

G.I.-30 SEPT. 1976

GEOCRES No. 30M5-114DIST. 4 REGION W.P. No. 159-75-09CONT. No. 79-80W. O. No. STR. SITE No. 10-283HWY. No. 403LOCATION Q.E. W./Ford Drive/403
Link InterchangeNo. of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

GENERAL NOTES

CLASS OF CONCRETE
 DECK & PIER COLUMNS - 5000 PSI
 BARRIER WALLS - 4000 PSI
 REMAINDER - 3000 PSI

CLEAR COVER TO REINFORCING STEEL
 DECK: TOP - 2" BOTTOM - 1 1/2"
 COLUMNS: - 2 1/2"
 FOOTINGS AND ABUTMENTS - 3"
 REMAINDER - AS NOTED

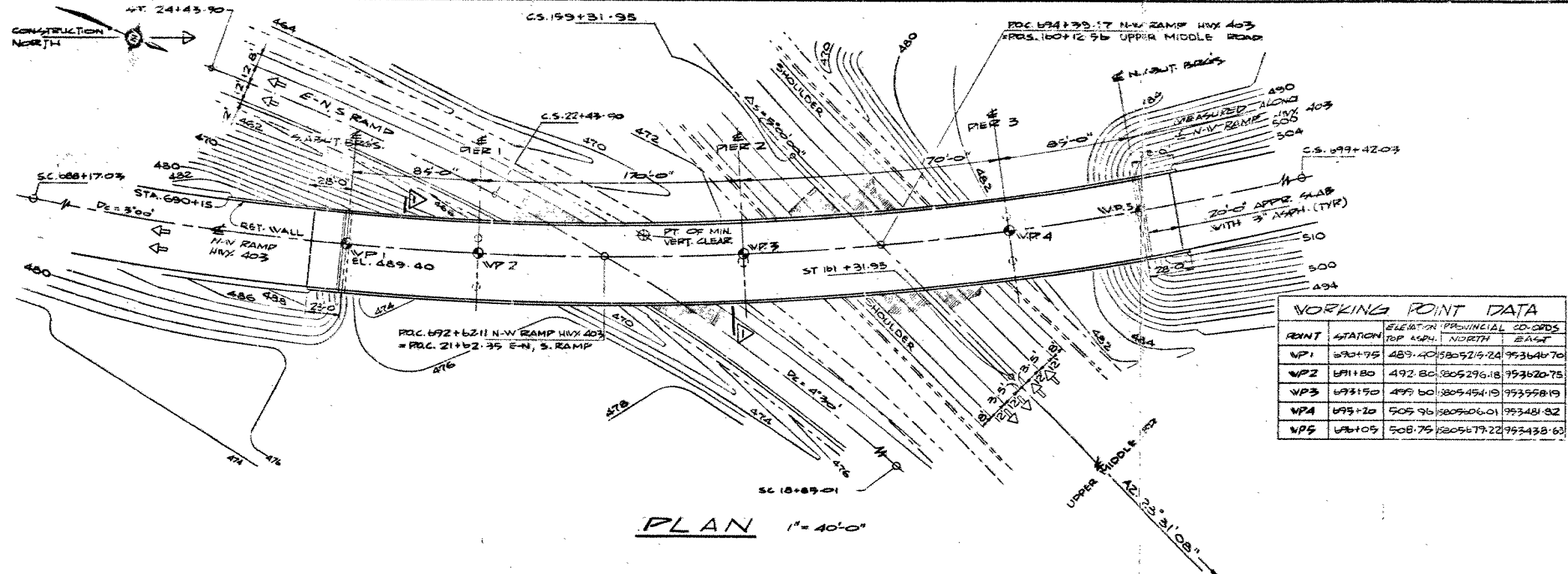
GRADE OF REINFORCING STEEL
 400
 REINF. BARS WITH THE DESIGNATION 'C' AT THE END OF BAR MARKS SHALL BE COATED BARS.

CONSTRUCTION NOTES
 THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF $\pm 1/8"$
 NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, SET-LED AND CURED.

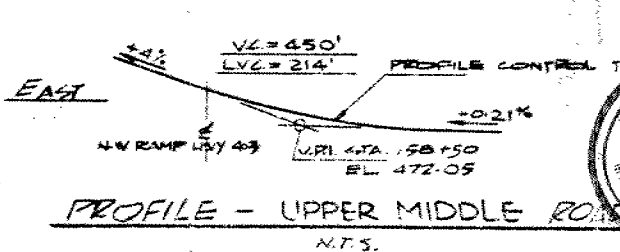
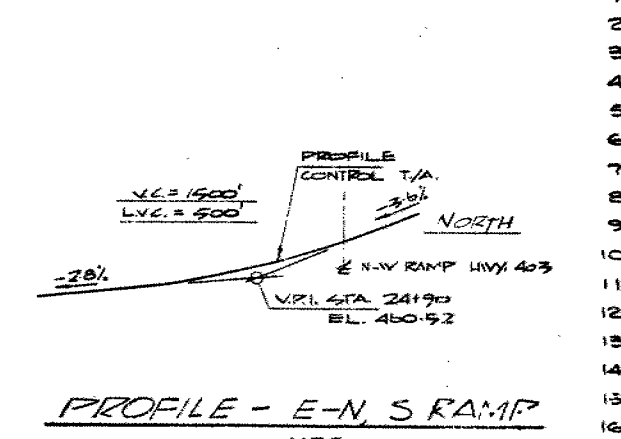
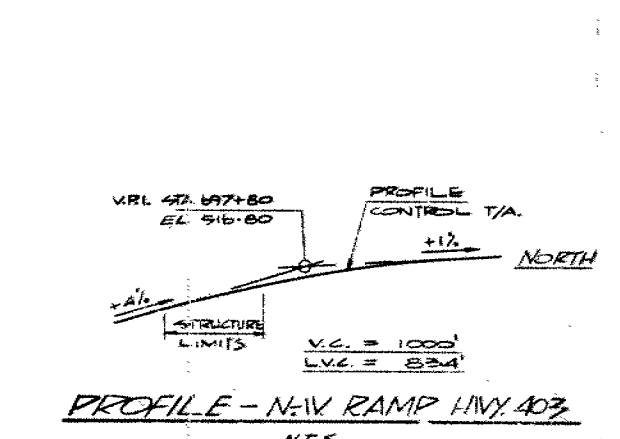
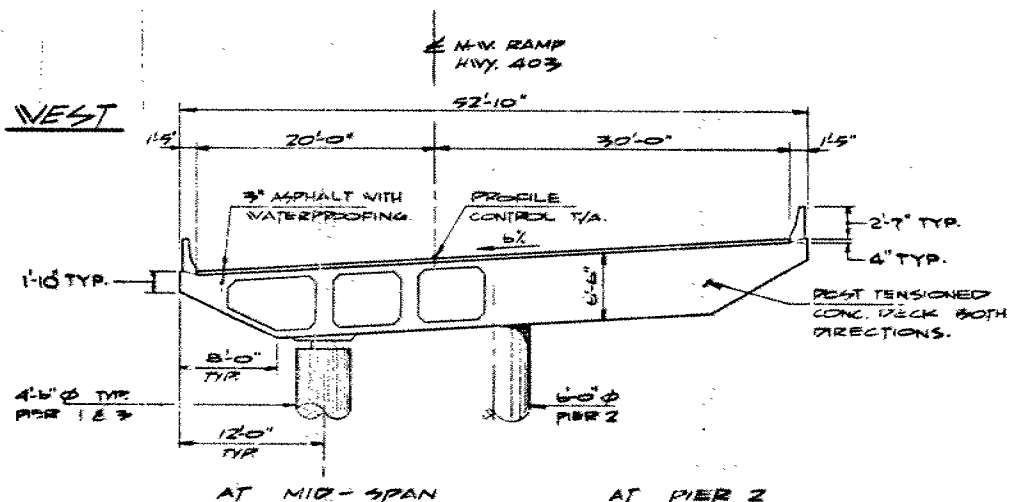
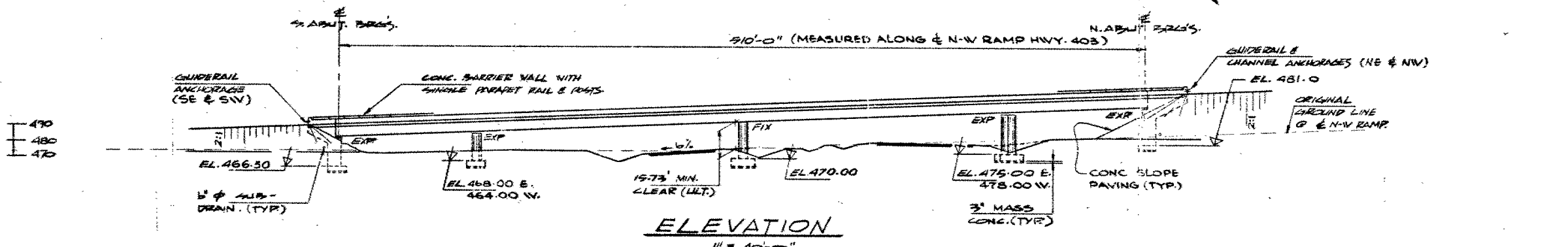
TO ACHIEVE THE MIN. CLEAR COVER OF 2" SPECIFIED, THE TOP LAYER OF DECK STEEL SHALL BE PLACED PRIOR TO CONCRETING WITH A CLEAR COVER OF $2 1/2" \pm 1/2"$ TOLERANCE.

