

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M15-59

DIST. 7 REGION

W.P. No. 7-79-05

CONT. No. 83-67

W. O. No.

STR. SITE No. 21-429

HWY. No. 35/115

LOCATION Third Line Overpass

No of PAGES -

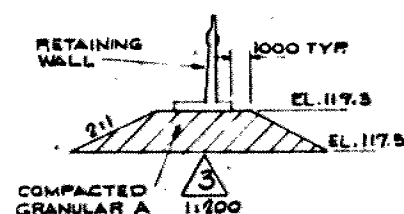
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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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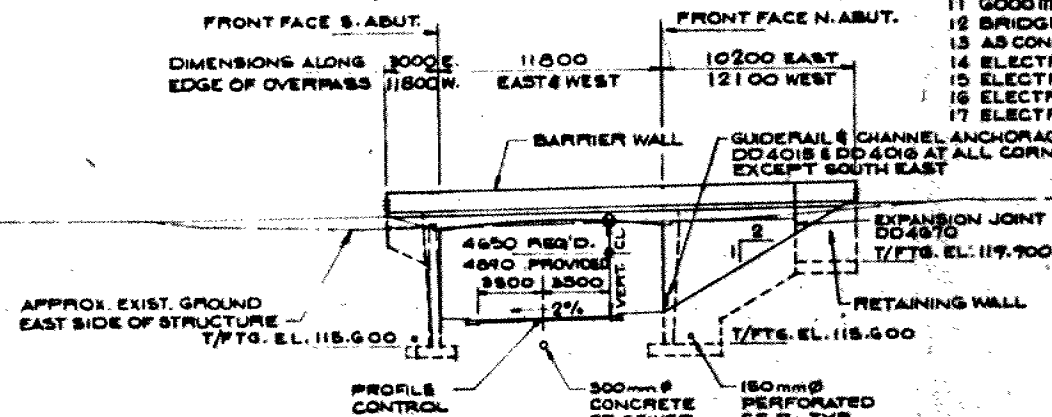
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DIMENSIONS ARE IN MILLIMETRES
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ELEVATIONS, COORDINATES, CURVE
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STATIONS ARE IN KILOMETRES + METRE.



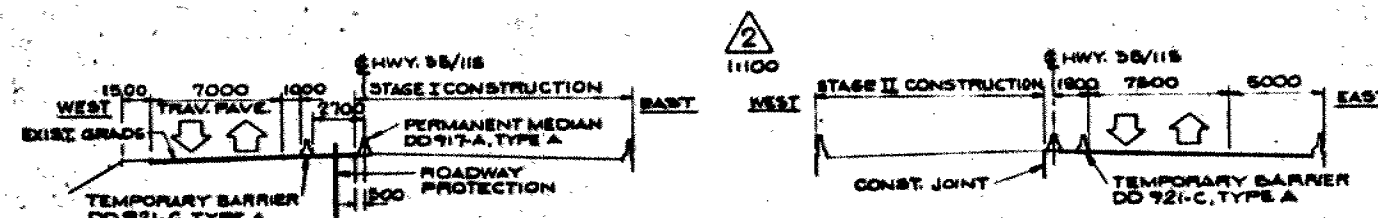
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FRONT FACE S. ABUT.		FRONT FACE N. ABUT.	
DIMENSIONS ALONG EDGE OF OVERPASS	3000 E. 11800 W.	11800 EAST & WEST	10200 EAST 12100 WEST



- 1 GENERAL ARRANGEMENT
- 2 BOREHOLE LOCATIONS & SOIL STRATA
- 3 FOUNDATION LAYOUT & REINFORCING
- 4 DECK REINFORCING - STAGE I
- 5 WINGWALLS & RET. WALL - STAGE I
- 6 DECK REINFORCING - STAGE II
- 7 WINGWALLS & RET. WALLS - STAGE II
- 8 DECK ELEVATIONS & DETAILS
- 9 BARRIER WALL I
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- 11 6000 MM APPROACH SLAB
- 12 BRIDGE DATA & SITE NUMBER DATA
- 13 AS CONSTRUCTED ELEV. & DIM.
- 14 ELECTRICAL EMBEDDED WORK
- 15 ELECTRICAL STANDARDS I
- 16 ELECTRICAL STANDARDS II
- 17 ELECTRICAL STANDARDS III

CONCRETE QUANTITIES	
CONCRETE IN BRIDGE	523.790 m
CONCRETE IN BARRIER WALLS	17.549 m
CONCRETE IN RETAINING WALLS	18.678 m
CONCRETE IN APPROACH SLABS	70.070 m



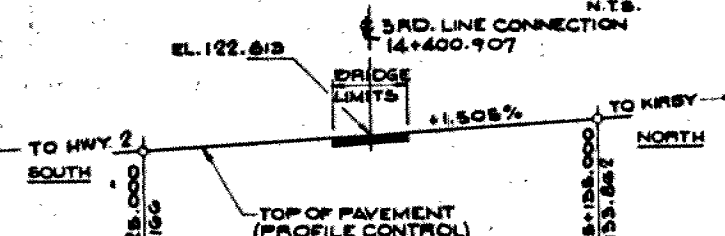
TRAFFIC STAGING

<u>CLASS OF CONCRETE</u>	
DECK, ABUTMENTS, WING WALLS AND	
BARRIER WALLS	30 MPa
RETAINING WALL STEMS	30 MPa
REMAINDER	20 MPa
<u>CLEAR COVER TO REINFORCING STEEL</u>	
FOOTINGS	100 ± 25 mm
ABUTMENTS, WING WALLS AND	
RETAINING WALLS	80 ± 20
DECK	70 ± 20 TOP 40 ± 10 BOT.
BARRIER WALLS	70 ± 20
REMAINDER	70 ± 20
	UNLESS NOTED


