

ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

WP 159-75-08

DIST 4

HWY QEW/Ford Drive/ STR SITE 10-282B  
403

W-N Ramp Hwy. #403 under North Service Road

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TYPE	DISCARD AFTER	RECOMM. BY
JARS	77 of 01	M.D.
TUBES	-	-
ROCK CORES	The remainder of contract	M.D.

## FOUNDATION INVESTIGATION REPORT

For

W-N Ramp Hwy. #403 under North Service Road  
QEW/Ford Drive/403 Interchange  
W.P. 159-75-08, Site 10-282B  
District 4, Hamilton

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### INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project during the period of March 24, 1977 to March 29, 1977. The fieldwork consisted of 5 sampled boreholes advanced by means of a continuous flight auger machine equipped with solid stem augers. In addition, diamond drilling techniques were employed to obtain BXL size core of the bedrock. The boreholes ranged in depth from 30 to 40 feet below the ground surface.

### SITE DESCRIPTION AND GEOLOGY

The site is located approximately 1100 feet north of the existing Queen Elizabeth Way underpass at Ford Drive in the Town of Oakville, Regional Municipality of Halton. The land immediately adjacent to the site has a gentle rolling topography sloping down to the south. Drainage ditches excavated within the area have exposed the underlying red shale characteristic of the Queenston shale area. The land is developed for farming purposes.

Physiographically the site lies on the southern edge of the region referred to as the 'South Slope'. This region is a strip of land bounded by the Iroquois Plain on the south and the Peel Plain on the north extending from the Niagara escarpment to the Trent River. The region is characterized by a shallow till overlying shale of the Queenston and Dundas Formations of the Upper Ordovician age.

### SUBSURFACE CONDITIONS

Generally uniform subsurface conditions were found to exist across the site. A 5 to 7 foot layer of clayey silt was found to overly shale

bedrock of the Queenston Formation. Detailed description of the various soil and rock types encountered in each borehole are given in the Record of Borehole Sheets. The estimated stratigraphical profile and sections shown on Drawing No. 1597508-A are based upon this information. From ground level downwards, the various soil types encountered are as follows:

#### Clayey Silt, Trace of Sand

Immediately below the natural ground level a cohesive stratum 5 to 7 feet thick consisting of clayey silt with traces of sand was encountered. The Standard Penetration Tests gave a 'N' value range of 22 to 82 blows/ft. Based on these 'N' values the consistency of this stratum is estimated to range from very stiff to hard.

The physical properties of the clayey silt as determined from laboratory testing are summarized below:

		<u>Range</u>	<u>Average</u>
Liquid Limit	( $W_L$ ) %	26-32	29
Plastic Limit	( $W_p$ ) %	14-20	17
Moisture Content	( $W$ ) %	8-14	12
Plasticity Index	$I_p$	10-14	12

The results of the Atterberg Limit tests are shown on the Plasticity Chart on Fig. 1. The Atterberg Limits indicate that the cohesive stratum is generally inorganic and of low plasticity.

#### Bedrock - Shale

Underlying the cohesive deposit is shale bedrock which was proven to a maximum depth of 34 feet. The bedrock can be described as soft, fine textured, red in colour, fissile having thin horizontal bedding planes with seams of limestone up to 6" thick. Generally, the upper 3 to 6 ft. of the shale bedrock is moderately weathered. However, in B.H. #9 in addition to the upper weathered zone two distinct bands of weathered shale were also encountered. These weathered zones extend from 14' to 16' 5" and 18' 2" to 21' 8" below the ground surface. A detailed description of the bedrock is given on the Record of Borehole Sheets.

The rock quality designation (RQD) classification gives an indication of the quality of the bedrock with respect to the number of fractures and amount of softening or alternation of the rock mass. The RQD is the total length of rock core pieces of 4 or more inches in length expressed as a percentage of the total length of core drilled. The RQD for the cored shale bedrock varies from 0 to 85%, indicating a rock quality ranging from very poor to good. Generally, the higher RQD values being measured at greater depths in the boreholes.

#### GROUNDWATER

The groundwater level conditions were observed by measuring in the open boreholes during and after the completion of the foundation investigation. The groundwater levels were found to vary between elevation 484.4 and 488.4 which corresponds to 1.0 to 1.5 feet below the existing ground surface. The groundwater levels are shown on the Record of Borehole Sheets as well as on Drawing No. 1597508-A.

## DISCUSSION AND RECOMMENDATIONS

As part of the proposed new complex interchange connecting QEW to Hwy. 403 a structure will be required to carry Hwy. 403 W-N Ramp under the North Service Road.

In the vicinity of the proposed structure, the existing ground level is at about elevation 487. The proposed grade of the North Service Road will be at elevation 493 and the grade of the W-N Ramp is to be at elevation 470. This will necessitate fills of 6 ft. and cuts of about 17 ft.

A three span structure (38'-69'-38') with perched abutments and two centre piers are presently being considered for the structure carrying the North Service Road over the W-N Ramp.

### Abutments Foundation

The abutments for the proposed structure can be supported on spread footings situated within the clayey silt stratum at or below elevation 482 for the west abutment and at or below elevation 485 for the east abutment. Footings so founded may be designed for a bearing pressure of up to 3.0 tons per square foot. In any case, the underside of the footing should be provided with at least 4 feet earth cover for frost protection requirements.

For estimating the earth pressure of granular backfill on the abutment walls a coefficient of active earth pressure of  $K_a = 0.33$  may be used if some movement at the top of the wall is permitted. If no movement at the top of the wall is anticipated, a coefficient of earth pressure at rest  $K_0 = 0.5$  may be used for design purposes.

To estimate the horizontal resistance to sliding between rough concrete and the clayey silt stratum, an adhesion value of up to 2000 psf may be used for design purposes.

In order to relieve the build up of hydrostatic pressures behind the abutment walls the structure should be backfilled with free draining granular material and provided with weepholes or other type of drainage conduit.

### Pier Foundation

The proposed grades of the W-N Ramp will be such that the pier footings will be situated within the sound shale bedrock. Therefore, it is recommended that the piers be supported on spread footings designed for an allowable bearing pressure of up to 10 tons per square foot. Since the shale is frost susceptible, the underside of the footings should be provided with 4 feet of earth cover.

### Other Considerations

To prevent softening of the shale bedrock due to weathering at the footing elevation, it should be covered with 3 inches of mass concrete immediately after the completion of the excavation.

No dewatering problems are anticipated for the construction of the abutment and pier footings. Any minor seepage or surface runoff into the excavations can be handled by pumping from sumps.