LIST OF DRAWINGS

- GENERAL DRAWING
- BORE HOLE LOCATIONS & SOIL STRATA
- FOOTING DETAILS
- SOUTH ABUTMENT AND WINGWALLS
- NORTH ABUTMENT AND WINGWALLS
- RETAINING WALL
- PIER DETAILS
- DECK DETAILS
- TRANSV. CABLE DETAILS
- LONGIT. CABLE DETAILS
- DECK REINFORCING
- BARRIER WALL I
- BARRIER WALL II
- STEEL RAILINGS (SINGLE TUBE)
- 20 FT APPROACH SLAB
- DETAILS OF CONC SLOPE PAVING
- AS CONSTRUCTED ELEV & DIM
- STANDARD DETAILS - I
- STANDARD DETAILS - II

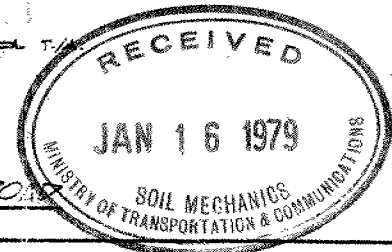


WORKING POINT DATA				
POINT	STATION	ELEVATION	PROVINCIAL CO-ORDS	
			NORTH	EAST
VP1	690+75	489.40	5305219.24	95364070
VP2	691+80	492.80	5305296.18	95362075
VP3	693+50	499.50	5305494.19	95359819
VP4	695+20	505.96	5305606.01	95348182
VP5	696+05	508.75	5305679.22	95343863



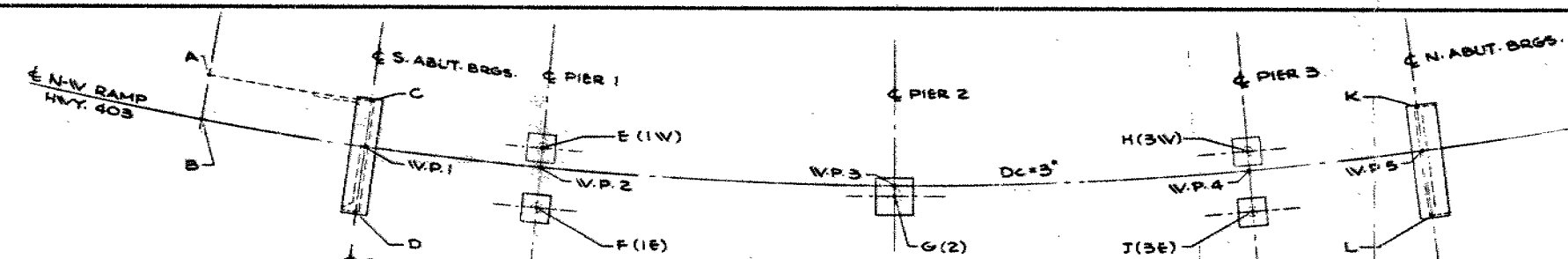
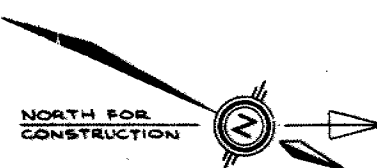
B.M. ELEV. 472.83
 TOP OF N.E. CORNER OF CONCRETE PORCH ON N. FACE OF HOUSE
 520' LT., STA. 551+90 Q.E.W.

NOTE
 PIER COLUMN IS INTEGRAL WITH DECK AT PIER 2.