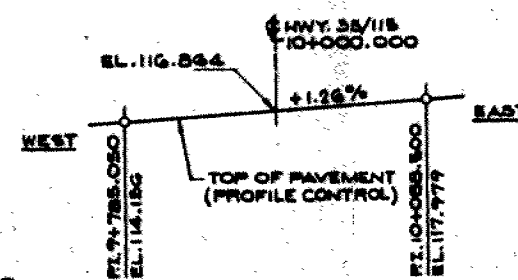
REINFORCING STEEL
REINFORCING STEEL SHALL BE GRADE 400
EXCEPT AS NOTED.
BARS MARKED WITH SUFFIX C SHALL BE
COATED BARS.

CONSTRUCTION
BACKFILL SHALL BE PLACED SIMULTANEOUSLY
BEHIND BOTH ADJUTMENTS, KEEPING THE HEIGHT
OF THE BACKFILL APPROXIMATELY THE SAME.
AT NO TIME SHALL THE DIFFERENCE IN
ELEVATIONS BE GREATER THAN 600 mm.
CONCRETE BARRIER WALLS ON RETAINING
WALLS SHALL NOT BE CAST UNTIL THE RETAINING
WALL BACKFILL HAS BEEN COMPLETED.

I.F. - INSIDE FACE
E.F. - EACH FACE
O.F. - OUTSIDE FACE
E.S. - EACH SIDE
E.W. - EACH WAY
T/F - TOP OF FOOTING



N.T.S.



REGISTERED PROFESSIONAL ENGINEER
ONTO.
D. C. CRAMM
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

D.M. 123.047
CUT CROSS, NORTH WEST
CORNER OF GAS ISLAND
34.1 RT. 14 + 365.5 HWY. 35/115

APR 21 1982

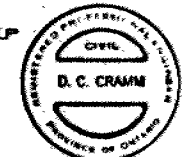
DATE	BY	DESCRIPTION
DESIGN	J.C.L.	CHECK D.C.C. LOADING CHBDC 4-7M DATE 82-03-01
DRAWING	J.C.L.	CHECK D.C.C. SITE 21-429 DWS

SHEET

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AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.



DRAWING NOT TO BE SCALED
100 mm ONE ORIGINAL DRAWING

APR 21 1982

REVISE								
	DATE	BY	DESCRIPTION					
	DESIGN	J.C.L.	CHECK	D.C.C.	LOADING	OHBOC	A-79	DATE 82-05-0
	DRAWING	G.S.N.	CHECK	J.C.L.	SITE	21-429	DWG	



Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 7-79-05 DIST 7

HWY 35/115 STR SITE 21-429

Third Line Overpass
4.5 km North of Hwy 401

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FOUNDATION INVESTIGATION REPORT

For

Third Line Overpass
4.5 km North of Hwy 401
W. P. 7-79-05, Site 21-429
Hwy 35/115, District 7, Port Hope

INTRODUCTION

This report presents the results of a foundation investigation program carried out for the above-mentioned structure location between 81-05-19 and 81-05-21. The fieldwork consisted of 6 sampled boreholes advanced by means of continuous flight augers for depths ranging from 7.9 to 12.5 metres below ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located on Hwy 35/115 some 170 metres north of the existing Clarke 3rd Line Concession Road intersection, in the Town of Newcastle, Regional Municipality of Durham.

The topography across the site is moderately undulating with the terrain south of the site sloping towards Lake Ontario. The predominant land use is commercial mixed farming and grain crops.

Physiographically, the site is located on the South Slope Region which is characterised in this area by surficial fine sands and silt overlying highly calcareous sandy glacial tills.

SUBSURFACE CONDITIONS

Uniform subsurface conditions were encountered across the site. Underlying the existing roadway fill and explored to a maximum depth of 12.5 metres is an overconsolidated glacial till deposit. Bedrock was not encountered in any of the borings at the site.

The boundaries between the various soil types, insitu and laboratory test results, as well as stabilized groundwater levels, are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, are shown on Drawing Number 77905-A.

The various soil types encountered are briefly described in the following paragraphs.

Existing Fill Material

The existing Hwy 35/115 roadway fill was found to range in thickness from 2.0 to 3.6 metres on the west side and non-existent on the east side which indicates the sloping nature of the ground surface at this site. This fill consists of 0 to 1.5 metres of a compact silty sand with gravel overlying a firm to stiff silty clay fill of low plasticity with sand. The cohesive portion of the fill is probably indigenous to the parent glacial till of the area.

Silt to Silty Clay (Glacial Till)

The predominant deposit underlying the site and explored

to a maximum depth of 12.5 metres is an overconsolidated glacial till deposit consisting of a slightly plastic silt to silty clay with sand and varying amounts of gravel. Gradation curves of representative samples of this deposit are plotted in envelope form on Figure 1. Occasional seams and layers of silty sand were encountered throughout this relatively incompressible deposit.

Results of laboratory tests consisting of Atterberg Limit and water contents are summarized as follows:

	<u>Range</u>	<u>Average</u>
Water content (W)%	4 - 21	9
Liquid Limit (w_L)%	12 - 25	15
Plastic Limit (w_p)%	9 - 13	10
Plasticity Index (I_p)%	2 - 13	4

These results are plotted on the plasticity chart, figure 2, and indicate the glacial till deposit to be an inorganic slightly plastic silt to silty clay of low plasticity (ML - CL).