### Approach Fill - North Service Road

For the North Service Road, approach fills of up to 6 feet in height will be required at the proposed structure. No slope stability problems are expected provided the slopes are constructed at 2:1 (horizontal:vertical).

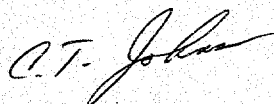
### Cut - W-N Ramp

As mentioned previously, a cut of up to 17 feet will be necessary at the structure site in order to reach the profile grade of the proposed W-N Ramp of Hwy. 403. This cut will be made through the cohesive clayey silt and into the shale bedrock. The shale is susceptible to weathering and erosion, therefore, the cut should be treated as an earth cut and constructed with 2:1 slopes. It is further recommended that the cut slopes be covered with topsoil and sodded according to current MTC standards.

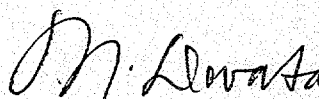
MISCELLANEOUS

The field work for this investigation was carried out under the supervision of Mr. C.T. Johnson. The equipment used was owned and operated by Geocon Ltd., Toronto and Atcost, Ltd., Toronto.

This report was written by Mr. C.T. Johnson, Project Engineer and reviewed by Mt. M. Devata, Supervising Engineer.



C.T. Johnson  
Project Engineer



M. Devata, P. Eng.  
Supervising Engineer



MD/CTJ/bp  
May, 1977

## FOUNDATION REQUEST

In a memorandum dated February 16, 1977, Mr. G.C.E. Burkhardt, Head, Structural Section requested the Soil Mechanics Section to prepare a Foundation Investigation Report for the North Service Road Structure over W-N Ramp Hwy. #403.

## FIELD AND LABORATORY INVESTIGATION PROCEDURES

A total of five boreholes four of which were accompanied with a dynamic penetration test were put down using a muskeg mounted auger machine equipped with solid stem augers and rock coring equipment.

The locations and elevations of the boreholes were surveyed by personnel from the Central Regional Surveys and Plans Section.

Disturbed soil samples were received by means of a 2 inch O.D. split spoon sampler driven in accordance with the specifications of the Standard Penetration Test. Rock core of the bedrock was obtained by coring with BXL diamond bits.

The samples were visually examined and identified in the field and again in the laboratory. Following this examination, laboratory testing was carried out on selected representative samples of the cohesive stratum to determine the natural moisture content, Atterberg Limits and grain size distribution.

The rock core was examined and logged in detail in the laboratory by Mr. B.K. Glassford, Geologist.



HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 9

WP 159-75-08

LOCATION Co-ords. N 15,805,939; E 953,723

ORIGINATED BY CTJ

DIST 4 HWY 403

BORING DATE March 29, 1977

COMPILED BY CTJ

DATUM Geodetic

BOREHOLE TYPE Solid Stem Auger; BXL core & Cone Test

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
489.4	Ground Level															
0.0	Clayey silt, trace of sand															
484.4	Hard, Red		1	SS	82											
5.0			2	SS	700	6"										
479.4	(Weathered)					480										
10.0	(Sound)															
	Shale Bedrock		3	RC	100%											RQD 0%
	(Weathered)			BXL	Rec											
	(Weathered)		4	RC	100%	470										RQD 50%
	(Weathered)			BXL	Rec											
	* See below															RQD 50%
458.5			5	RC	100%	460										
				BXL	Rec											
30.9	End of Borehole															
	* Shale Bedrock, red colour, soft, fine texture, fissile with thin seams of limestone up to 6" thick, thin horizontal bedding															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 10

WP 159-75-08 LOCATION Co-ords. N 15,805,795; E 953,656 ORIGINATED BY CTJ  
 DIST 4 HWY 403 BORING DATE March 24, 1977 COMPILED BY CTJ  
 DATUM Geodetic BOREHOLE TYPE Solid Stem Auger; BXL Core & Cone Test CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$		
486.0	Ground Level															GR SA SI C
0.0	Clayey silt, trace of sand. Very stiff to hard. Red		1	SS	22											0 5 67 28
479.0			2	SS	99											
7.0	Shale bedrock (weathered)		3	SS	140/10"											
474.0	(sound)		4	SS	100/4"											
12.0			5	SS	100/5"	470										
	Shale Bedrock, red colour, fine texture soft, fissile with thin seams of limestone up to 5" thick thin horizontal bedding.		6	SS	100/8"											
			7	BXL	60% Rec											RQD 0%
			8	RC BXL	100% Rec	460										
456.0			9	BXL	100% Rec											
30.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE N<sup>o</sup> 11

WP 159-75-08

LOCATION Co-ords. N 15,805,900; E 953,757

ORIGINATED BY CTJ

DIST 4 HWY 403

BORING DATE March 28, 1977

COMPILED BY CTJ

DATUM Geodetic

BOREHOLE TYPE Solid Stem Auger; BXL core & Cone Test

CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$		UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	$w_p$	$w$		
488.2	Ground Level													
0.0	Clayey silt, trace of sand		1	SS	31									
482.2	Very stiff Red		2	SS	145/11"									
6.0	(Weathered)													
479.2	(Sound)													
9.0	Shale Bedrock		3	RC BXL	100% Rec									RQD 40%
	Shale Bedrock, red colour, fine texture soft, fissile, with interbedded thin seams of limestone up to 6" thick, thin horizontal bedding.		4	RC BXL	100% Rec									RQD 50%
			5	RC BXL	100% Rec									RQD 85%
448.4														
39.8	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 12

WP 159-75-08 LOCATION Co-ords. N 15,805,758; E 953,686 ORIGINATED BY CTJ  
 DIST 4 HWY 403 BORING DATE March 24, 1977 COMPILED BY CTJ  
 DATUM Geodetic BOREHOLE TYPE Solid Stem Auger; BXL core CHECKED BY RS

SOIL PROFILE		STRAT. PLOT	SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
485.4	Ground Level															
0.0	Clayey silt, trace of sand															
479.4	Very stiff Red		1	SS	31											
6.0			2	SS	55	480										
			3	SS	100	481"										
473.4	(weathered)		4	SS	100	482"										
12.0	(sound)		5	SS	100	483"										
	Shale Bedrock					470										
	Shale Bedrock, red colour, fine texture soft, fissile with thin seams of limestone present, thin horizontal bedding		6	RC BXL	100% Rec	460										RQD 50%
			7	RC BXL	100% Rec											RQD 75%
452.7																
32.7	End of Borehole															

