sneider Corner on existing Burnhamthorpe Road in the City of Mississauga, Regional Municipality of Peel.

The topography of the area is gently sloping in a southerly direction. The land is developed for farming purposes.

Physiographically, the site is situated in the region of "South Slope". The characteristic deposit in the vicinity of the area under investigation is composed of cohesive glacial till overlying granular deposits. According to known geological information, the overburden is underlain by shale bedrock of Meaford-Dundas formation, Ordovician Period.

This physiographic region is well drained by the Credit, Oakville and Etobicoke Creeks which have cut deep valleys into the overburden. However, in many of the interstream areas drainage is still imperfect.

SUBSURFACE CONDITIONS

General

The subsurface conditions were found to be quite uniform over the site. Within the depths of investigation subsoil consists of a stratum of cohesive glacial till followed by a deposit of silt with traces of sand and occasional clayey silt layers. Detailed descriptions of the various soil types encountered are given in the Record of Borehole Sheets. The estimated stratigraphical sections are shown in Drawing 10-280-2. From ground level downwards the various soil types encountered are as follows:

Glacial Till

Underlying a thin layer of topsoil is a deposit of cohesive glacial till. It was fully penetrated at two locations and was found to have a thickness of about 34 feet. Elsewhere it was not fully penetrated but was explored to a depth of up to 36 feet below ground surface. The cohesive glacial till is comprised of a heterogeneous mixture of clayey silt, sand and gravel. The Standard Penetration Tests gave 'N' values ranging from 26 blows to over 100 blows per foot indicating that the glacial till has a very stiff to hard consistency, but generally hard.

The physical properties of the glacial till as determined from laboratory testing are summarized below:

<u>Identity Indices</u>		<u>Range</u>
Liquid Limit	(W _L) %	18-29
Plastic Limit	(W _p) %	10-15
Moisture Content	(W) %	7-16

The results of the Atterberg Limit tests are shown on the Plasticity Chart (Figure 1) and the typical grain size distribution curves are presented in an envelope form in Figure 2. The Atterberg Limits indicate that the cohesive stratum is inorganic and of low plasticity.

Silt With Trace of Sand, Occasional Clayey Silt Layers

This deposit underlies the cohesive glacial till stratum and was explored only in one location to a depth of 27 feet below the glacial till. The material in the stratum is mainly silt with

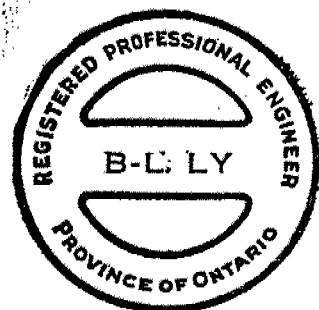
traces of sand and occasional thin layers of clayey silt. The 'N' values ranged from 54 to over 100 blows per foot, indicating that the silt has a very dense relative density.

Groundwater

The groundwater levels were observed by measuring the water level in the open boreholes during and shortly after the completion of the foundation investigation. The groundwater levels were found to vary between elevations 593 and 583 which corresponds to depths of three feet to 13 feet below the existing ground surface.

B. Ly

B. Ly, P. Eng.
Senior Engineer



M. Devata

M. Devata, P. Eng.
Supervising Engineer

APPENDIX

RECORD OF BOREHOLE No 1

W P 158-75-04 LOCATION Co-ords N 15,813,952; E 942,864 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3/4" H.S. Auger & Cone Test COMPILED BY V.K.
DATUM Geodetic DATE August 11, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100				
597.7	Ground Level															
0.0	Topsoil															
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel. (Glacial Till) Hard		1	SS	32											16 18 45 21
			2	SS	48											
			3	SS	144/9"											
			4	SS	94											
	Brown		5	SS	179/11"											0 9 79 12
	Grey		6	SS	153											
			7	SS	155/11"											8 25 47 20
			8	SS	138/11"											
561.2			9	SS	145											
36.5	End of Borehole															

*3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 2 (Formerly BH 3 W.O. 76-11005)

22

W P 158-75-04 LOCATION Co-ord's. N 15,814,034; E 942,898 ORIGINATED BY VK
DIST 4 HWY 403 BOREHOLE TYPE H.S. 3 1/2" Auger (CME#55) & Cone Test COMPILED BY VK
DATUM Geodetic DATE June 30, 1976 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
595.0	Ground Level																
0.0	Topsoil																
	Het. mix. of clayey silt with sand, occasional gravel (Glacial Till)		1	SS	45		590										0 34 52 14
	Hard		2	SS	100/	9"											
	Brown		3	SS	98/	9"											
	Grey		4	SS	100/	8"											
			5	SS	120/	6"	580										
			6	SS	125/	6"											
			7	SS	100/	9"	570										
			8	SS	97/												0 11 47 42
561.0			9	SS	54/		560										0 23 68 9
34.0	Silt with trace of sand, occ. clayey silt layers		10	SS	115/												22 75 (3)
	Very Dense gravelly sand Dense		11	SS	125/	11"	550										
	clayey silt Hard		12	SS	100/	9"											0 2 87 11
			13	SS	70/	11"	540										0 3 95 2
534.0	Clayey silt Hard		14	SS	100/	11"											0 1 89 10
61.0	End of Borehole																



RECORD OF BOREHOLE No 3

23

W P 158-75-04

LOCATION Co-ords N 15,814,085; E. 942,972

ORIGINATED BY V.K.

DIST 4 HWY 403

BOREHOLE TYPE 3 1/2 H.S. Auger & Cone Test

COMPILED BY V.K.

DATUM Geodetic

DATE August 11, 1977

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x 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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
595.6	Ground level										
0.0	Topsoil										
	Mat. Mix. of Clayey Silt, Sand and Gravel (Glacial Till) Hard		1	SS	45		590				0 24 50 26
			2	SS	71						
			3	SS	120						
	Brown Grey		4	SS	74						
			5	SS	101		580				
			6	SS	54						0 54 38 8
			7	SS	60		570				4 12 45 39
			8	SS	42						
561.6											
34.0	Silty sand (fine)										
559.1	V. Dense		9	SS	53		560				0 93 (7)
36.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 4

24

W P 158-75-04 LOCATION Co-ords N 15,814,130: E 942,918 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3/4 H.S. Auger & Cone Test COMPILED BY V.K.
DATUM Geodetic DATE August 12, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
593.9	Ground level																
0.0	Topsoil																
	Het. Mix. of Clayey Silt, Sand and Gravel.		1	SS	84		590										30 22 36 12
	(Glacial Till)		2	SS	62												13 25 44 18
	Hard		3	SS	100/4"												
	Brown		4	SS	56		580										4 27 48 21
	Grey																
576.9	Boulders		5	SS	100/4"												
17.0	End of Borehole																



RECORD OF BOREHOLE No 5

25

W P 158-75-04 LOCATION Co-ords N 15,814,062; E 942,863 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" H.S. Auger & Cone Test COMPILED BY V.K.
DATUM Geodetic DATE August 12, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
595.2	Ground level																
0.0	Topsoil																
	Het. Mix of Clayey Silt, Sand and Gravel. (Glacial Till) Hard		1	SS	48		590										25 18 41 16
			2	SS	79												
			3	SS	105												
			4	SS	96												0 29 56 15
			5	SS	99		580										
			6	SS	46												0 32 49 19
			7	SS	56		570										
			8	SS	49												1 30 30 39
558.7			9	SS	65		560										3 24 57 16
36.5	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