Based on interpretation of Standard Penetration Test "N" values and augering operations, the consistency of this deposit is assessed generally as hard.

GROUNDWATER

Overnight stabilized borehole water levels were encountered within the glacial till deposit at elevations of 118.2 to 118.7 on the west side and elevations 120 to 120.8 on the east side. This indicates that the groundwater has a westerly gradient which reflects the natural sloping terrain across the site.

DISCUSSION AND RECOMMENDATIONS

As part of the proposed widening of Hwy 35/115, a 3-span overpass structure is contemplated to carry Hwy 35/115 over the 3rd Line Concession Road. Since no change in the existing highway grade is planned, cuts in the order of 7.2 metres and realignment of the 3rd Line will be required.

Recommendations pertaining to the foundations of the new structure and related earth works are summarized as follows:

In consideration of the overconsolidated nature of the glacial till deposit, structural elements can be founded on shallow spread footing-type foundations.

Abutment Foundations

The north abutment can be supported on spread footings founded at or below elevation 119.5 for an allowable bearing pressure of 500 kPa. The south abutment footing can be founded at or below elevation 117.5 for a similar loading of 500 kPa. Alternatively, subexcavation of localized firm to stiff material to elev. 117.5 under the west half of the south abutment footing and backfilling with well-compacted Granular "A" or mass concrete to a suitable founding elevation would allow for a design capacity of 335 kPa.

Pier Foundations

Pier elements can be founded on spread footings at or below elevation 115 for an allowable bearing pressure of 500 kPa.

For the purposes of the O. H. B. D. C., the following design parameters are given:

	<u>Factored Capacity at U.L.S. (kPa)</u>	<u>Capacity at S. L. S. Type II (kPa)</u>
N. Abutment	750	500
S. Abutment (without subexcavation)	750	500
S. Abutment (with subexcavation)	500	335
Piers	750	500

Earth pressure should be computed as per Subsection 6.6.1.2.2 of the O. H. B. D. C. Manual.

Resistance to sliding of the spread footings can be calculated assuming an adhesional value of 100 kPa between the base of the footing and the undisturbed glacial till.

The underside of all footing elements should be provided with a minimum 1.5 metres of earth cover for frost protection purposes.

No major dewatering difficulties are anticipated for footing excavations due to the moderately impervious nature of the subsoil. Groundwater seepage can be controlled by perimeter ditches and pumping from corner sumps.

No stability problems are anticipated for cut slopes constructed to a 2:1 geometry.

The existing west embankment slope should be stripped and benched as per current M. T. C. Standards prior to any embankment widening.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. Z. Mabraïdopoulos, Student Technician, utilizing equipment owned and operated by Master Soil Ltd., Toronto. The preliminary letter of foundation recommendations dated 81 07 15 and this report were written by Mr. T. J. Kazmierowski, Foundations Engineer and reviewed by Mr. M. Devata, Senior Foundations Engineer.



A handwritten signature in black ink, appearing to read 'T. J. Kazmierowski'.

T. J. Kazmierowski, P, Eng.
Foundations Engineer

A handwritten signature in black ink, appearing to read 'M. Devata'.

M. Devata, P. Eng.,
Senior Foundations Engineer

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 7-79-05 LOCATION Co-ords. 4 866 411.2N; 376 999.5 E ORIGINATED BY Z. M.
 DIST 7 HWY 115/35 BOREHOLE TYPE Hollow Stem Flight Augers COMPILED BY Z. M.
 DATUM Gondaric DATE 81 05 19 CHECKED BY [Signature]

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					
122.7	Pavement shoulder															
0.0	Fill Silty sand with gravel		1	SS	13											
120.7	Silty clay with sand		2	SS	6											0 37 43 20
2.0	(Glacial Till) Silt to silty clay of low plasticity with sand traces of gravel		3	SS	23											20 43 27 10
			4	SS	82											
			5	SS	91											0 46 38 16
			6	SS	96											
	Hard		7	SS	136											
	Brown															
	Grey		8	SS	67											9 65 24 2
	Occasional silty sand layers															
113.3			9	SS	112	20 cm										
9.4	End of borehole															

RECORD OF BOREHOLE No 2

METRIC

W P 7-79-05 LOCATION Co-ords. 4 866 390.8 N.; 377 006.1 E. ORIGINATED BY Z M
DIST 7 HWY 115/35 BOREHOLE TYPE Hollow Stem Flight Augers COMPILED BY Z M
DATUM Geodetic DATE 81 05 19 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					
122.5	Pavement shoulder																
0.0	(Fill) Silty sand some gravel						122										
	Silty clay with sand and gravel		1	SS	7												20 23 36 21
119.8	Firm						120										
2.7	(Glacial Till)		2	SS	41												
	Silt to silty clay of low plasticity with sand and varying amounts of gravel		3	SS	92		118										21 31 33 15
			4	SS	101	23 cm	116										
	Hard		5	SS	60	10 cm											11 43 34 10
	Brown		6	SS	69	10 cm	114										
	Gray		7	SS	104	25 cm											0 63 31 6
	Occasional layers of silty sand		8	SS	35	5 cm											
			9	SS	101	18 cm	112										0 40 46 14
110.0			10	SS	100	15 cm											
12.5	End of borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 3