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

## RECORD OF BOREHOLE No 17

WP 159-75-08

LOCATION Co-ords. N 15,805,835; E 953,725

ORIGINATED BY CTJ

DIST 4 HWY 403

BORING DATE March 25, 1977

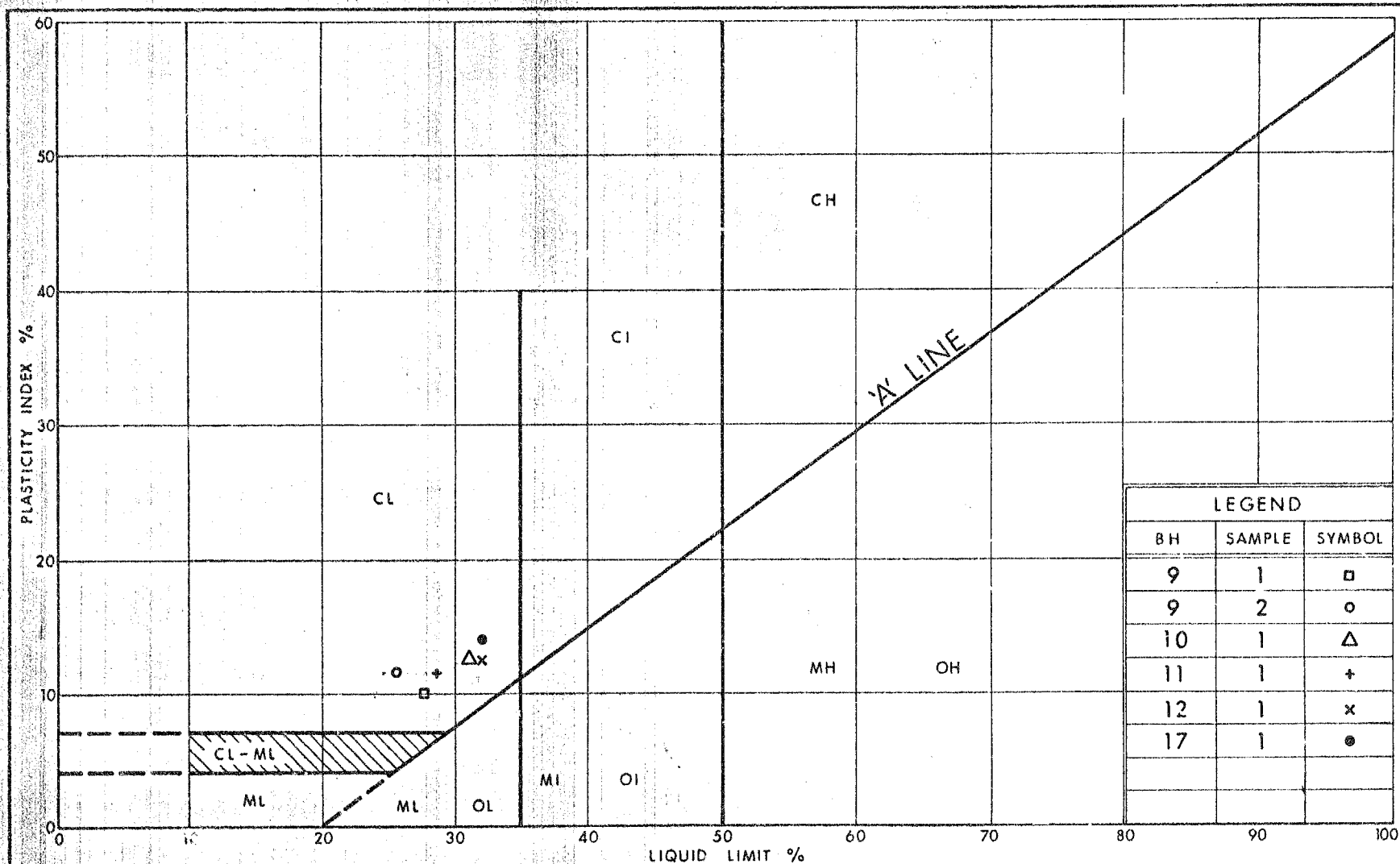
COMPILED BY CTJ

DATUM Geodetic

BOREHOLE TYPE Solid Stem Auger; BXL Core &amp; Cone Test

CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
487.2	Ground Level															
0.0	Clayey silt, trace of sand, occ. cobbles		1	SS	44											
481.2	Hard Red		2	SS	137	9 1/2"										
6.0	Shale Bedrock		3	SS	100	6"										
475.2	(weathered)		4	SS	100	6"										
12.0	(sound)		5	SS	100	4"										
	Shale Bedrock, red colour, fine texture, soft fissile, bedding close to very close, interbedded with lime stone seams up to 6" thick, thin horizontal bedding.		6	SS	100	3"										
			7	SS	100	1"										
457.5			8	RC BXL	100% Rec	460										RQD 40%
29.7	End of Borehole															



Ministry of  
Transportation and  
Communications

PLASTICITY CHART  
CLAYEY SILT  
TRACE OF SAND

FIG No 1

W P 159 - 75 - 08

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### PENETRATION RESISTANCE

'N'-STANDARD PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF . 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL. THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>c LB/SQ FT</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

### TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W	THINWALL OPEN
W.S	WASHED SAMPLE	T.P	THINWALL PISTON
S.T	SLOTTED TUBE SAMPLE	OS	OESTERBERG SAMPLE
A.S	AUGER SAMPLE	F.S	FOIL SAMPLE
C.S	CHUNK SAMPLE	R.C	ROCK CORE

P.H SAMPLE ADVANCED HYDRAULICALLY

P.M SAMPLE ADVANCED MANUALLY

### SOIL TESTS

U	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

# ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

## SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_P$	PLASTIC LIMIT
$I_P$	PLASTICITY INDEX
$w_S$	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$
$I_C$	CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$C_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