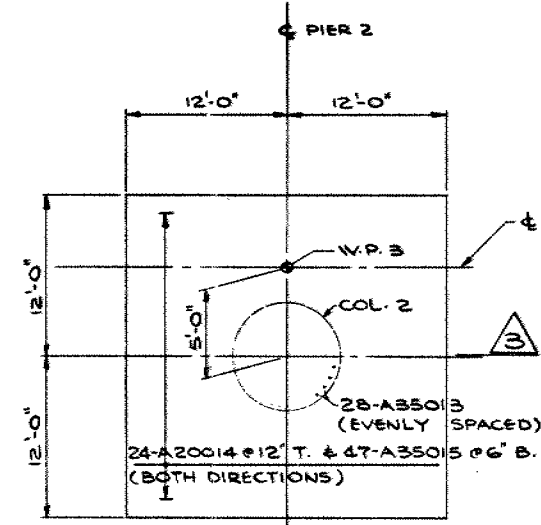
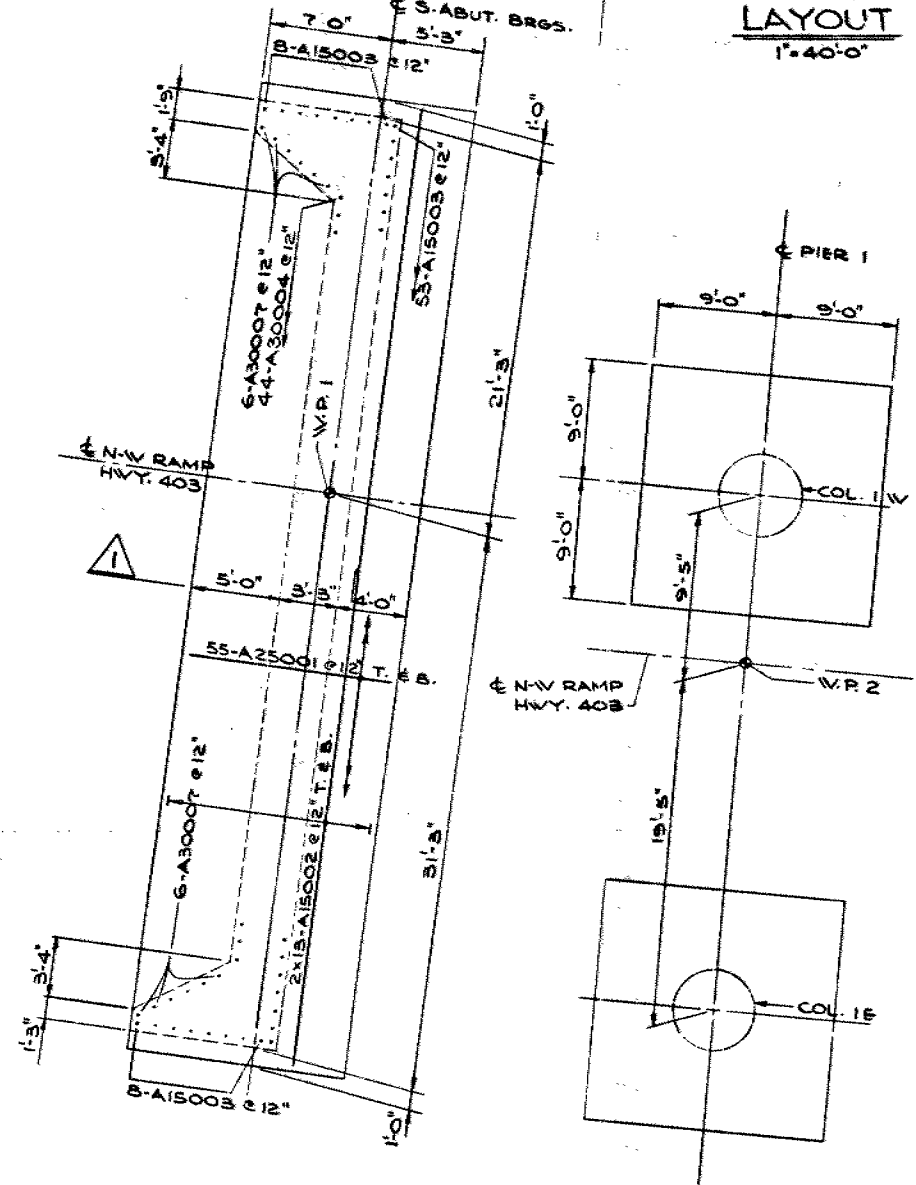
FOR REDUCED PLAN
 USE SCALE BELOW
 3 INCHES ON ORIGINAL PLAN

REVISIONS	DATE	BY	CHECK	DESCRIPTION	DATE	BY
DESIGN				LOADING	5-20-44	
DRAWING				CHECK	SITE No 10-253	DWG 1

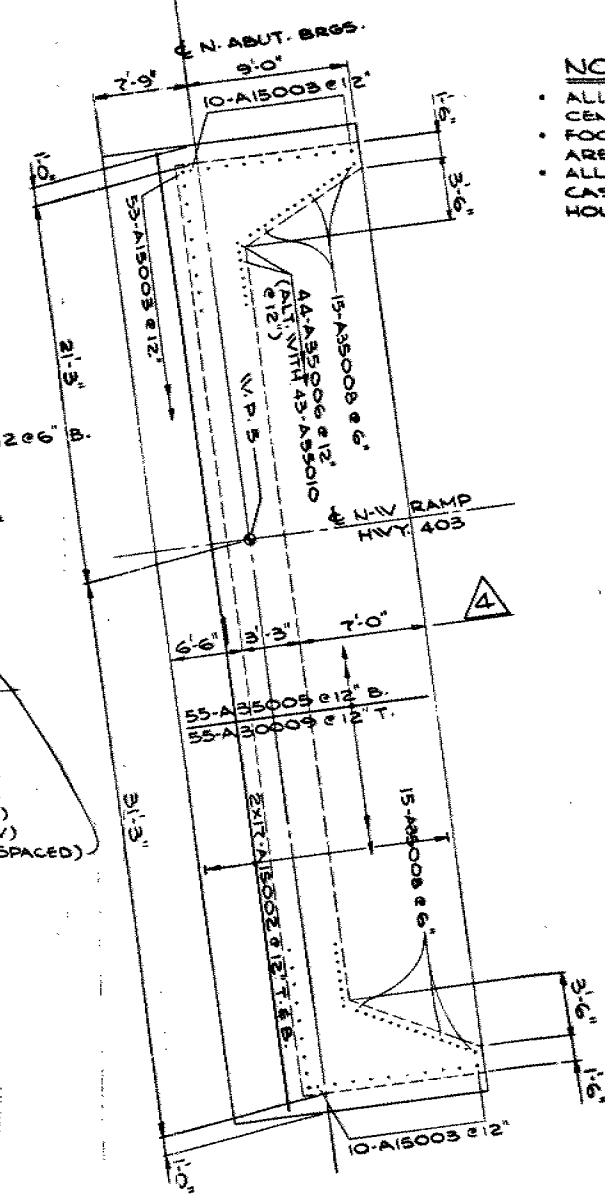


LAYOUT
1"=40'-0"

POINT	STATION	COORDINATES	
		N	E
A		15805132.91	953647.20
B	693+15	15805138.08	953667.81
C		15805209.21	953626.33
V.P. 1	690+95	15805215.24	953646.70
D		15805224.12	953676.67
E		15805293.10	953611.85
V.P. 2	691+80	15805296.18	953620.75
F		15805302.52	953639.11
V.P. 3	693+50	15805454.19	953558.19
G		15805456.23	953562.75
H		15805601.40	953473.61
V.P. 4	695+20	15805606.01	953481.82
J		15805615.50	953498.77
K		15805668.02	953420.59
V.P. 5	696+05	15805679.22	953438.65
L		15805695.69	953465.21

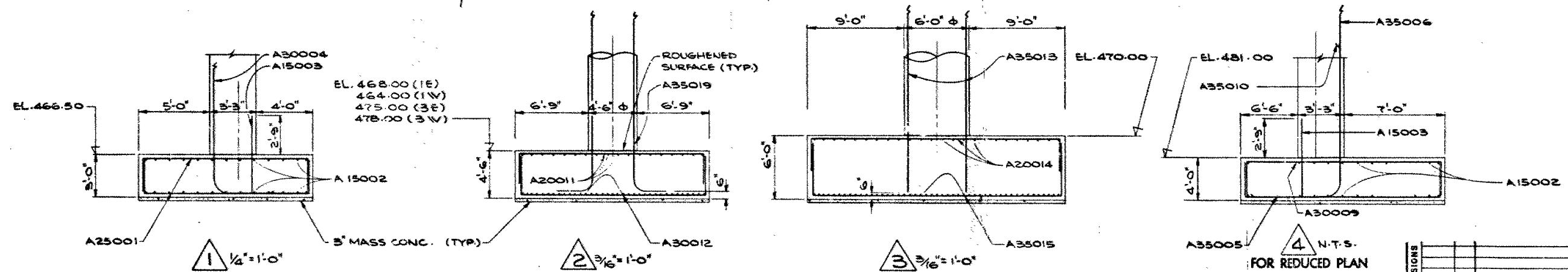


PLAN
N.T.S.



NOTES:

- ALL DIMENSIONS ALONG CENTRE LINES ARE RADIAL.
- FOOTINGS OF PIER 1 & PIER 3 ARE SIMILAR EXCEPT NOTED.
- ALL MASS CONCRETE TO BE CAST ON BEDROCK WITHIN 3 HOURS AFTER EXCAVATION.