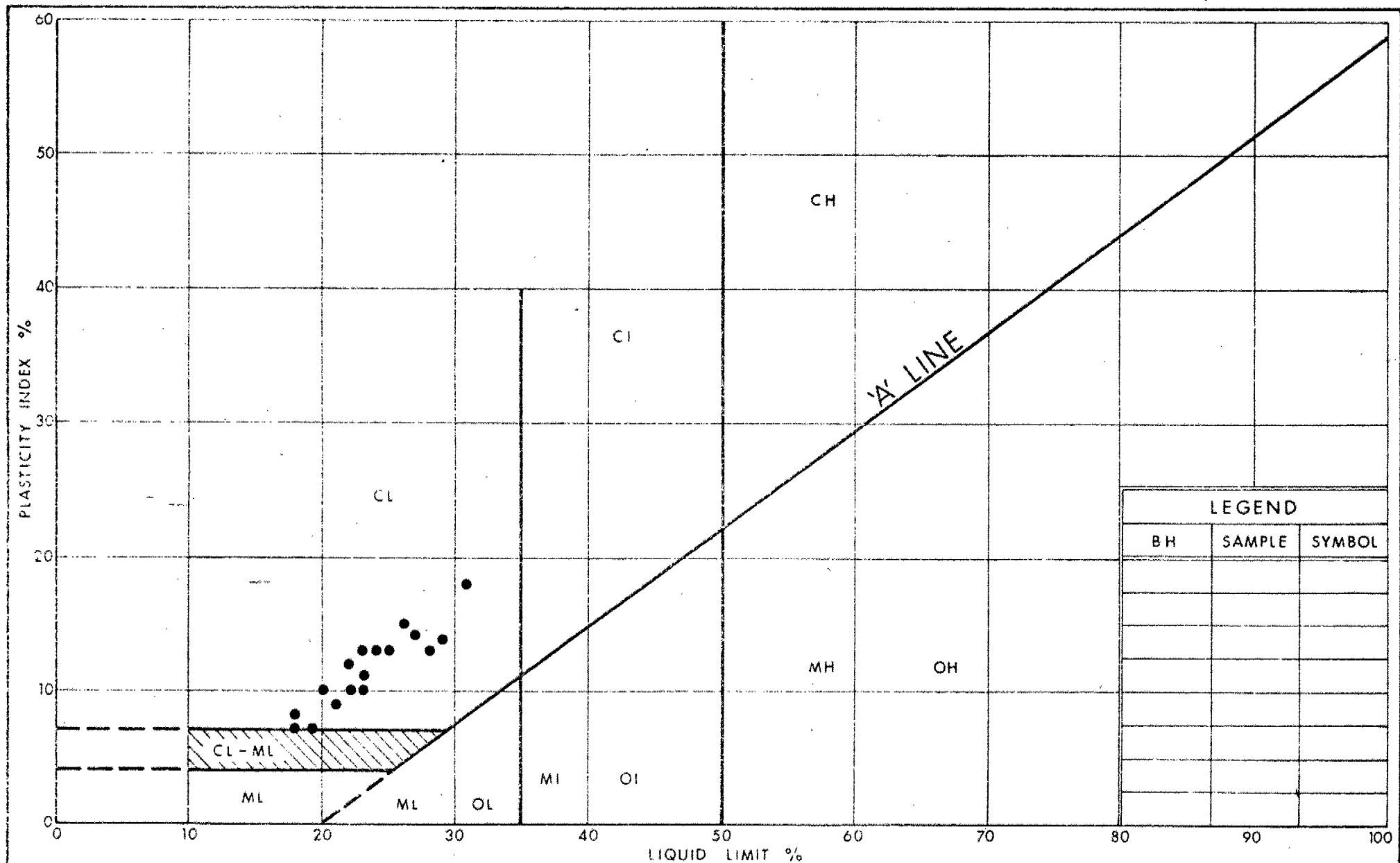
20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 6

26

W P 158-75-04 LOCATION Co-ords N 15,813,997; E 942,809 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" H.S. Auger & Cone Test COMPILED BY V.K.
DATUM Geodetic DATE August 12, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
597.4	Ground Level															
0.0	Topsoil															
	Het. Mix. of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff to Hard		1	SS	38		590									4 19 52 25
			2	SS	54											
			3	SS	123											
			4	SS	51											
			5	SS	101		580									0 23 62 15
			6	SS	63											
			7	SS	26											
			8	SS	135		570									
560.9			9	SS	36											0 19 60 21
36.5	End of Borehole															



Ontario

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PLASTICITY CHART COHESIVE GLACIAL TILL.

FIG No 1

W P 158 - 75 - 04



GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIX OF CLAYEY SILT, SAND & GRAVEL

WP 158 - 75 - 04

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 159-75-03

DIST 4

HWY 403

STR SITE 10-281

Hwy. 403 Link, Hwy. 5 Underpass

CONT. 79-31

DISTRIBUTION

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R.D. Gunter
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SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	<i>Feb. 28, 1978</i>	<i>BL</i>
TUBES		
ROCK CORES		

FOUNDATION INVESTIGATION REPORT

For

Hwy. 403 Link, Hwy. 5 Underpass
Hwy. 403, District 4, Hamilton
W.P. 159-75-03, Site 10-281

INTRODUCTION

This report contains the results of a foundation investigation performed by the Soil Mechanics Section at the site of the above mentioned project.

Fieldwork was carried out during July 18 to July 20, 1977 using 3¼" diameter hollow stem, continuous flight augers and BXL coring techniques to advance 6 boreholes to depths ranging from 25 to 31 feet below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located on Hwy. 5, 1 mile west of Winston Churchill Blvd., in the Town of Oakville and the City of Mississauga. The land adjacent to the site has a gently rolling topography, generally sloping down to the southeast toward Lake Ontario.

Hwy. 5 is in a 7 to 10 foot cut at the top of a very gently sloped hill. To the west of the site, the ground slopes down for ½ mile to the valley of Joshuas Creek which meanders within a steep-sided valley with a flood plain about 100 feet wide.

Land in the area is used primarily for wheat and grazing with some residential use.

Numerous ponds dot the area, kept full by the high water table. Water can also be seen lying in depressions in the ground surface, including the ditches beside Hwy. 5, for several days after a rain.

The site lies within the South Slope physiographic region. This region is characterized by glacially deposited overburden overlying shale bedrock of the Queenston and Dundas Formations of the upper Ordovician age.

SUBSURFACE CONDITIONS

General

At this site a mostly noncohesive, fluvial glacial deposit was found immediately below a very thin layer of topsoil. This was underlain by a cohesive glacial till deposit in most locations, followed by shale bedrock.

The upper 6 to 10 feet of the noncohesive deposit is composed of silt with a trace of sand and clay. Below this silt layer fine sand extends to between 11 and 20 feet.

At the south end of the west abutment only, the fine sand layer is underlain by a 5 foot thick deposit of well graded sand extending to bedrock at 25 feet. No cohesive glacial till was found at this location.

Underlying the fine sand layer in all other locations is a glacial till deposit of predominantly clayey silt, with a trace of sand and occasional gravel.

Red shale bedrock was found below the glacial till at depths ranging from 23 to 28 feet.

Detailed descriptions of the various soil and rock types encountered in each borehole are given on the Record of Borehole Sheets. Due to the variable strata sequences encountered, the Record of Borehole Sheets and the profile and cross-sections presented in Drawing No. 1597503-A should be consulted for detailed stratigraphic information.

A detailed description of the subsoil types is given in the following paragraphs.

Silt, Trace of Sand and Clay

This deposit is 6 to 10 feet thick extending from below a very thin topsoil layer (less than 6 inches). The material consists of silt with a trace of sand and a trace to some clay. Typical grain size distribution curves of the material in this deposit are shown in Fig. 1. Standard Penetration Test 'N' values ranging from 31 to 98 indicate a relative density of dense to very dense in this layer. The permeability of this material as estimated from the grain size distribution curves is approximately 10^{-8} to 10^{-7} m/sec.