METRIC

W P 7-79-05 LOCATION Co-ords. 4 866 380.3 N.; 377 009.5 E. ORIGINATED BY Z M
DIST 7 HWY 115/35 BOREHOLE TYPE Hollow Stem Flight Augers COMPILED BY Z M
DATUM Geodetic DATE 81 05 20 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				
122.2	Pavement shoulder														
0.0	(Fill) silty sand some gravel		1	SS	13										
			2	SS	7										
	Silty clay of low plasticity with sand		3	SS	10										
	Firm to stiff		4	SS	6										
118.6			5	SS	14										
3.6	Brown (Glacial Till)		6	SS	89/25 cm										
	Silt to silty clay of low plasticity with sand and varying amounts of gravel		7	SS	96/15 cm										
	Silty sand layers throughout		8	SS	110/20 cm										
112.9	Hard		9	SS	52/5 cm										
9.3	End of borehole														

+3, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 4

METRIC

W P 7-79-05 LOCATION Co-ords 4 866 390.0 N.; 377 035.0 E. ORIGINATED BY Z M
DIST 7 HWY 115/35 BOREHOLE TYPE Solid Stem Flight Augers COMPILED BY Z M
DATUM Geodetic DATE 81 05 20 CHECKED BY *GP*

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			20	40	60	80	100					
121.9	Ground surface															GR SA SI CL
0.0	(Glacial Till)		1	SS	23	20 cm										12 33 39 16
	Silt to silty clay		2	SS	75											41 34 24 1
	with sand and		3	SS	78											
	varying amounts of		4	SS	115											
	gravel		5	SS	107											11 45 30 14
	Brown		6	SS	90											
	Grey		7	SS	63											
	Silty sand layers		8	SS	44											
	throughout		9	SS	85											
	Hard		10	SS	134											
110.8																
11.1	End of borehole															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 5

METRIC

W P 7-79-05 LOCATION Co-ords 4 866 411.8 N.; 377 025.7 E. ORIGINATED BY Z M
 DIST 7 HWY 115/35 BOREHOLE TYPE Solid Stem Flight Augers COMPILED BY Z M
 DATUM Geodetic DATE 81 05 20 CHECKED BY [Signature]

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					
121.9	Ground surface																GR SA SI CL
0.0	(Glacial Till) Silt to silty clay of low plasticity with sand and varying amounts of gravel		1	SS	57		120										
			2	SS	120/25	cm	118										
	Brown		3	SS	124		116										16 40 30 14
	Gray		4	SS	64/5	cm	114										37 38 19 6
	Silty sand layers throughout		5	SS	60/8	cm	112										.0 67 27 6
			6	SS	80/10	cm	110										
			7	SS	56/8	cm											
	Hard		8	SS	100/14	cm											
			9	SS	100/13	cm											
109.6			10	SS	100/13	cm											
12.3	End of borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 6

METRIC

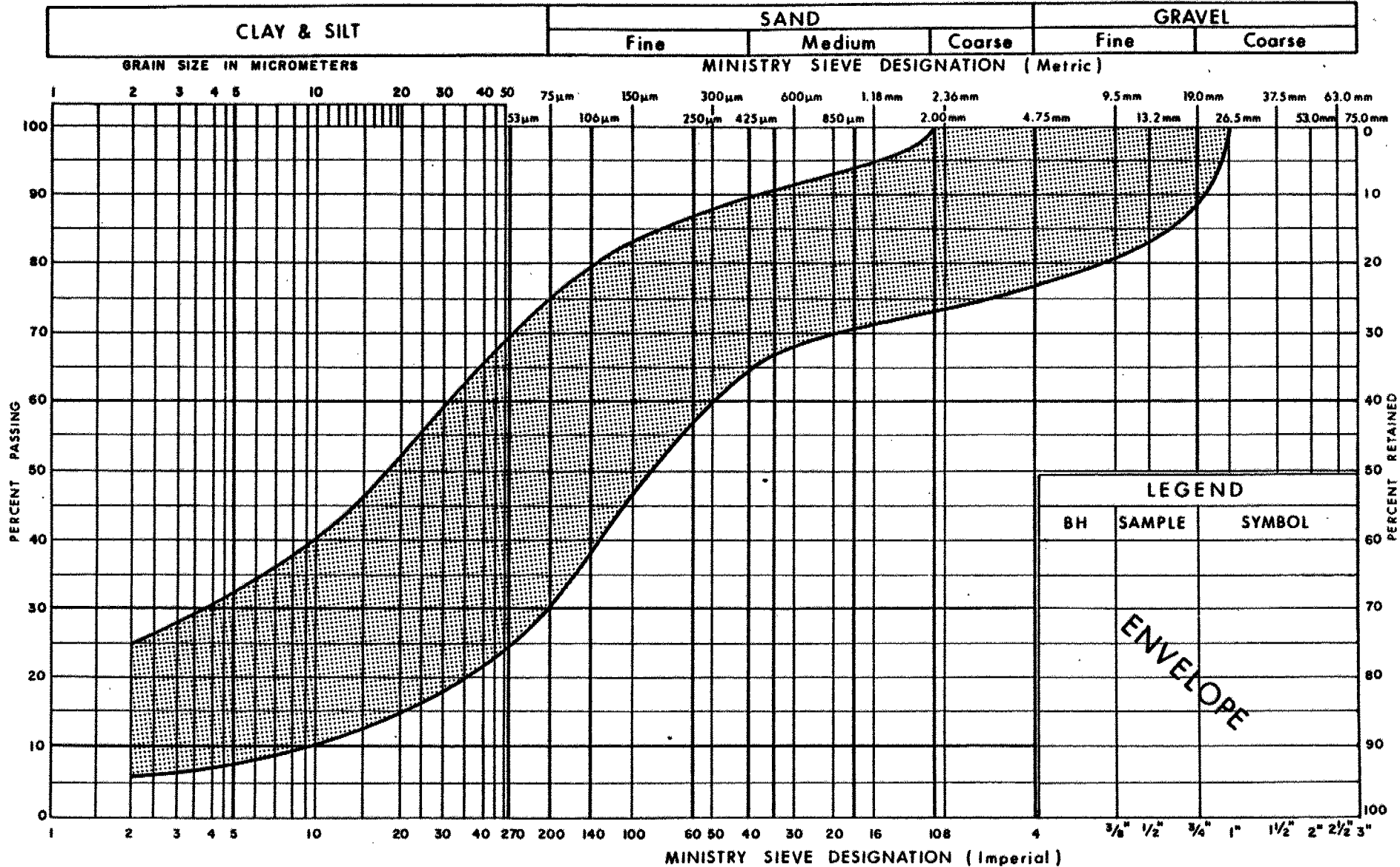
W P 7-79-05 LOCATION Co-ords 4 866 420.3 N; 377 024.6 E. ORIGINATED BY Z M
DIST 7 HWY 115/35 BOREHOLE TYPE Solid Stem Flight Augers COMPILED BY Z M
DATUM Geodetic DATE 81 05 21 CHECKED BY [Signature]