FOR REDUCED PLAN



REVISIONS	DATE	BY	DESCRIPTION
DESIGN		CHECK	LOADING HS 20-44
DRAWING		CHECK	SITE No 10-25 DWG 5

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 159-75-09 DIST 4

HWY 403 STR SITE 10-283

Q.E.W./Ford Drive/403 Link Interchange
N - W Ramp Highway 403 Over Ramp
E - N.S. and North Service Road

DISTRIBUTION

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R. Fitzgibbon
J. Anderson
G. Sloan

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SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	78 01 15	MA
TUBES	—	—
ROCK CORES	Save full amount of core	MA

FOUNDATION INVESTIGATION REPORT

For

Q.E.W./Ford Drive/403 Link Interchange

N - W Ramp Highway 403 Over Ramp

E - N.S. and North Service Road

W.P. 159-75-09, Site 10-283

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 period of Nov.9 and 10, 1977. The fieldwork consisted of 7 sampled boreholes advanced by means of a continuous flight auger machine equipped with 3¼" hollow stem augers. In addition, diamond drilling techniques were employed to obtain BXL size core of the bedrock. The boreholes ranged in depth from 10 to 20 ft. below the ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located approximately 500 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 Queenston shale. 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 Plains on the south and the Peel Plains on the north. The region is characterized by glacial till overburden underlain by shale bedrock of Queenston and Dundas Formation of the Upper Ordovician age.

SUBSURFACE CONDITIONS

Subsurface conditions were found to be uniform across the site. A 5 to 10 foot thick layer of clayey silt is underlain by shale bedrock of the Queenston Formation. A detailed description of the various

soil and rock types encountered in each borehole is given in the Record of Borehole Sheets. The estimated stratigraphical profile and sections shown on Drawing No. 1597509-A are based upon this information. From ground level downwards, the various types encountered are as follows:

Clayey Silt With Some Sand and Occasional Gravel

Under a 12" thick layer of topsoil is a cohesive stratum of 5 to 10 feet thick deposit of clayey silt with some sand and occasional gravel. The Standard Penetration Tests gave "N" values in the range of 21 to over 100 blows per foot. Based on these "N" values the consistency of this cohesive stratum is estimated to be very stiff to hard.

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

	<u>Range</u>
Liquid Limit (W_L) %	27 - 33
Plastic Limit (W_p) %	17 - 19
Moisture Content (W) %	9.5 - 15.5

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 10 feet. The bedrock may be described as soft, red in colour and fissile, having thin horizontal bedding planes with seams of limestone up to 8" thick. Generally, the upper 6" to 12" of the shale bedrock is weathered. A detailed description of the bedrock is given on the Record of Borehole Sheets. The rock quality designation (RQD) for the cored shale bedrock varies from 0% to 50%, indicating a rock quality ranging poor to good.

Groundwater

The groundwater level conditions were observed by measuring in the open

boreholes during and after the completion of the foundation investigation. This groundwater level was found to vary between elevation 468.3 and 480.7 which corresponds to 2.0 to 3.5 feet below the existing ground surface. The groundwater levels are shown on the Record of Borehole Sheets, as well as on Drawing No. 1597509-A.

DISCUSSION AND RECOMMENDATIONS

As part of the proposed new complex interchange connecting Q.E.W. to Hwy.403,a new structure will be required to carry Hwy.403 N-W Ramp over E-N-S Ramp and North Service Road.

In the vicinity of the proposed structure, the existing ground elevation varies from 472.0 to 483.0. The proposed grade of the N-W Ramp elevation varies from 492.0 to 509.0 feet. This will require embankments 20 feet at the south side and 26 feet at the north side of the structure.

A four span structure (90'-150'-150'-90') with perched abutments and three center piers are presently being considered.

Piers

The shale bedrock at this site is 5 to 10 feet below the existing ground elevation. The three center piers designated as Piers 1,2 and 3 can be founded on shale bedrock at the following elevations:

	<u>Elevations</u>
Pier 1	464.0
Pier 2	470.0
Pier 3	476.0

Piers founded on spread footings at the above indicated elevations can be designed for 10 t.s.f. Since the shale is frost susceptible, the underside of the footings should be provided with 4 feet of earth cover for frost protection.

Other Considerations

To prevent softening of the shale bedrock due to weathering, the excavated base should be covered with a minimum of 3" of mass concrete immediately after the excavation.

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

Abutments

According to present proposals "perched" type abutments are contemplated. The abutments can be supported on a core of well compacted granular "A" fill material above the natural subsoil as per M.T.C. current practices. An allowable load of $2\frac{1}{2}$ t.s.f may be used for design purposes. All the topsoil should be removed to the full base width of the granular core. Alternatively, these perched abutments can be supported on end bearing piles driven to the shale bedrock. For example, a 12BP74 steel H pile driven to bedrock can be designed for a safe load of 95 tons per pile.

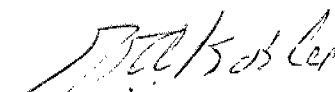
Approaches


The approach fills will be in the order of maximum 26 feet. No stability problems are anticipated for the proposed approach fills constructed with standard 2:1 slopes.

MISCELLANEOUS

The fieldwork was carried out during Nov.9 and 10, 1977 and supervised by Mr. V. Korlu, Project Engineer, who also prepared this report. The drilling equipment was owned and operated by Dominion Soils Limited of Toronto.

The report was reviewed by Mr. M. Devata, Supervising Engineer.


V. Korlu, P. Eng.
Project Engineer


M. Devata, P. Eng.
Supervising Engineer

MD/VK/eh
January 1978

APPENDIX

RECORD OF BOREHOLE No 1

W P 159-75-09 LOCATION Co-ords N 15 805 666; E 953 420 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" Hollow Stem Auger BXL Core COMPILED BY P.J.
DATUM Geodetic DATE November 9th, 1977 CHECKED BY P.J.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
483.7	Ground Level												
0.0	Topsoil												
478.7	Clayey silt with traces of sand Hard		1	SS	46		480						0 6 76 18
5.0	Shale		2	BXL	100% Rec.								
473.7	Bedrock												
10.0	End of Borehole						470						
	Bedrock: Shale, Brown red colour, fine texture, soft, fissile - R.Q.D. 0%												

RECORD OF BOREHOLE No 2

W P 159-75-09 LOCATION Co-ords N 15 805 696; E 953 468 ORIGINATED BY V.K.
 DIST 4 HWY 403 BOREHOLE TYPE 3½" Hollow Stem Auger BXL Core COMPILED BY C.J.
 DATUM Geodetic DATE November 10th, 1977 CHECKED BY C.J.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
483.1	Ground Level													
0.0	Topsoil													
478.1	Clayey silt with trace of sand Hard		1	SS	50		480							0 2 74 24
5.0	Shale		2	BXL	100% Rec.									
473.1	Bedrock													
10.0	End of Borehole						470							
	Bedrock: Shale, brown red colour, fine texture, soft and fissile R.Q.D. 0%													

RECORD OF BOREHOLE No 3

W P 159-75-09 LOCATION Co-ords N 15 805 604; E 953 491 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3½" Hollow Stem Auger BXL Core COMPILED BY *el.f.*
DATUM Geodetic DATE November 9th, 1977 CHECKED BY *el.f.*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT Σ					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					
481.1	Ground Level																
0.0	Topsoil																
476.1	Clayey Silt with traces of sand Hard		1	SS	44		480										0 9 71 20
5.0	Shale		2	BXL	100% Rec.												
	Bedrock						470										
466.1																	
15.0	End of Borehole																
	Bedrock: Shale, brown red colour, with few thin beds of grey shale, fine texture, soft and fissile -R.Q.D. 0%																