Sand With Some Silt

This material underlies the silt layer and extends to depths below ground surface between 11 and 20 feet (elevation 549 and 540). Its composition varies

from sand with some silt to sandy silt in some locations. Typical grain size distribution curves of this material are shown in Fig. 2. The relative density of this material is generally dense to very dense but was found to be compact in one location, at the north end of the west abutment at a depth of 10 feet (elev. 550).

Sand (South End of West Abutment)

At the south end of the west abutment a 5 foot thick sand deposit was found to underly the fine sand layer and extend to bedrock at 25 feet. This material is well graded sand with a trace of silt and gravel. It is in a very dense condition. The permeability of this material is estimated as 10^{-7} to 10^{-6} m/sec.

This deposit is thought to have originated as a valley which was cut into glacial till and subsequently filled with fluvial sand.

Glacial Till

In all other locations the fine sand deposit is underlain by glacial till of predominantly clayey silt, with a trace of sand and occasional gravel. This deposit has a thickness of up to 15 feet and is underlain by bedrock at elevation 532 to 537. The consistency of this till is hard and its plasticity is in the low range.

The engineering properties of the cohesive glacial till as determined by laboratory testing are summarized below:

<u>Identity Tests</u>	<u>Range (%)</u>	<u>Average (%)</u>
Liquid Limit (W_L)	27-30	28
Plastic Limit (W_p)	14-16	15
Natural Moisture Content (W)	14-19	17
Plasticity Index (I_L)	12-15	13

Typical grain size distribution curves for this material are shown in Fig. 3.

Shale Bedrock

Red Queenston shale bedrock with occasional thin limestone layers and gray shale pockets was found at depths between 23 and 28 feet (elev. 532 to 537). The surface of the bedrock is relatively flat. Its upper 1 to 3 feet is weathered.

The shale is quite soft and has a low compressive strength as observed during field examinations; therefore, although high RQD values were recorded, the quality of the bedrock is assessed as poor to medium.

Groundwater Conditions

The groundwater table at the time of the fieldwork was found to be at elevation 556.5, about $4\frac{1}{2}$ feet below the Hwy. 5 road surface. Water was also observed lying in ground surface depressions and ponds throughout the area. Since the site was at the top of a gentle hill, these observations indicate relatively poor downward drainage, resulting in perched water conditions at the ground surface.

DISCUSSION AND RECOMMENDATIONS

It is proposed to construct an underpass and interchange at this site connecting Hwy. 5 and Hwy. 403. The interchange will include a two span, 200 foot structure carrying Hwy. 5 over Hwy. 403. To achieve the proposed profile grade and required clearance, Hwy. 403 will be in a cut approximately 15 feet deep. Our recommendations pertaining to the design and construction of the structure foundations are given in the following paragraphs.

Pier Foundation

The pier for the proposed structure may be supported on spread footings founded in the fine sand layer at or below elevation 549. A bearing capacity of 2 tsf may be assumed for design of the pier footings.

For frost protection purposes, a minimum 4 feet of earth cover or equivalent insulation must be provided to the underside of the footing.

Due to the high groundwater table and the relatively pervious sand layer, a temporary dewatering scheme will be necessary during excavation and construction of the pier footing. The groundwater table should be lowered to at least 1 foot below founding elevation during this time.

To prevent disturbance of the founding surface, a working slab of lean concrete should be placed immediately after excavation and inspection of the surface.

Abutment Foundations

The abutments may be supported on spread footings or on piles.

Spread footings: Spread footings should be founded in the silt deposit at or below elevation 558. Alternatively, if a perched abutment is desired, the footings can be founded on a compacted granular pad placed on the silt deposit at or below elevation 558 as shown in Fig. 4. At the footing locations, the sub-base of the existing Hwy. 5 and all loose material should be completely removed prior to construction of the footings. It may be necessary to bring the ground surface back up to the founding elevation with mass concrete or compacted granular material.

For either footing scheme a bearing capacity of 2 tsf may be assumed for design and a minimum 4 feet of earth cover or equivalent insulation should be provided to the base of the footings for frost protection purposes.

If the footing is placed directly on the silt deposit, a working slab of lean concrete should be placed immediately after excavation and inspection to prevent disturbance of the founding surface.

The groundwater table should be kept at least 1 foot below founding elevation during excavation and construction of the footings. This should not present a problem as the normal groundwater table is below this elevation. Any seepage or run-off into the excavation can be removed by pumping from sumps.

Piles: Either H piles or tube piles may be used for the abutment foundation. They should be designed as end-bearing piles and for the maximum structural capacity of the sections chosen. Pile driving should be controlled by Hiley formula.

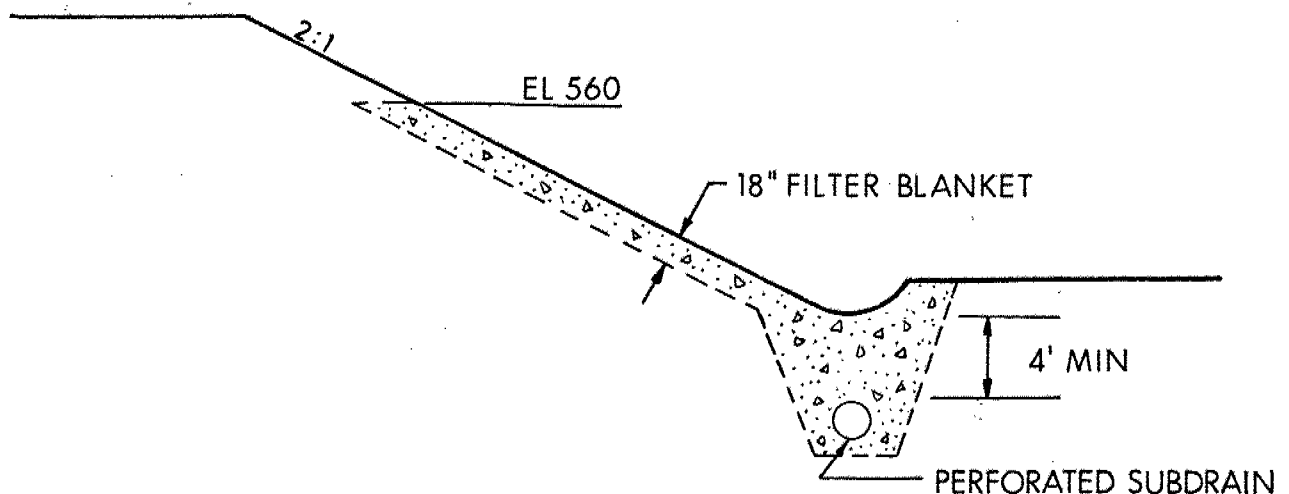
The estimated tip elevations at which the piles would achieve the design capacity are tabulated below:

	<u>H Pile</u>	<u>Tube Pile</u>
West Abutment - North End	535	538
West Abutment - South End	538	548
East Abutment - North End	540	545
East Abutment - South End	542	545

Embankments

No stability problems are anticipated for the proposed cuts for Hwy. 403 if 2:1 slopes are used.

Due to the high groundwater table, seepage will occur through the silt layer and, if not intercepted, will result in erosion and sloughing of the slope surfaces. In order to prevent this damage, a filter blanket at least 18 inches thick should be placed where water bearing material may intersect the slope within 100 feet of the structure. This filter blanket should drain to a perforated subdrain, installed at least 4 feet below ground surface, which in turn should drain to a stream or storm sewer system. A typical section incorporating a filter blanket is shown below.



MISCELLANEOUS

The fieldwork was carried out under the supervision of Mr. J. White. The equipment was owned and operated by Master Drilling Company Ltd.