## GENERAL

$\pi$	> 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

## STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

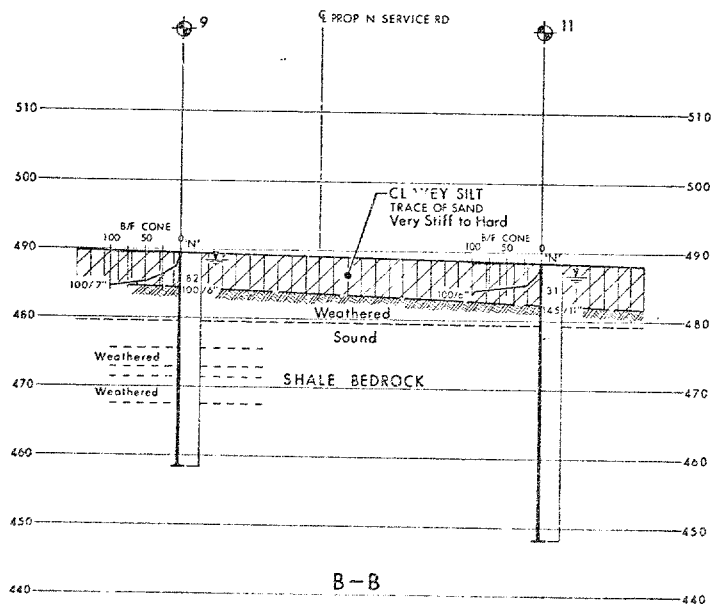
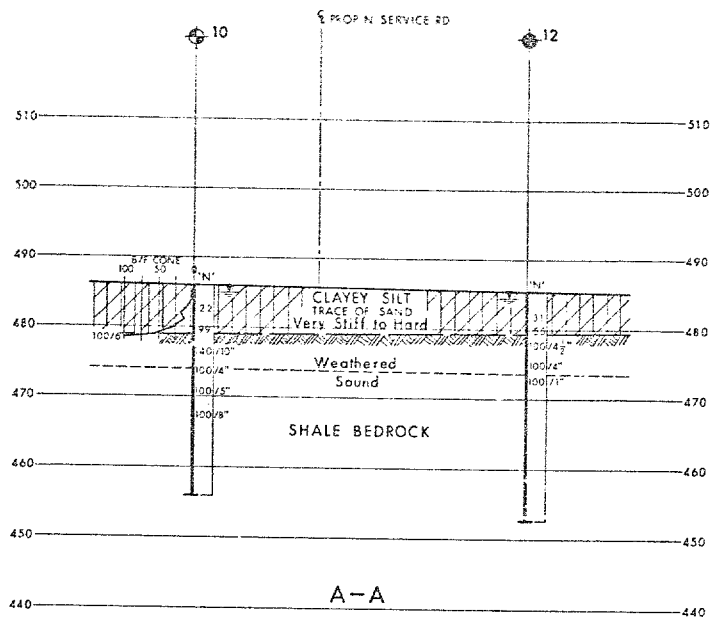
## FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

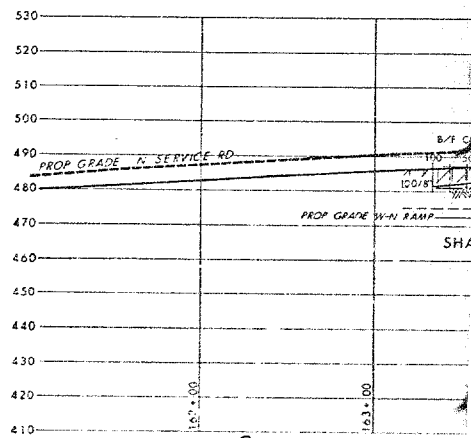
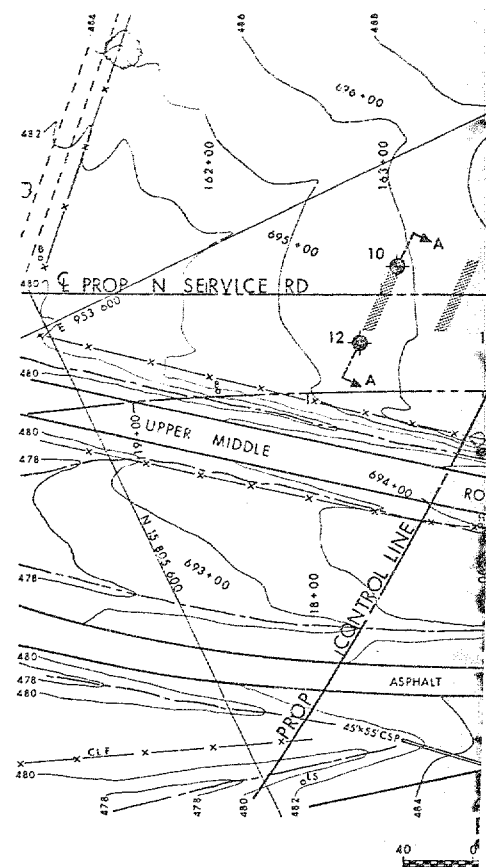
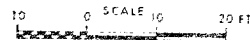
## SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL





SECTIONS



PROFILE - PROPOSED

HOR 40  
VERT 20

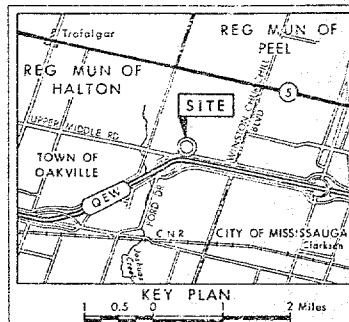
CONT No  
WP No 159-75-08

PROPOSED NORTH SERVICE RD

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



KEY PLAN  
0.5 0 2 Miles

### LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/ft (Std Pen Test 350 ft lbs energy)
- Cone Blows/ft (60° Cone, 250 ft lbs energy)
- WL at time of investigation Mar 1977

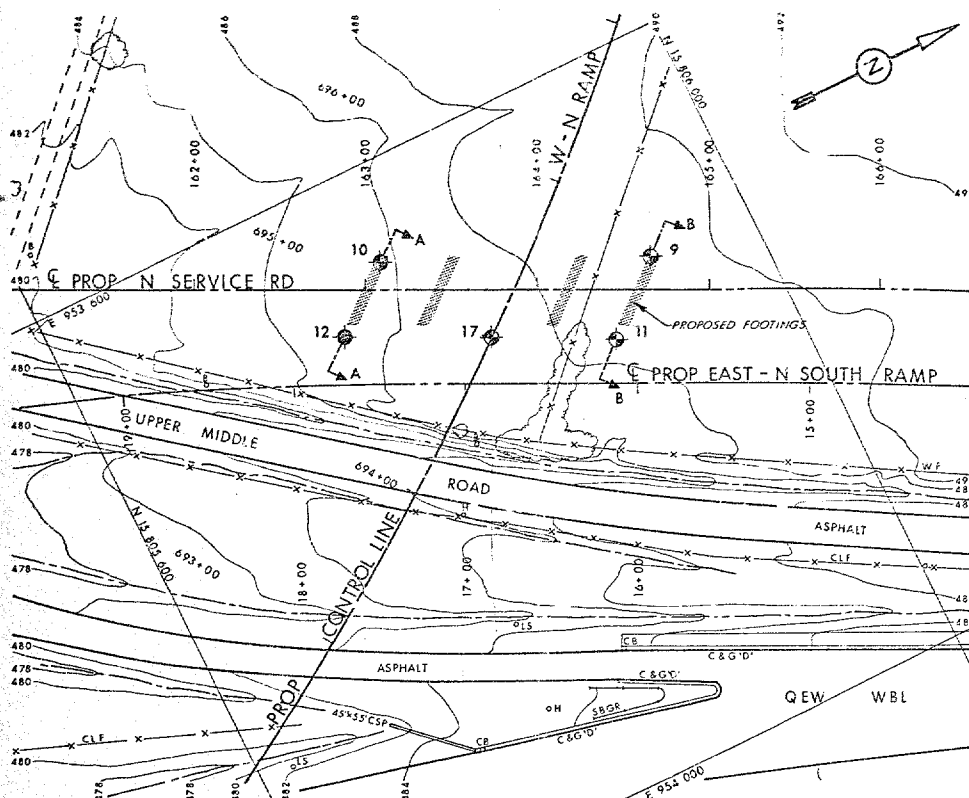
No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
9	489.4	15 805 939	953 723
10	486.0	15 805 795	953 656
11	488.2	15 805 900	953 757
12	485.4	15 805 758	953 686
17	487.2	15 805 835	953 725