RECORD OF BOREHOLE No 4

W P 159-75-09 LOCATION Co-ords N 15 805 464; E 953 561 ORIGINATED BY V.K.
 DIST 4 HWY 403 BOREHOLE TYPE 3 1/4" Hollow Stem Auger BXL Core COMPILED BY *el. J.*
 DATUM Geodetic DATE November 10th, 1977 CHECKED BY *el. J.*

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					
476.9	Ground Level																
0.0	Topsoil																
	Clayey silt with traces of sand		1	SS	32												0 3 72 25
469.9	Hard		2		95		470										
7.0	Shale with seams of shaly limestone		3	BXL	100% Rec.												
459.9	Bedrock						460										
17.0	End of Borehole																
	Bedrock: Shale, brown red colour, fine texture, soft and fissile. Shaly Limestone, light grey colour, fine texture medium hard to soft. R.Q.D. 0%																

RECORD OF BOREHOLE No 5

W P 159-75-09 LOCATION Co-ords N 15 805 333; E 953 616 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3 1/4" Hollow Stem Auger BXL Core COMPILED BY *g.f.*
DATUM Geodetic DATE November 10th, 1977 CHECKED BY *g.f.*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT Σ					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					
474.8	Ground Level																
0.0	Topsoil																
	Clayey Silt With Traces of Sand Very Stiff		1	SS	21		470										0 8 52 40
			2	SS	29												
464.3			3	SS	100												0 2 67 31
10.5	Shale With Seams of Shaly Limestone		4	BXL	100% Rec.		460										
	Bedrock																
454.3	End of Borehole																
20.5	Bedrock: Shale, brown red colour, fine texture, soft and fissile. Shaly limestone, light grey colour, medium hard to soft, medium texture R.Q.D.0%																



RECORD OF BOREHOLE No 6

W P 159-75-09 LOCATION Co-ords N 15 805 241; E 953 615 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" Hollow Stem Auger BXL Core COMPILED BY V.K.
DATUM Geodetic DATE November 10th, 1977 CHECKED BY V.K.

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							
472.5	Ground Level														
0.0	Topsoil														
	Clayey Silt With Some Sand and Gravel		1	SS	24		470								
463.0	Very Stiff to Hard		2		58									14 17 39 30	
9.5	Weathered		3	SS	66/	9"									
457.5	Shale With Seams of Shaly Limestone Bedrock		4	BXL	100% Rec.		460								
15.0	End of Borehole														
	Bedrock: Shale, brown red colour, fine texture, soft and fissile. Shaly limestone, light grey colour, medium hard to soft, medium texture R.Q.D.0%														

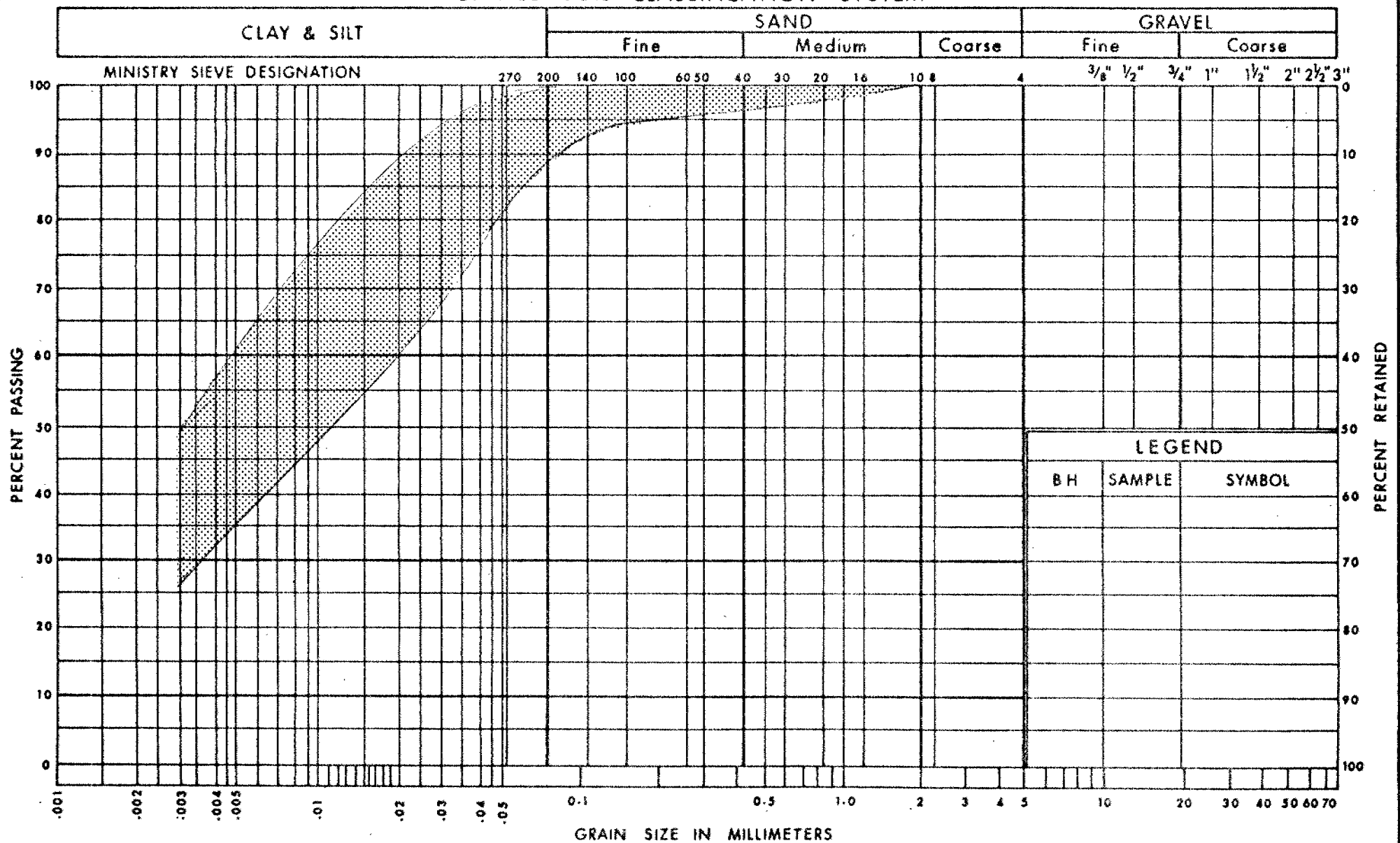


RECORD OF BOREHOLE No 7

W P 159-75-09 LOCATION Co-ords N 15 805 259; E 953 669 ORIGINATED BY V.K.
DIST 4 HWY 403 BOREHOLE TYPE 3 1/2" Hollow Stem Auger BXL Core COMPILED BY S.I.
DATUM Geodetic DATE November 9th, 1977 CHECKED BY W.J.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT Σ		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	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		W _p	W	W _L		
471.8	Ground Level													
0.0	Topsoil						470							
	Clayey Silt With Traces of Sand		1	SS	32									
	Hard		2	SS	40									
462.8	Weathered		3	SS	50/	5"								
9.0	Shale With Seams of Shaly Limestone		4	BXL	100% Rec.		460							
457.3	Bedrock													
14.5	End of Borehole													
	Bedrock:													
	Shale, brown red colour, fine texture, soft and fissile. Shaly limestone, light grey colour, fine texture, medium hard to soft, shale R.Q.D.0% limestone R.Q.D.50%													