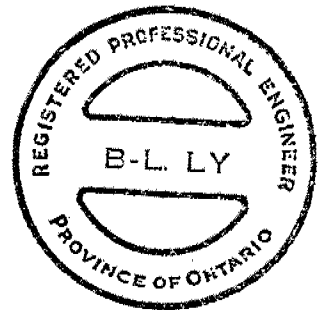
This report was prepared by Mr. J. White and reviewed by Mr. B. Ly.

James R White

J. White
Student Technician (Field)

B. Ly

B. Ly, P. Eng.
Senior Engineer










BL/JW/gs
August, 1977

APPENDIX

RECORD OF BOREHOLE No 11

W P 159-75-03 LOCATION Co-ords N 15,810,069: E 948,600 ORIGINATED BY J.R.W.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
 DATUM Geodetic DATE July 19, 1977 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH										WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE														
560.0	Ground Level																					
0.0	Silt trace of sand and clay Dense						550										0 5 84 11					
554.0			1	SS	35																	
6.0	Fine sand with silt Compact																					
549.4			2	SS	17																	
10.6	Silt some clay traces of sand																					
546.0																						
14.0	Glacial Till Het. mixture of clayey silt, some sand occasional gravel						540										39 28 26 7					
			3	SS	72																	
			4	SS	53												0 5 66 29					
			5	SS	38																	
			6	SS	88																	
	Hard																					
533.5			7	SS	110																	
531.8	Shale Bedrock		8	SS	131	7"																
28.1	End of Borehole																					

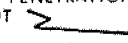
+³, x⁵: Numbers refer to
Sensitivity

20
15
10

5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12

W P 159-75-03 LOCATION Co-ords N 15,810,147: E 948,662 ORIGINATED BY J.R.W.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger- BXL Rock Core COMPILED BY J.R.W.
 DATUM Geodetic DATE July 18, 1977 CHECKED BY ---

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH						
								20 40 60 80 100						
								O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
							WATER CONTENT (%)							
							Wp ——— W ——— Wl							
559.1	Ground Level											10 20 30		
0.0	Silt trace of sand and clay Dense		1	SS	31									
554.1			2	SS	52									
5.0	Fine sand with silt Very Dense		3	SS	60									0 59 (41)
548.1			4	SS	69									
11.0	Silt with sand Very Dense		5	SS	106/6"									0 35 (65)
544.1			6	SS	70/6"									
15.0	Glacial Till Hard		7	SS	64/6"									
535.1	Het. mixture of clayey silt, some sand occasional gravel		8	SS	98/6"									
24.0	Bedrock red soft shale some limestone layers		10	RC	-									
529.5	and grey shale pockets		12	RC	95%									RQD 87%
29.6	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 13

W P 159-75-03 LOCATION Co-ords N 15,810,217; E 948,715 ORIGINATED BY J.R.W.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
 DATUM Geodetic DATE July 19, 1977 CHECKED BY RC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
560.1	Ground Level						560										GR SA SI CL
0.0																	
552.6	Silt traces of sand and Dense		1	SS	89												0 4 85 11
7.5	Sand traces of silt Very Dense		2	SS	65		550										
546.6																	
13.5	Glacial Till Hard		3	SS	140												
	Het. mixture of clayey silt, some sand occasional gravel		4	SS	78/6		540										
537.1			5	SS	145												
535.6	Shale Bedrock		6	SS	182												
24.5	End of Borehole																
	Note: Water level not established																

+³, x⁵: Numbers refer to
Sensitivity

20
15 \diamond 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 14

W P 159-75-03 LOCATION Co-ords N 15,810.017: E 948.664 ORIGINATED BY J.R.W.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger -BXL Rock Core COMPILED BY J.R.W.
 DATUM Geodetic DATE July 18, 1977 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
559.8	Ground Level																GR SA SI CL
0.0	Silt trace of sand Very Dense		1	SS	84		550							o			0 12 (88)
550.8			2	SS	98												
9.0	Sand with silt Very Dense		3	SS	92												
544.3																	
15.5	Silt trace of sand Very Dense		4	SS	97		540							o			7 76 (17)
540.3			5	SS	-												
19.5	Sand trace of silt and gravel Very Dense		6	SS	99									o			17 64 (19)
535.3																	
24.5	Weathered Shale with limestone chips		7	SS	98/51									o			7 27 48 18
26.8	Shale bedrock with limestone layers		8	SS	107/76												
529.2			9	RC	100%		530										RQD 98%
30.6	End of Borehole																

+³, x⁵: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 15

W P 159-75-03 LOCATION Co-ord N 15,810,097 E 948,726 ORIGINATED BY J.R.W.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
 DATUM Geodetic DATE July 19, 1977 CHECKED BY JRS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
560.1	Ground Level																
0.0	Silt traces of sand and clay Hard																
551.1			1	SS	47												
9.0	Sand some silt occasional gravel and cobbles		2	SS	37		550							5 75 (20)			
544.6	Dense to Very Dense		3	SS	71												
15.5	Glacial Till		4	SS	88									0 8 61 31			
	Het. mixture of clayey silt, some sand occasional gravel		5	SS	186		540										
533.1	Hard		6	SS	187									0 6 74 20			
27.0	Shale Bedrock		7	SS	185/6"												
28.5	End of Borehole																

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 16

W P 159-75-03 LOCATION Co-ords N 15,810,175: E 948,789 ORIGINATED BY J.R.W.
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Augers COMPILED BY J.R.W.
 DATUM Geodetic DATE July 20, 1977 CHECKED BY RS

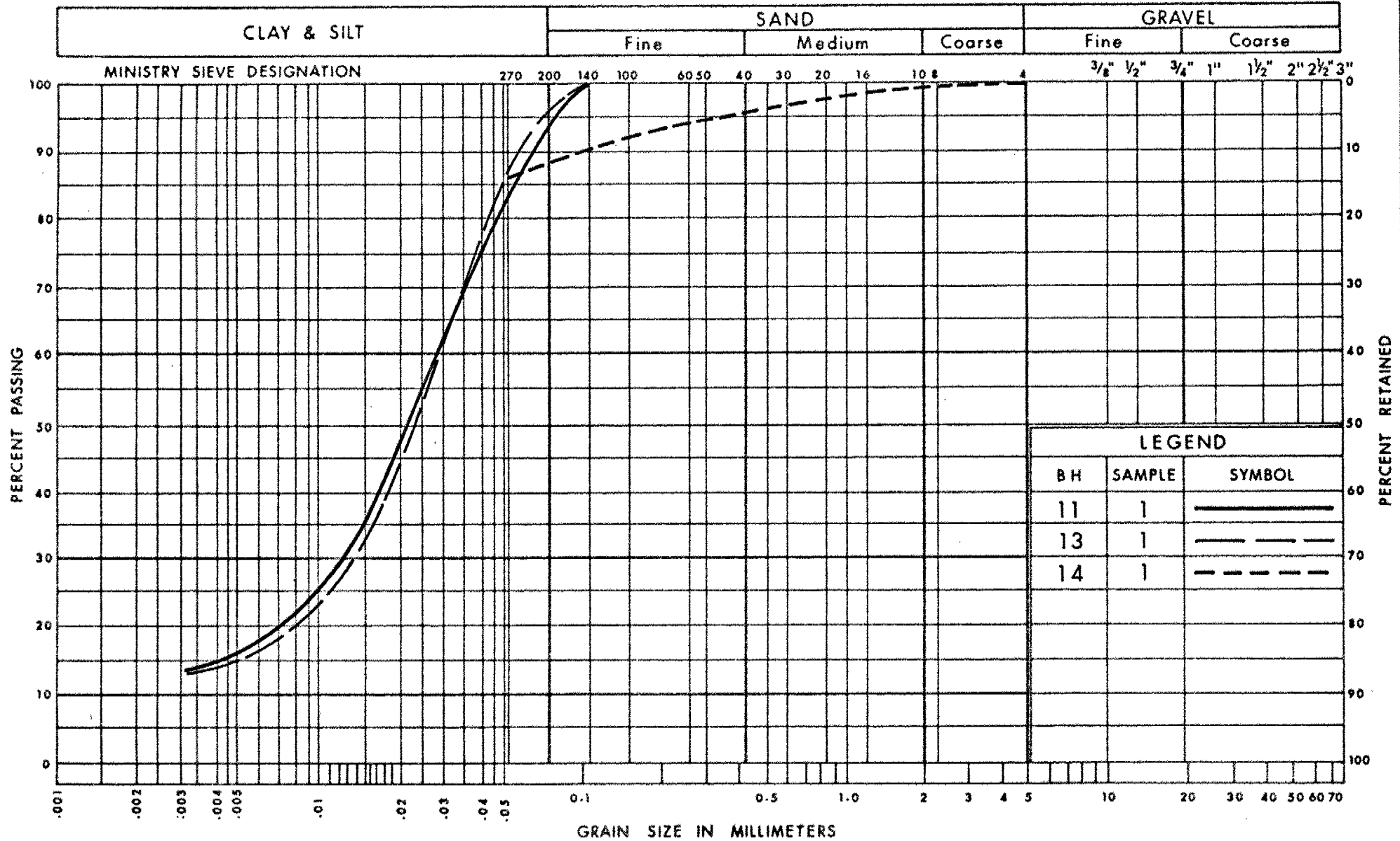
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
559.7	Ground Level																GR SA SI CL
0.0	Silt trace of sand occasional cobbles																
550.7							550										0 74 (26)
9.0	Fine Sand some silt Very Dense		1	SS	142												
546.7																	
13.0	Silt some clay and sand		2	SS	111												
544.2																	
15.5	Glacial Till Het. mixture of clayey silt, some sand occasional gravel		3	SS	115		540										1 12 60 27
535.2	Hard		4	SS	123												
24.5	Weathered Shale		5	SS	103												1 31 50 18
531.7	Shale Bedrock		6	SS	13976"												
28.0	End of Borehole																
	Note: Water level not established																