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					
122.8	Ground surface																
0.0	Fill silty clay some sand and gravel stiff		1	SS	10												
121.4			2	SS	29												
1.4	(Glacial Till)		3	SS	74											0 43 42 15	
	Silt to silty clay of low plasticity with sand		4	SS	106											14 43 28 15	
	Some gravel Brown		5	SS	88												
	Grey		6	SS	43											14 32 39 15	
	Occasional silty sand		7	SS	137	25 cm											
114.9	Seams hard		8	SS	100	10 cm											
7.9	End of borehole																

+³, x⁵: Numbers refer to Sensitivity

20
15
10
5
(%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM

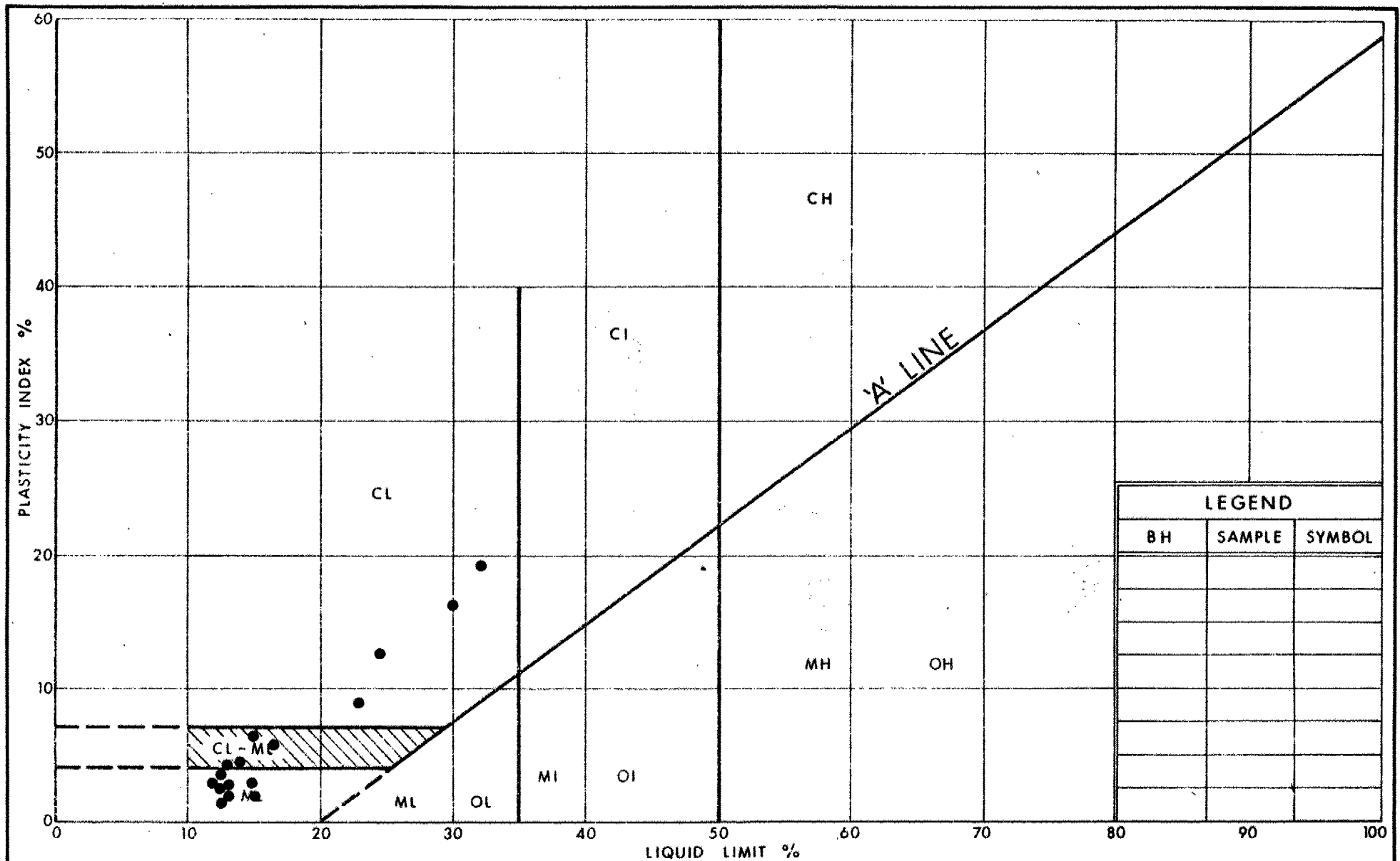


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GRAIN SIZE DISTRIBUTION
SILT TO SILTY CLAY OF LOW PLASTICITY
WITH SAND & VARYING AMOUNTS OF GRAVEL (Glacial Till)