UNIFIED SOIL CLASSIFICATION SYSTEM

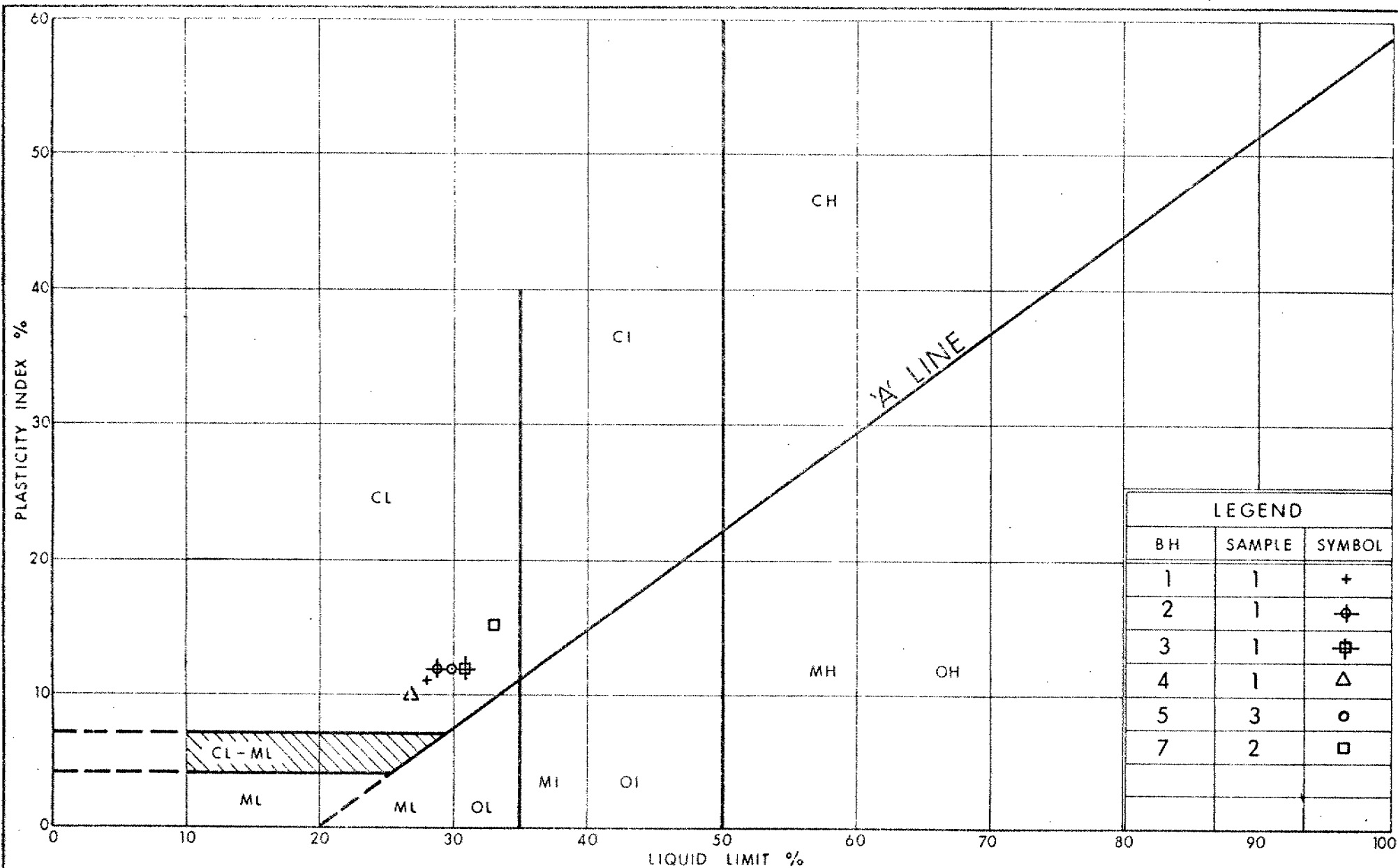


**Ministry of
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GRAIN SIZE DISTRIBUTION CLAYEY SILT WITH TRACES OF SAND

FIG No 1

W P 159-75-09



Ontario

Ministry of
Transportation and
Communications

PLASTICITY CHART CLAYEY SILT WITH TRACES OF SAND

FIG No 2

W P 159-75-09

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_r OVERCONSOLIDATION RATIO (OCR)

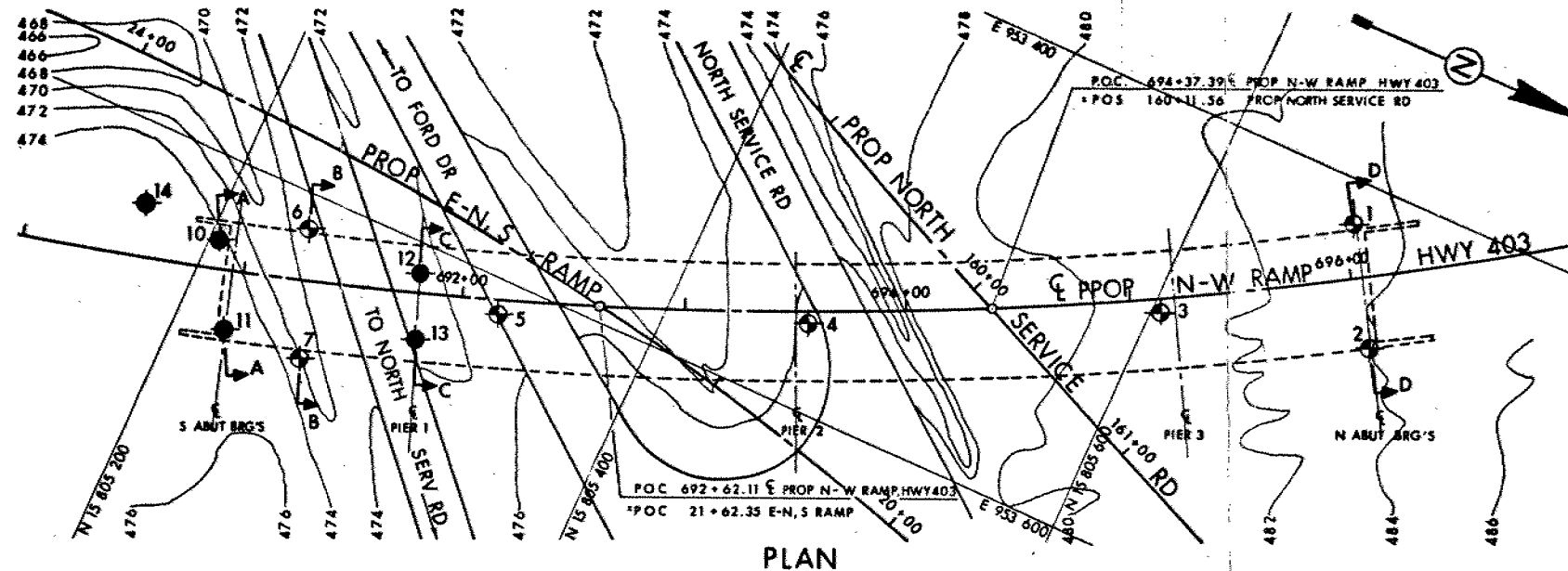
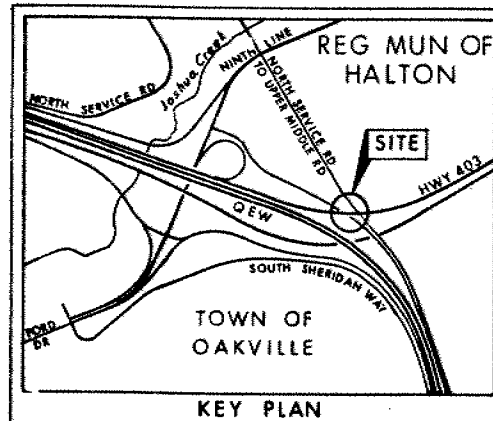
NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