### -NOTE-

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

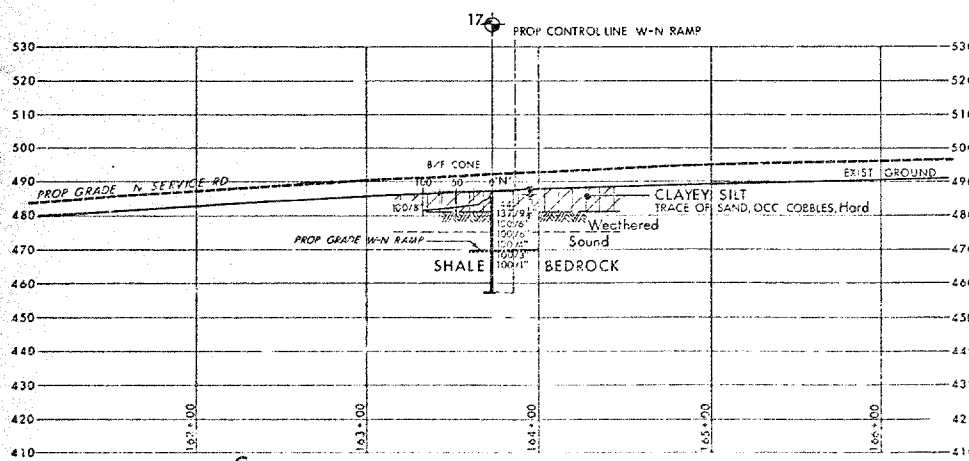
REVISIONS	DATE	BY	DESCRIPTION

REVISED: 403 W-N RAMP  
CHECKED: C.J. WICKERT, DATE: May 25, 1977, SITE NO: 2828  
DRAWN: R.S. WICKERT, DATE: May 25, 1977, SITE NO: 1597508-A



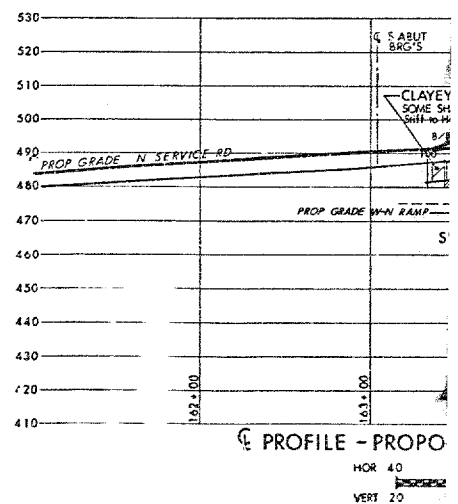
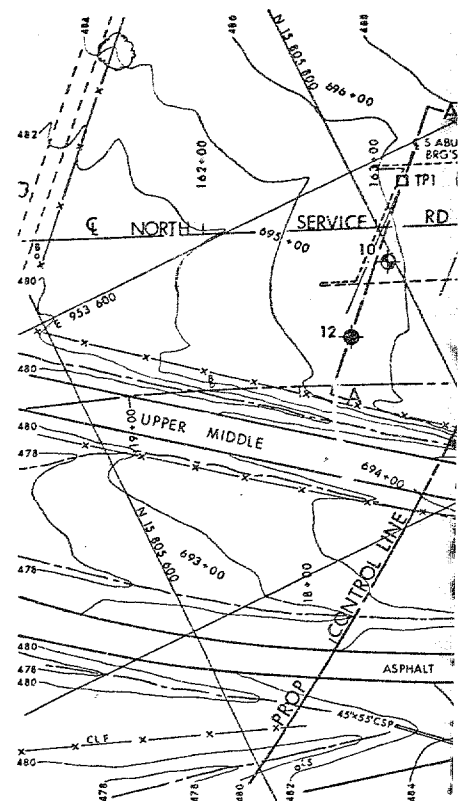
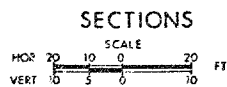
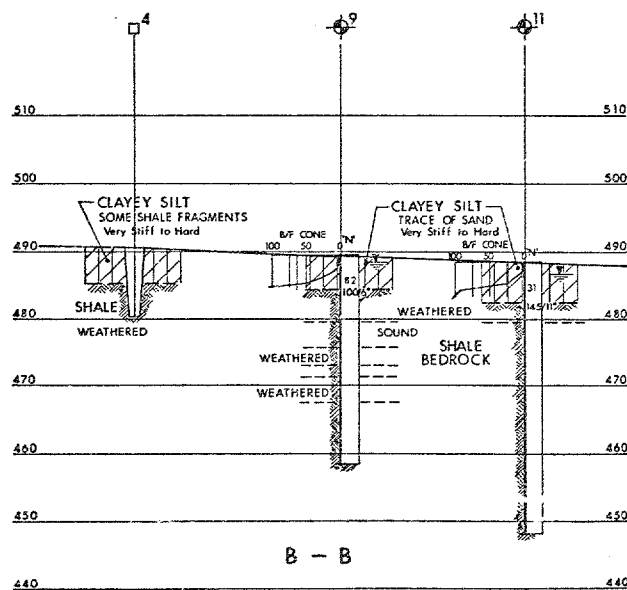
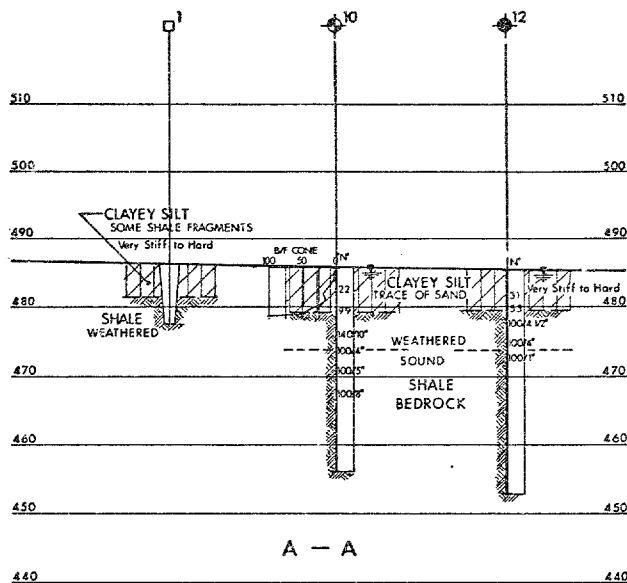
### PLAN