+³, x⁵: Numbers refer to
Sensitivity

20
15
10

5 (%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM



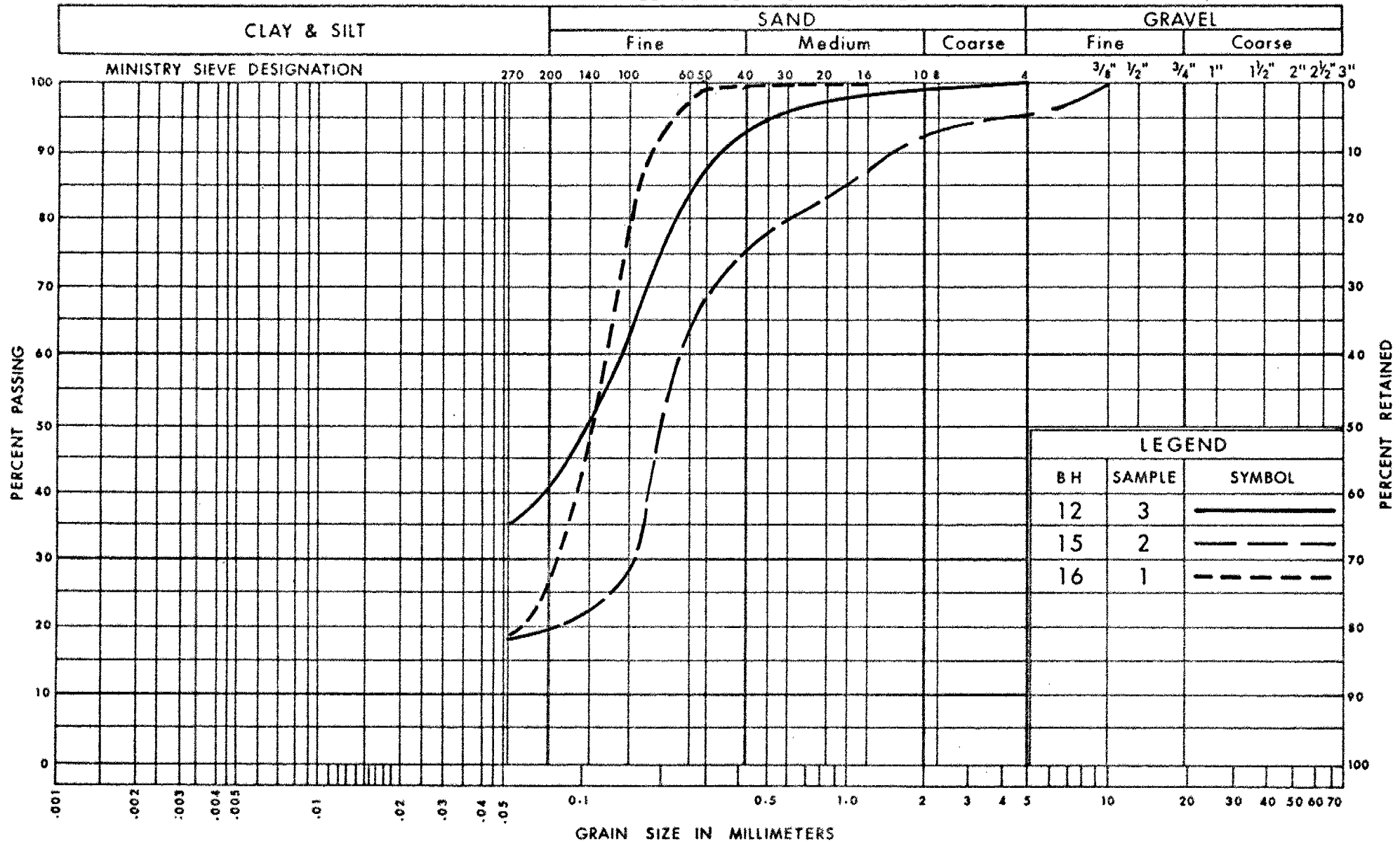
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILT
TRACE OF SAND & CLAY