CONT No
WP No 159-75-09

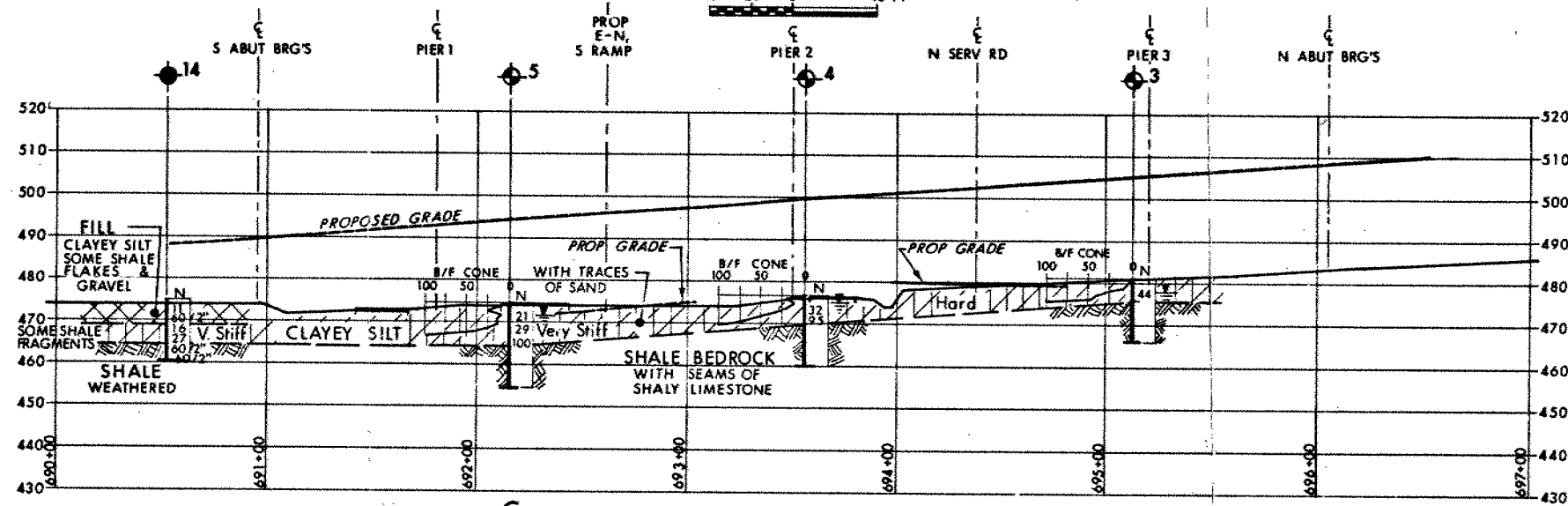


N-W RAMP HWY 403 OVER
E-N, S RAMP & NORTH SERVICE RD
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PLAN
SCALE
40 20 0 40 FT



PROFILE - PROPOSED N-W RAMP HWY 403

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- "N" Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- ↓ W.L. at time of investigation Nov 1977,
W.L. for B.H. 14 see RECORD OF
BOREHOLE

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	483.7	15 805 666	953 420
2	483.1	15 805 696	953 468
3	481.1	15 805 604	953 491
4	476.9	15 805 464	953 561
5	474.8	15 805 333	953 616
6	472.5	15 805 241	953 615
7	471.8	15 805 259	953 669
10	474.0	15 805 302	953 640
11	475.7	15 805 221	953 671
12	472.9	15 805 291	953 612
13	473.9	15 805 302	953 640
14	476.0	15 805 165	953 634

NOV 1977

OCT 1978

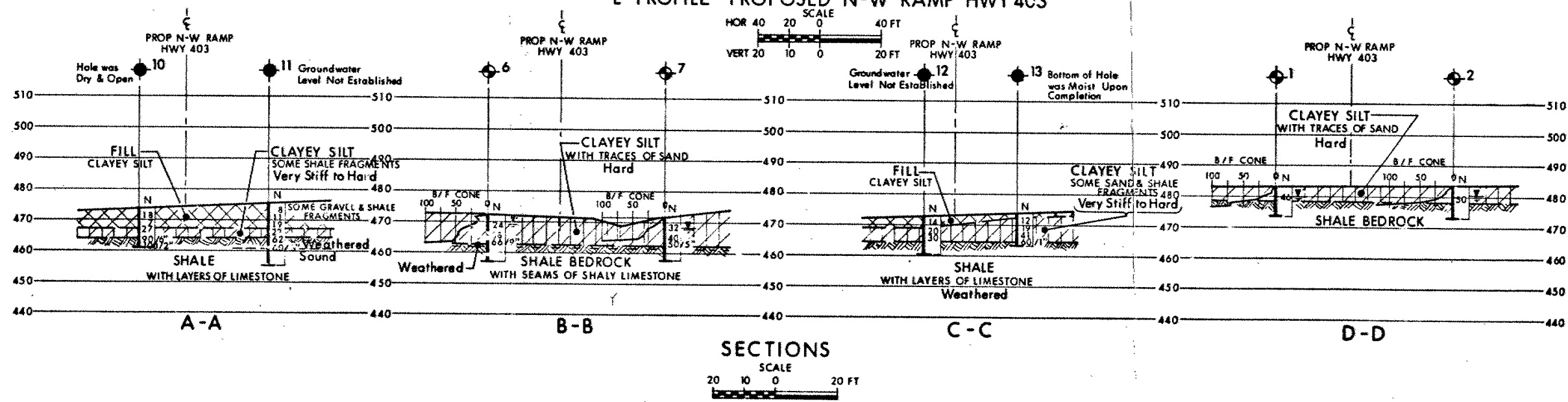
-NOTE-
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

GEORES No 30 M5 -114

HWY No 403	CHECKED	DATE APR 25, 1979	DIST 4
SUBM'D & L	CHECKED	APPROVED	SITE 10-283
DRAWN R S	CHECKED	APPROVED	DWG 10-283-2

REF No DWG 10-283-1, May 1978



SECTIONS

SCALE
20 10 0 20 FT



Memorandum

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

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

Attention:

Date: 78 11 07

Our File Ref.

In Reply to

Subject: Re: Addendum to Foundation Investigation and
Design Report for N-W Ramp, Hwy. 403 Over E-N,S Ramp
and Upper Middle Road, QEW/Ford Drive/Hwy. 403 Link
Interchange, Site 10-283, W.P. 159-75-09
District #4, Hamilton

A foundation investigation and design report for the above mentioned structure was submitted by the Soil Mechanics Section on 78 01 12. The Preliminary Bridge Plan Drawing (10-283-P1) submitted to us indicates that the south abutment and Pier #1 have been relocated approximately 35 feet southerly from the original proposal. Further, it was recently proposed by the Regional Structural Section that a 60 foot long retaining wall would be constructed on the west side of the south abutment in order to retain the approach fills from encroaching on the future E-N,S Ramp. In view of this, it was decided that an additional investigation would be carried out to obtain subsurface data for the design and construction of the relocated footings and the retaining wall.