0 SCALE 40 80



### PROFILE - PROPOSED NORTH SERVICE ROAD

HOR 40 0 SCALE 40 80 FT  
VERT 20 0 20 AC FT

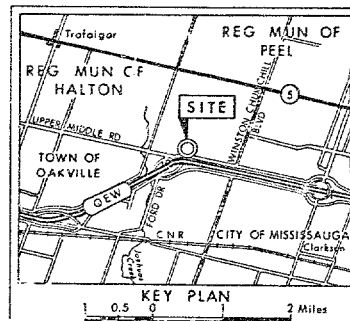


CONT No  
WP No 159-75-08



W-N RAMP HWY 403 UNDER  
NORTH SERVICE ROAD  
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



# LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/ft (Std Pen Test 350 ft lbs energy)
- Cone Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation Mar 1977
- TEST PITS

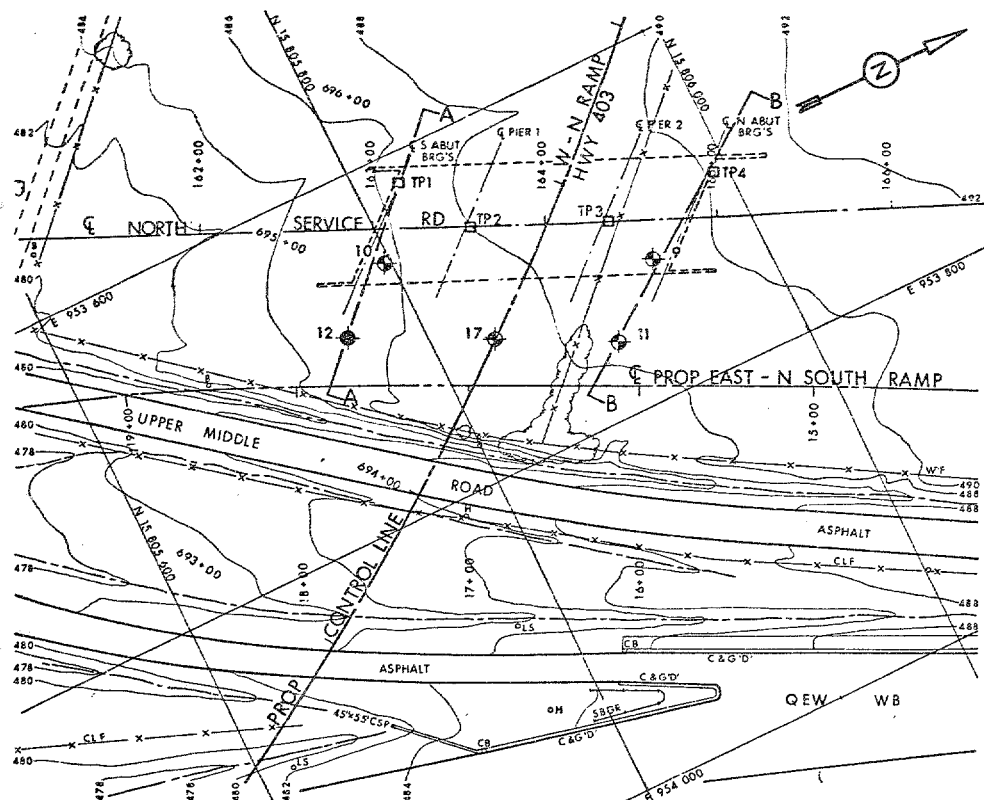
No	ELEVATION	CO-ORDINATES NORTH	EAST
9	489.4	15 805 939	953 723
10	486.0	15 805 795	953 656
11	488.2	15 805 900	953 751
12	485.4	15 805 758	953 686
17	487.2	15 805 635	953 725
TEST PITS			
1	486.6	15 805 823	953 618
2	487.9	15 805 848	953 659
3	489.2	15 805 923	953 694
4	490.3	15 805 992	953 693

## -NOTE-

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

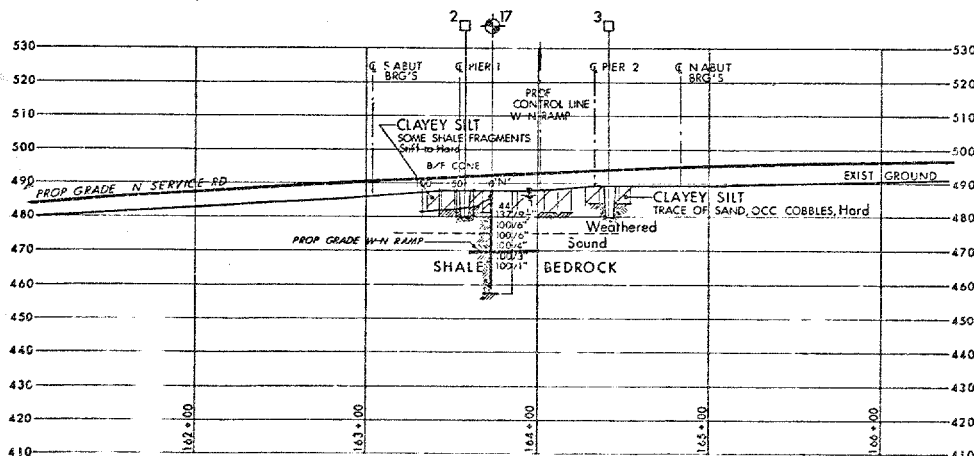
REVISIONS	DATE	DESCRIPTION
1	78 06 00	TEST PITS 1 TO 4 ADDED. SECTIONS REVISED

HWY No 403 W-N RAMP DIST 4  
S.W.D. C.F. CHARTERED SURVEYORS May 25, 1977, SITE NO - 2828  
DRAWN R.S. CHECKED M.A. APPROVED J.W. LONG O - 2828-2