FIG No 1

WP 159-75-03

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SAND
SOME SILT

FIG No 2

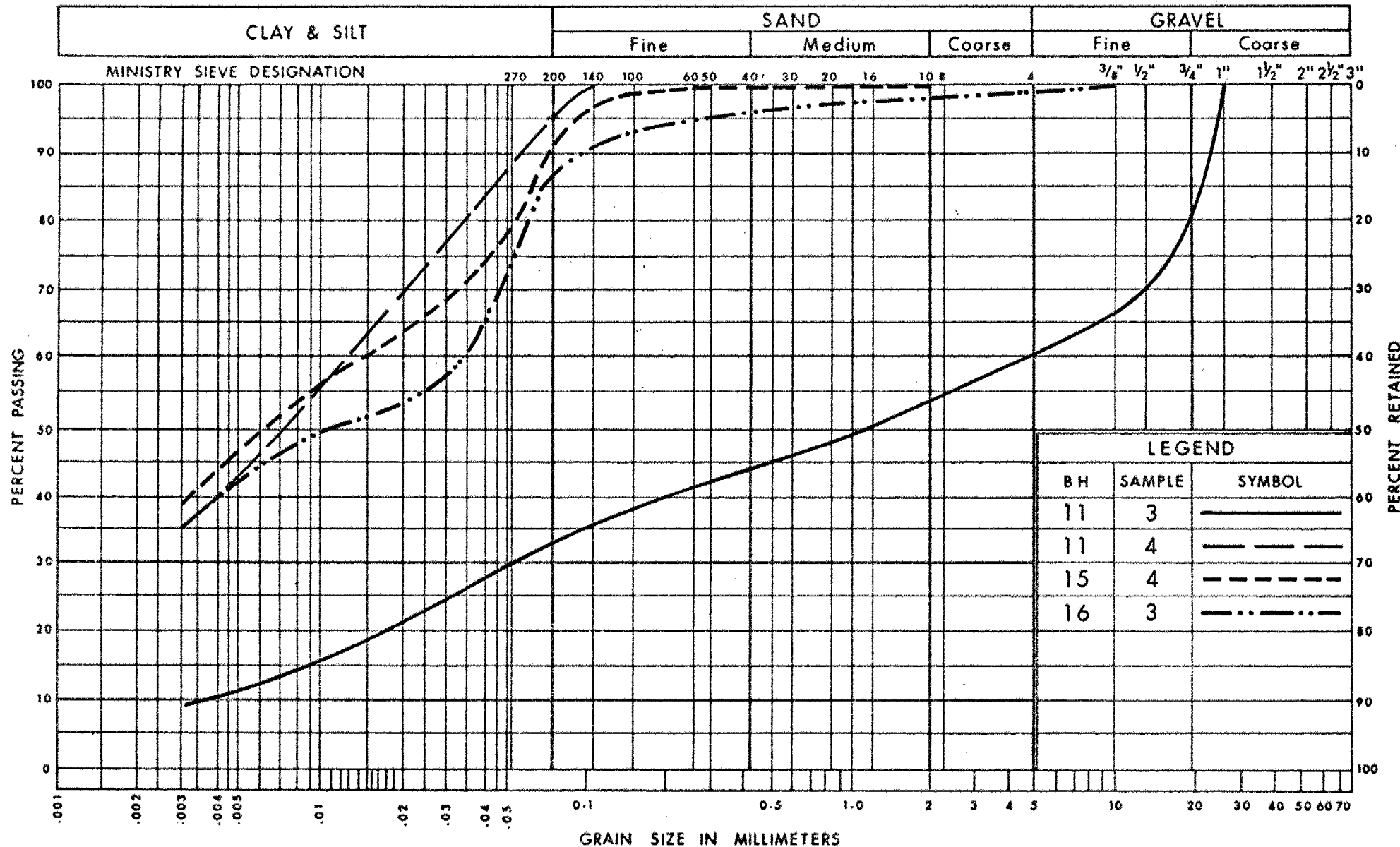
W P 159 - 75 - 03



Ontario

Ministry of
Transportation and
Communications

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

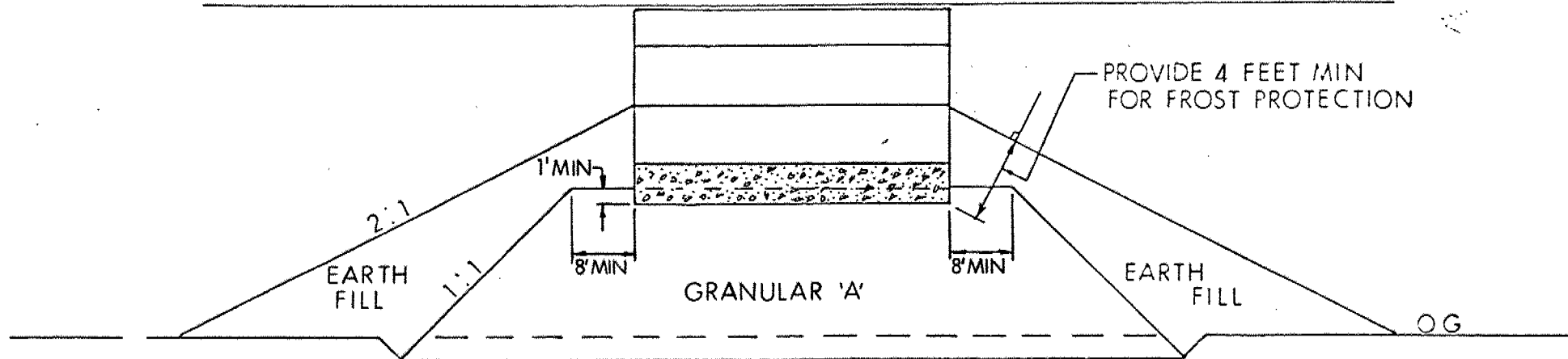
GRAIN SIZE DISTRIBUTION GLACIAL TILL

HET MIX OF CLAYEY SILT, SOME SAND, OCC GRAVEL

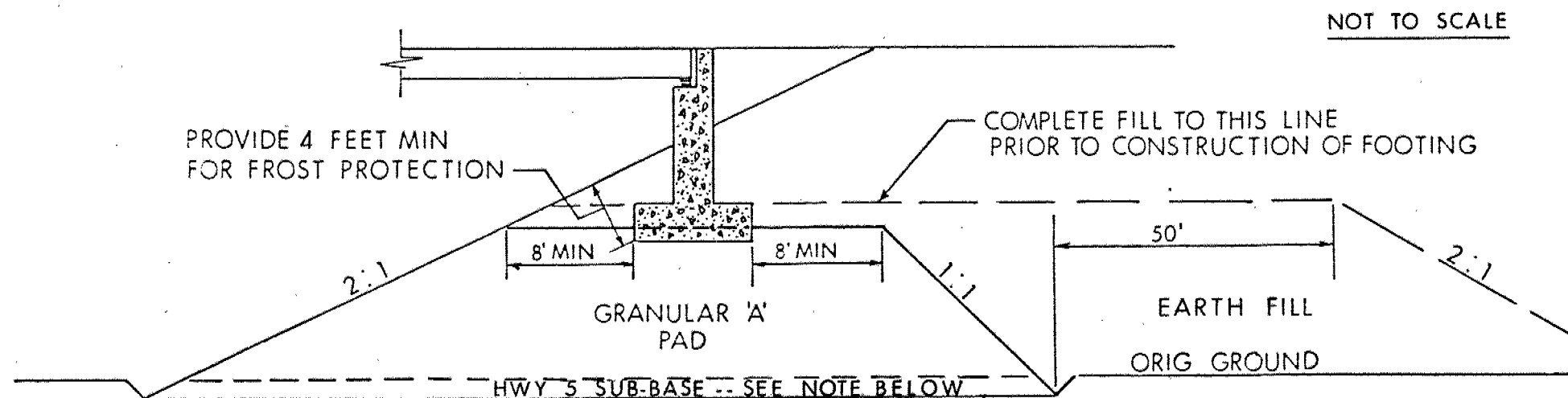
FIG No 3

W P 159-75-03

ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



X SECTION AT FACE OF ABUTMENT



NOT TO SCALE

LONGITUDINAL SECTION

NOTES:

- 1 - REMOVE HWY 5 SUB-BASE AND ANY LOOSE MATERIAL UNDER AREA OF GRANULAR 'A'
- 2 - PLACE GRANULAR 'A' & EARTH FILL TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' & EARTH FILL FOR FOOTING.