FIG No 1

W P 7 - 79 - 05



LEGEND

BH	SAMPLE	SYMBOL



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PLASTICITY CHART
SILT TO SILTY CLAY OF LOW PLASTICITY
WITH SAND & VARYING AMOUNTS OF GRAVEL (Glacial Till)

FIG No 2

W P 7 - 79 - 05

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BORE HOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 1" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A DRILLING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100% + IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD) FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300	0.3m - 1m	1m - 3m	>3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICAL
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

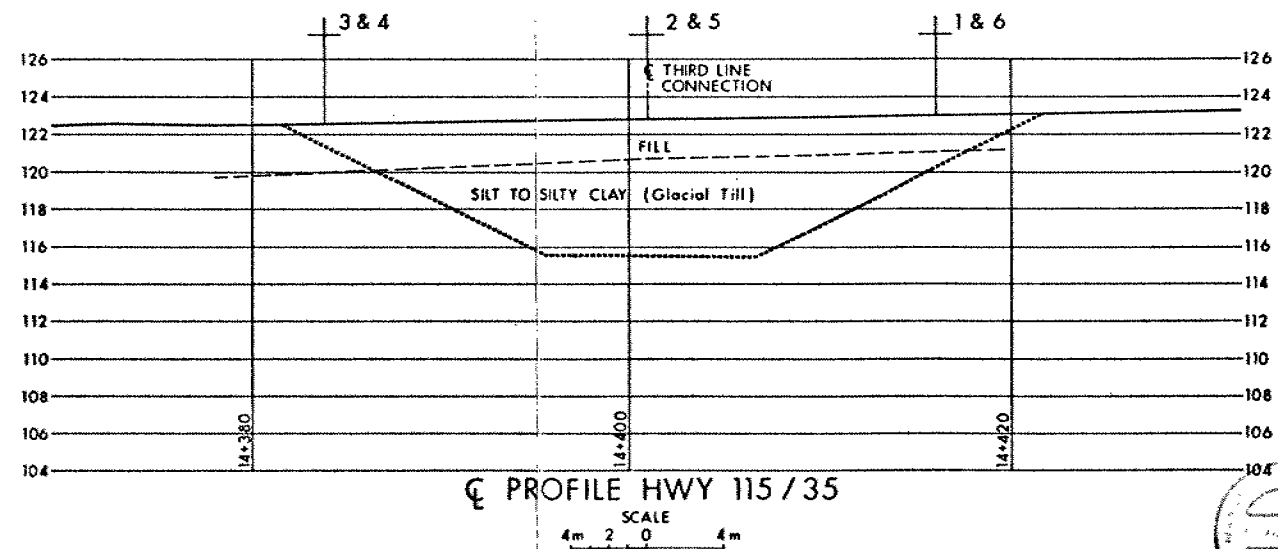
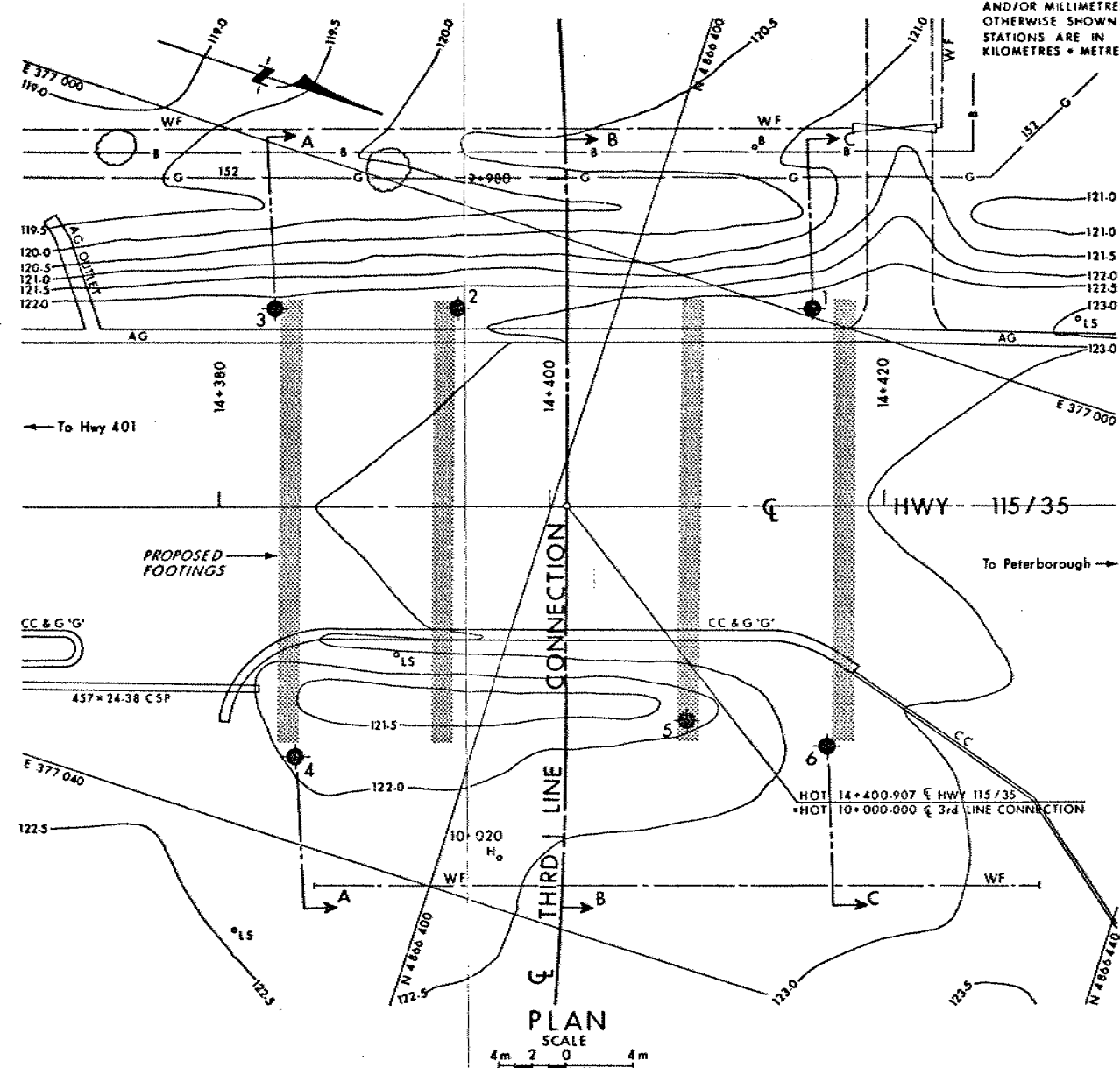
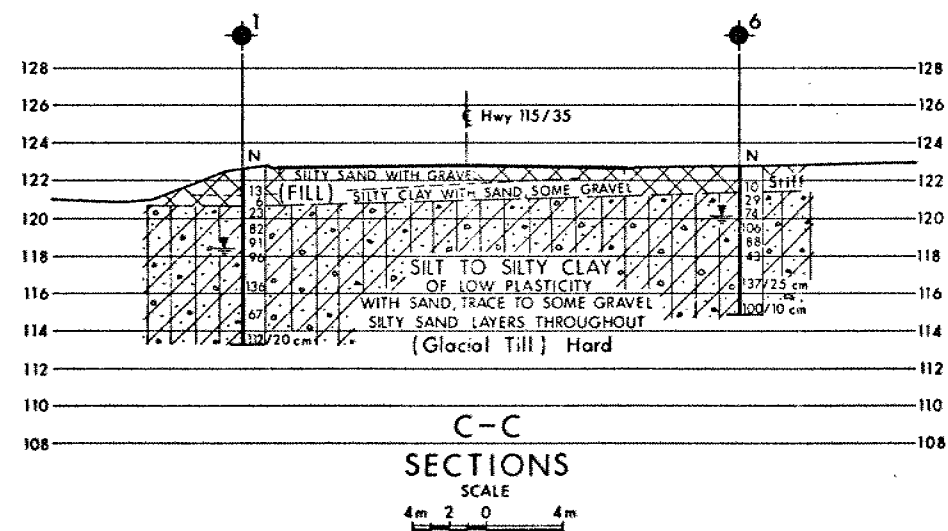
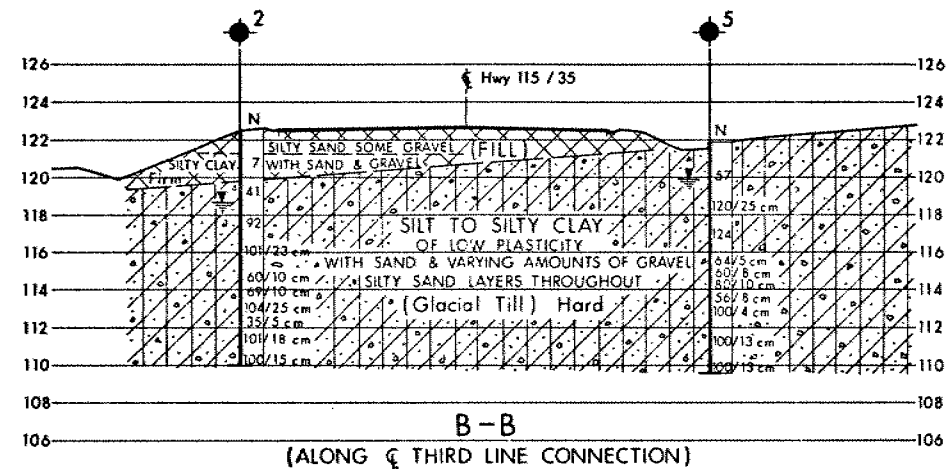
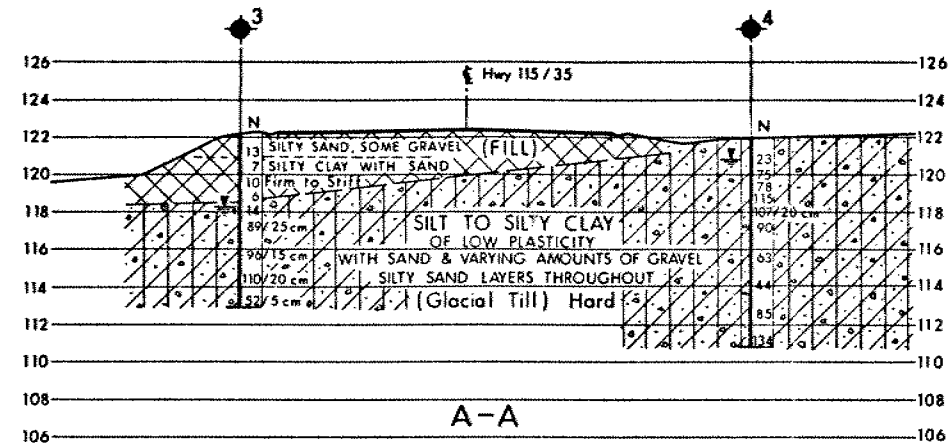
u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