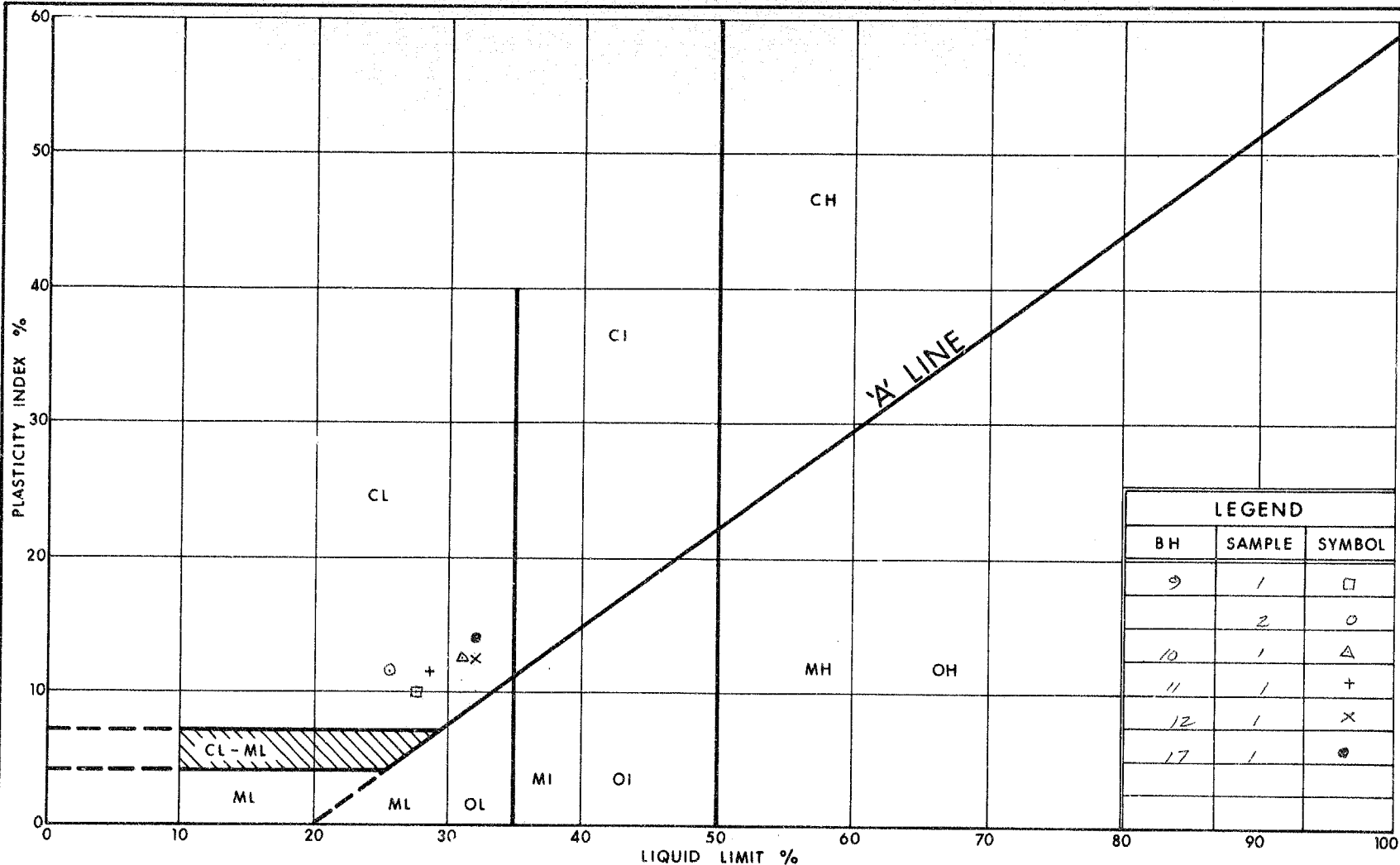
## PLAN

0 SCALE 40 FT



## PROFILE - PROPOSED NORTH SERVICE ROAD

HOR 40 0 SCALE 40 FT  
VERT 20 0 20



Ontario

 Ministry of  
Transportation and  
Communications

ENGINEERING SERVICES BRANCH

## PLASTICITY CHART

 CLAYEY SILT  
TRACE OF SAND.

FIG No 1

W P 159-75-08



## Memorandum

To: Mr. C.S. Grebski  
Head, Central Section  
Structural Office  
West Building, Downsview

From: Soil Mechanics Section  
Engineering Materials Office  
Room 315, Central Building

Attention: Mr. W. Lin

Date: 78 06 09

Our File Ref.

In Reply to

Subject: Re: 'N Ramp, Hwy. 403 Underpass  
North Service Road  
W.P. 159-75-08, Site 10-282-B  
District 4, Hamilton

Further to our memorandum of 78 04 10, we have now completed an additional investigation to determine the subsurface conditions at the new footing locations. In this additional investigation, four testpits were excavated by means of a backhoe. The locations and elevations of the testpits, together with our findings, are tabulated below:

<u>Testpit No.</u>	<u>Location</u>	<u>Elevation</u>	<u>Subsurface Conditions</u>
1	N 15805823 E 953618 (South Abutment)	486.6	0-5' very stiff reddish clayey silt with shale fragments 5-9' reddish weathered soft shale
2	N 15805848 E 953659 (South Pier)	487.9	0-5' very stiff reddish clayey silt with shale fragments 5-8.5' reddish weathered soft shale
3	N 15805923 E 953691 (North Pier)	489.2	0-5' very stiff reddish clayey silt with shale fragments 5-9.5' reddish weathered soft shale
4	N 15805992 E 953691 (North Abutment)	490.3	0-5.1' very stiff reddish clayey silt with shale fragments 5.1-10' reddish weathered soft shale

Based on this recent information, together with our previous subsurface data, we are satisfied with designs of the foundations as shown in Drawing No. 10-282B-1 and 3.

cont'd.....

The additional subsurface information will be included in our foundation report and subsoil strata drawing for contract purposes. This memorandum should be attached to our foundation report.