FIG 4

EXPLANATION OF TERMS USED IN REPORT

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

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. $C\bar{U}$ = 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
 w SLOPE ANGLE-BACKFACE OF WALL
 β ANGLE OF SLOPE
 N_q, N_c, N_{γ} 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 = $\frac{I_P \text{ of soil}}{I_P \text{ of } 2\mu m \text{ Soil Fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

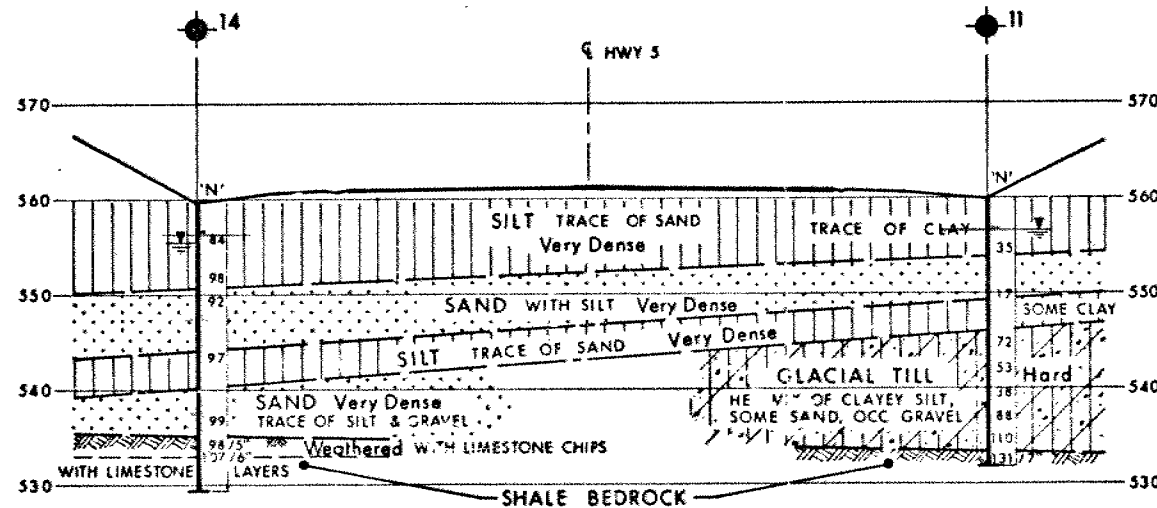
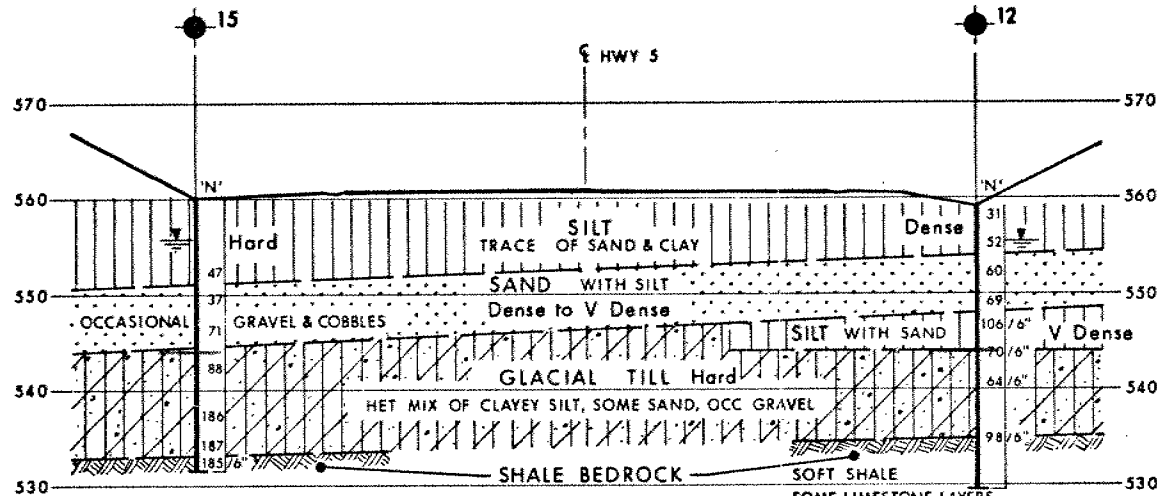
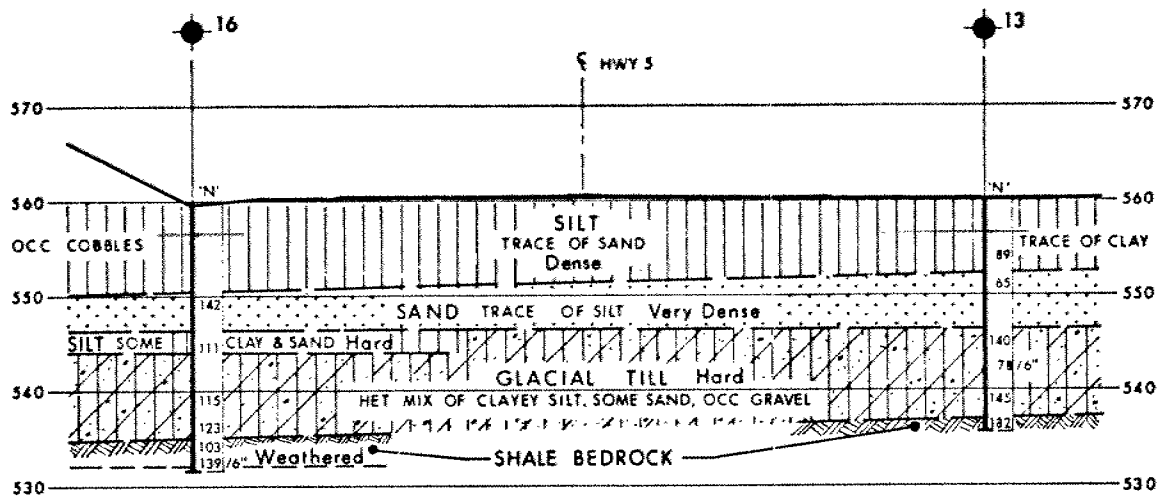
STRENGTH PARAMETERS