The additional investigation was carried out during the period of October 16 to October 17, 1978 consisting of five sampled boreholes (B.H. 10 to B.H. 14 inclusive). A sketch showing the location and elevation of the borings, together with Record of Borehole Sheets, are attached to this memorandum. A revised drawing incorporating the additional subsurface data will be submitted at a later date. This recent investigation revealed that in the vicinity of the retaining wall and the new footing locations, the site is underlain by a layer of cohesive earth fill, followed by a deposit of clayey silt and then by shale bedrock. The fill has a thickness ranging from 1.5 feet to 8.5 feet and is composed of local clayey silt subsoil. Based on the 'N' values which vary from 7 blows/foot to 19 blows/foot, it is inferred that the fill was relatively uniformly compacted. The clayey silt stratum is between 2.5 feet to 7.5 feet thick. The cohesive subsoil is reddish in color and has a very stiff to hard consistency. Reference should be made to the foundation report for a detailed description of the clayey silt. Bedrock is a soft, fissile, fine textured red shale with occasional limestone bands. The upper 4 feet of the bedrock was found to be weathered.

cont'd.....

Based on the subsurface conditions our recommendations are as follows.

Pier #1

The footings should be founded in shale bedrock at or below elevation 464.0. In such a case the footings can be designed for an allowable bearing pressure of 5 tsf. The shale is frost susceptible, therefore, the underside of the footings should have a minimum of 4 feet of earth cover for frost protection purposes. To prevent softening of the shale after it is exposed by excavation, a 3" mass concrete slab should be cast immediately after the footing formation surface is reached. No major de-watering problems are anticipated for the construction of the foundations.

South Abutment

The south abutment footing should also be founded within the shale bedrock at or below elevation 464.0 and designed for a bearing capacity of 5 tsf. If it is desirable to reduce the height of the abutment the footing founding level can be raised by supporting the spread footings on a well compacted Granular 'A' pad placed on the clayey silt stratum at elevation 466. In such a case a bearing capacity of 2.5 tsf can be assumed for design purposes. The underside of the abutment footings should also have a minimum of 4 feet of earth cover for frost protection purposes regardless of which foundation scheme is adopted.

Retaining Wall

The type of retaining wall has not been finalized at this stage. If a concrete cantilever retaining wall is adopted, it can be supported on spread footings founded either within the clayey silt at or below elevation 468.0 or on a well compacted granular 'A' pad placed on the natural undisturbed ground. For either foundation scheme, a bearing capacity of 2.5 tsf can be assumed. Alternatively, the retaining structure can be constructed of reinforced earth or interlocking bins. If such a scheme is adopted this Section will provide pertinent recommendations.

It should be noted that this memorandum, together with the enclosed borehole logsheets, should be attached to and read in conjunction with our foundation report for this project. If we can be of any further help to you, please contact us.

B. Ly
B. Ly
Senior Engineer

For: M. Devata
Supervising Engineer

BL/MD/gs
Attach.

cc: G.C.E. Burkhardt	D.E. Thrasher	R.S. Pillar
R.D. Gunter	G.A. Wrong	R. Hore
M.R. Ernesaks	B.J. Giroux	Files✓



Memorandum

To: Mr. C. Mirza,
Head,
Soils Mechanics Section,
Central Building, Downsview.

From: G.C.E. Burkhardt,
Structural Section,
Central Region.

Attention:

Date: 1978-10-11

Our File Ref.

In Reply to

Subject: RE: N-W Ramp Hwy. 403 Over E-N,S Ramp
& Upper Middle Road,
Q.E.W./Ford Drive/Highway 403 Link Interchange,
Site 10-283, W.P. 159-75-09,
District 4

Please note the following revisions to the site plan (new site plan attached) and the addition of a 60' retaining wall required at the end of the southwest wingwall of the above mentioned structure.

Revisions of the site plan contains the following points:

1. Change in name from North Service Road to Upper Middle Road. The name of the road changes just to east of the structure, this section will be called the Upper Middle Road and should be revised on drawings and correspondence.
2. Complete new horizontal and vertical alignments of Upper Middle Road.
3. Typical cross-sections.
4. Superelevation attaining at Upper Middle Road.

These changes are associated with the Upper Middle Road revised design.

Additional Retaining Wall:

On the south approach of this structure the high fill of the N-W Ramp Highway 403 interferes with E-N,S Ramp cut grading, and therefore it is desirable to design a retaining wall on the left side of the south abutment. The length of retaining wall would be approximately 60' starting at Sta. 690+15₊. A sketch showing the location is attached.

Could you please provide the Structural Office with sufficient data to enable them to design this additional retaining wall.

RAJ:gj
Attach.

c.c. W. Roters
R. Fitzgibbon

R. A. Jeffries
R.A. Jeffries,
Structural Supervisor,
for:
G.C.E. Burkhardt,
Head, Structural Section.

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

Mr. W.L. Lin

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

78 07 24

Re: N-W Ramp Hwy. 403 Over
E-N, S Ramp and North Service Road
W.P. 159-75-09, Site 10-283
District 4, Hamilton

We have reviewed the Preliminary Bridge Plan Drawing (10-283-P1).
Our comments are as follows:

It appears from your preliminary structure drawing that there is a considerable revision with regard to the location of the south abutment and Pier #1. The revised location is approximately 35 feet southerly from the original proposal. A shift of this nature should have been notified to this Section so that additional investigation or revised recommendations could have been provided.

It should be noted that the bedrock at the site is sloping and furthermore, the upper portion of the overburden contains organic material and softened zones. In order to provide necessary comments with regard to structure foundations and related earthworks, additional borings will have to be carried out. A structure with an estimated cost of \$1,067,000 should be designed with appropriate factual data. Therefore, this Section will carry out the necessary additional field investigation in order to provide relevant comments pertaining to foundation requirements. This investigation will be undertaken in the near future.

The granular 'A' core used to support the north abutment footing should have a horizontal clearance of 10 feet around the perimeter of the footing.

B. Ly
B. Ly
Senior Engineer

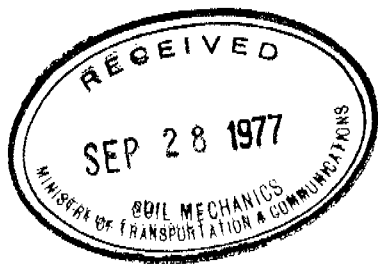
For: M. Devata
Supervising Engineer

BL/MD/gs

cc: G.C.E. Burkhardt
Files ✓

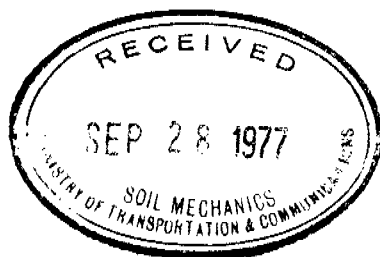
G.I.-30 SEPT. 1976

GEOCRES No. 30M5-114DIST. 4 REGION W.P. No. 159-75-01CONT. No. 79-80W. O. No. STR. SITE No. 10-283HWY. No. 403LOCATION N-W. RampNo of PAGES -=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:



North Service Road looking west
towards N-W Ramp Hwy. 403 alignment

SITE 10-283



Looking west along Joshua Creek towards
W-N Ramp alignment

SITE 10-283