B. Ly  
B. Ly  
Senior Engineer

For: M. Devata  
Supervising Engineer

BL/MD/gs

cc: G.C.E. Burkhardt (3)  
R.D. Gunter  
M.R. Ernesaks  
D.E. Thrasher (2)

G.A. Wrong  
B.J. Giroux  
R.S. Pillar

R. Hore

Files ]

DOCUMENT NO. 87-100000-100000-100000

GEOCRES No. 36 H.S. - III

DIST 4 REGION (FEDERAL)

W.P. No. 150-75-08

CONT. NO. 78-104

W. O. No.

STR. SITE No. 10-282 B

HWY. No. GEN / FREQ. DECE / HWY 413

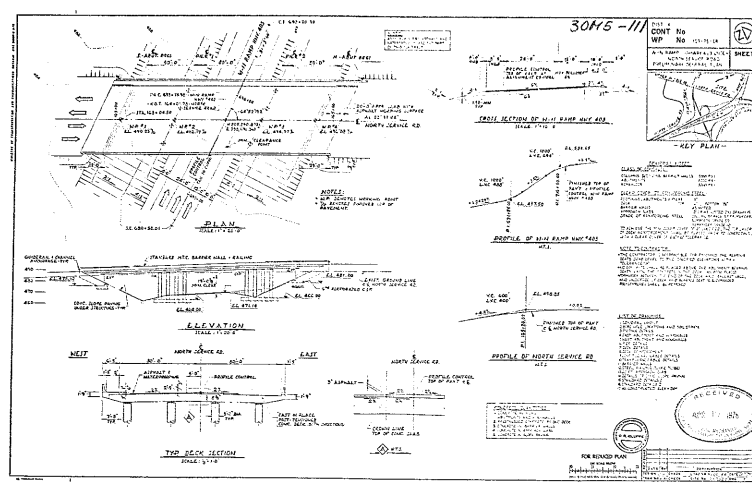
LOCATION W-N CAMP HWY 413

UNDER NORTH SERVICE ROAD

OVERLAY (HATCH) AT 10-282 B (10-282 B) TO ROAD (HATCH) 2

REMARKS



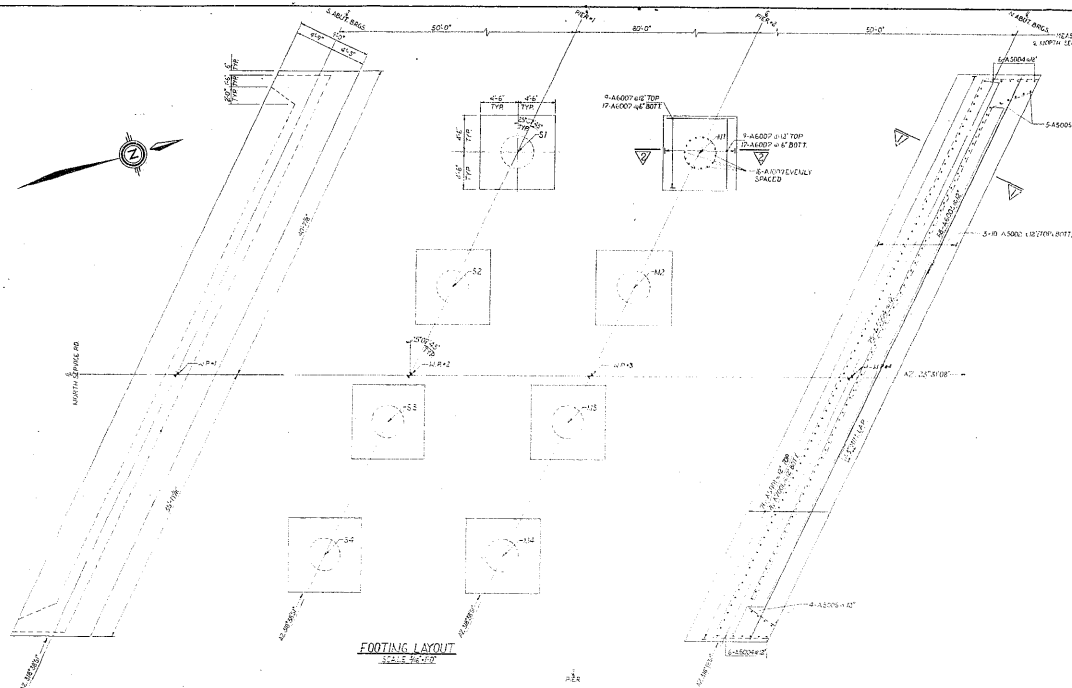


3045-111

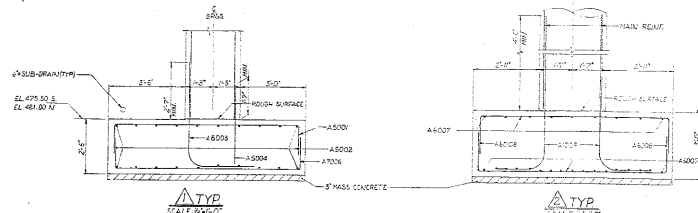
CONT No  
WP No 159-75-06

W-N RAMP HIGHWAY 403  
UNDER NORTH SERVICE RD  
FOOTING DETAILS

SHEET



FOOTING LAYOUT  
SCALE: 1/4" = 1'-0"



ATYP  
SCALE: 1/4" = 1'-0"

ATYP  
SCALE: 1/4" = 1'-0"

N.P. COORDINATES

N.P.	STATION	NORTH	EAST
+1	43+24.50	805844.66	155132.54
+2	43+54.50	805847.53	155132.50
+3	44+04.50	805851.88	155134.42
+4	44+34.50	805856.73	155135.37

PIER COLUMN COORDINATES

LOCATION	PIER	STATION	NORTH	EAST
PIER #1	S1	43+24.50	805844.66	155132.54
	S2	43+54.50	805847.53	155132.50
	S3	43+54.50	805847.53	155132.50
	S4	43+54.50	805847.53	155132.50
	S5	43+54.50	805847.53	155132.50
PIER #2	M1	44+04.50	805851.88	155134.42
	M2	44+34.50	805856.73	155135.37
	S1	44+04.50	805851.88	155134.42
	S2	44+34.50	805856.73	155135.37
	S3	44+04.50	805851.88	155134.42

NOTES

- \* ALL 3" MASS CONCRETE IMMEDIATELY AFTER EXCAVATION IS COMPLETED.
- \* ALL MASS CONCRETE AND SIDES OF ALL EXCAVATIONS TO BE CAST AGAINST UNDISTURBED MATERIAL.



FOR REDUCED PLAN

1/4" = 1'-0" PER  
1/4" = 1'-0" PER



DATE	BY	DESCRIPTION	DATE
DESIGNED	BY	CHECK	DATE
DRAWN	BY	CHECK	DATE