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

HYDRAULIC TERMS

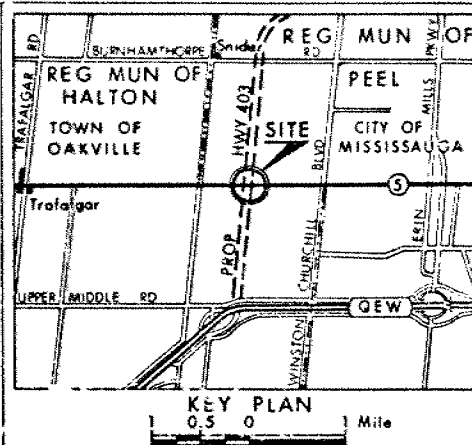
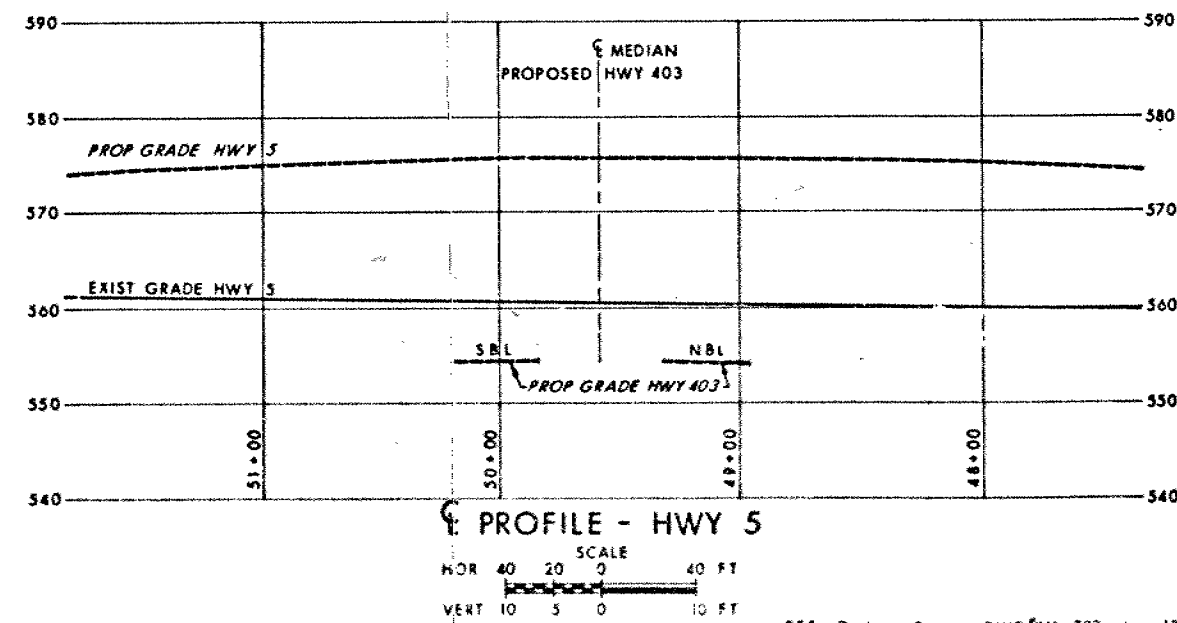
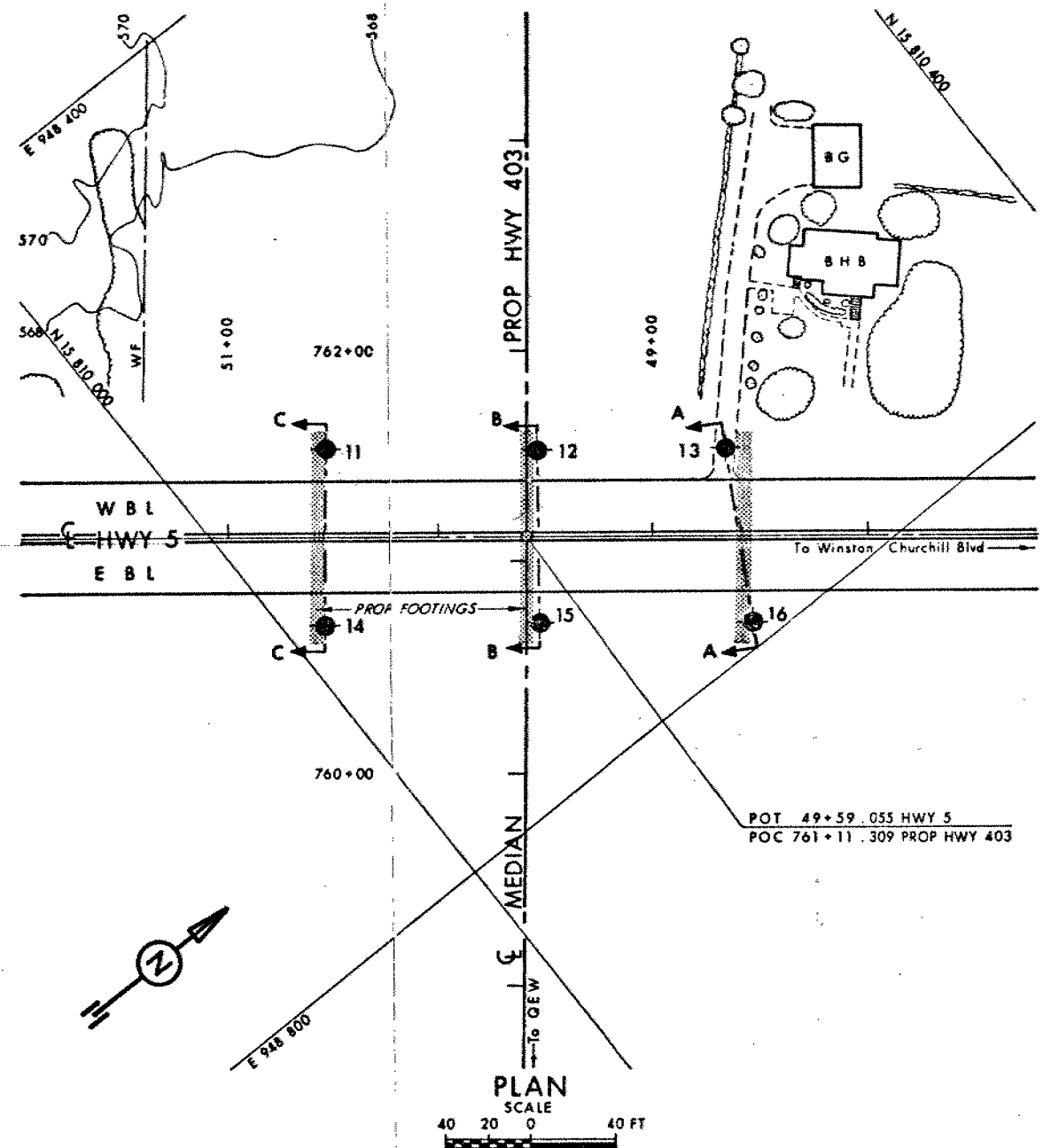
h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT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

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS



SECTIONS

SCALE
10 5 0 10 FT



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 July 1977
- WL for Bore Holes 13 & 16 not established

No	ELEVATION	CO ORDINATES NORTH	EAST
11	560.0	15 810 069	948 600
12	559.1	15 810 147	948 662
13	560.1	15 810 217	948 715
14	559.8	15 810 017	948 664
15	560.1	15 810 097	948 726
16	559.7	15 810 175	948 789

-NOTE-

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

REVISIONS	DATE	BY	DESCRIPTION

Mr. C.S. Grebski
Head, Central Section
Structural Office
2nd Floor, West Building

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

78 09 28

Mr. W. Lin

Re: Hwy. 403 Underpass at Hwy. 5
W.P. 159-75-03, Site 10-281
Hwy. 403, District 4, Hamilton

We have reviewed the final bridge drawings. Our comments are as follows.

1. Since excavation for the pier footings will be carried out below groundwater in granular soil, a dewatering scheme will be required to prevent 'boiling' of the base of the excavation. If sheeting is used, it should be extended at least 1 1/2 feet into the cohesive glacial till stratum.
2. The abutment footings can be constructed by carrying out oversized excavation and pumping from sumps.
3. The 3" mass concrete should be poured immediately after completion of the footing excavation.

B. Ly
Senior Engineer

For: M. Devata
Supervising Engineer

BL/MD/gs

cc: G.C.E. Burkhardt
D. MacDonald
Files ✓

Mr. W. L. Lin
Design Engineer
Central Section
Structural Office , West Building

Soil Mechanics Section
Engineering Materials Office
3rd Floor, Central Building

Mr. R.E. Haynes

78 04 26

Re: Hwy. 403 Underpass at Hwy. 5
W.P. 159-75-03, Site 10-281
District 4, Hamilton

Further to your memorandum of 78 04 21, we have reviewed your newly proposed footing formation levels in relation to our subsurface data and recommend the following for your design purposes:

<u>Footing Location</u>	<u>Elev.</u>	<u>Allowable Pressure</u>	<u>Lateral Resistance</u>
East Abutment	557	2.5 tsf	coef.of friction=0.55
Centre Pier	544	4.0 tsf	Adhesion = 2 tsf
West Abutment	557	2.5 tsf	coef. of friction=0.55

B. Ly

B. Ly
Senior Engineer

~BL/ig ~

cc: Files ✓



Memorandum

To: Mr. C. Mirza,
Head, Soil Mechanics Section,
Central Bldg., Third Floor,

From: Structural Office,
2nd Floor, West Building,
Downsview.

Attention: Mr. B. Ly

Date: 78 04 21

Our File Ref.

In Reply to

Subject: Hwy. 403 Underpass at Hwy. 5
W.P. 159-75-03, Site 10-281
District 4, Hamilton

The proposed bottom of footing elevations for the above structure are given below:

	<u>Station</u>	<u>Elev.</u>
East Abutment	48 + 59.055	557
Pier	49 + 59.055	544
West Abutment	50 + 59.055	557

With this new information, would you please confirm whether the bearing capacity recommended in the foundation report may be increased. In addition, would you please recommend a design value for the co-efficient of friction between the soil and underside of footing.

R. E. Haynes

R. E. Haynes,
Structural Project Engineer.

REH/mh

c.c. W. Lin
G.C.E. Burkhardt