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



METRIC

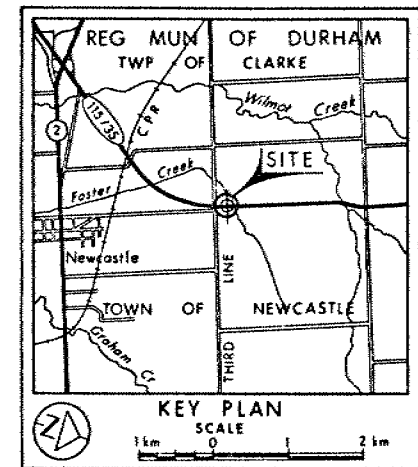
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN.
STATIONS ARE IN
KILOMETRES + METRES.

CONT No
WP No 7-79-05

THIRD LINE OVERPASS
(4.5 km North of Hwy 401)
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 1981 05

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	122.7	4 866 411.2	376 999.5
2	122.5	4 866 390.8	377 006.1
3	122.2	4 866 380.3	377 009.5
4	121.9	4 866 390.0	377 035.0
5	121.9	4 866 411.8	377 025.7
6	122.8	4 866 420.3	377 024.6

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

Geocres No 30M15-59

HWY No 115/35	DIST 7
SUBMITTAL CHECKED DATE 1981 08 11	SITE 21-429
DRAWN CHECKED	DWG 77905-A

memorandum



To: Mr. W. L. Lin,
Design Engineer,
Operating Section,
Central Region


Date: 81 12 29

From: Pavement & Foundation Design Section,
Room 315, Central Building

Re: Third Line Overpass at Highway 35/115,
W. P. 7-79-05, Site 21-429-PI, District 7

We have reviewed the preliminary general arrangement drawing pertaining to the above-mentioned project and have noted the change from a three-span structure to a single-span structure with elevated retaining walls.

This change in design will not necessitate any further foundation investigation with all recommendations in the foundation investigation report remaining valid.


H. J. Sturm,
Engineer-in-Training

HJS/bd

For:

M. Devata,
Senior Foundations Engineer

memorandum



To: Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region

Date: 81 07 15

From: Pavement & Foundation Design Section
Room 313, Central Building

Re: Proposed Third Line Overpass
Site 21-429, W.P. 7-79-05
Hwy. 35/115, District 7, Port Hope

We have now completed the fieldwork for the foundation investigation report pertaining to the above mentioned project. In order to satisfy your scheduling and preliminary design requirements, this memo will summarize the subsurface conditions encountered and present design recommendations regarding structure foundations and the related earthworks. The complete foundation investigation and design report will be forwarded upon completion of laboratory testing and drafting requirements.

Subsurface Conditions

In general, subsurface conditions across the site are uniform. The existing roadway fill ranges in thickness from 2.0 to 3.7 on the west side to nonexistent on the east side. This fill consists of 0 to 1.5 metres of compact silty sand with gravel overlying a firm to stiff silty clay fill with sand. The predominant deposit underlying the site and explored to a maximum depth of 12.5 metres is an overconsolidated glacial till consisting of a slightly plastic silt to silty clay of low plasticity (ML-CL) with sand and varying amounts of gravel. Occasional seams and layers of silty sand were encountered throughout this relatively incompressible deposit. Based on Standard Penetration Test 'N' values and interpretation of augering operation the consistency of this deposit is assessed as hard.

Bedrock was not encountered in any of the borings at the site.

Stabilized borehole water levels were encountered within the glacial till deposit at approx. elevations of 118 on the west side and elev. 120 on the east side. This indicates that the groundwater has a westerly gradient which reflects the sloping topography across the site.

Discussion and Recommendations

As part of the proposed widening of Hwy. 35/115, a 3 span overpass structure is contemplated to carry Hwy. 35/115 over the 3rd Line Concession Rd. Since no change in the existing Hwy. 35/115 grade is planned, cuts in the order of 7.2 metres and realignment of the 3rd Line will be required.

cont'd...../2

Recommendations pertaining to the foundations of the new structure and related earth works are summarized as follows:

In consideration of the overconsolidated nature of the glacial till deposit, structural elements can be founded on shallow spread footing-type foundations.

Abutment Foundations

The north abutment can be supported on spread footings founded at or below elevation 119.5 for an allowable bearing pressure of 500 kPa. The south abutment footing can be founded at or below elevation 117.5 for a similar loading of 500 kPa. Alternatively, subexcavation of localized firm to stiff material to elev. 117.5 under the west half of the south abutment footing and backfilling with well compacted Granular 'A' or mass concrete to a suitable founding elevation would allow for a design capacity of 335 kPa.

Pier Foundations

Pier elements can be founded on spread footings at or below elevation 115 for an allowable bearing pressure of 500 kPa. For the purposes of the O.H.B.D.C., the following design parameters are given:

	<u>Factored Capacity at U.L.S. (kPa)</u>	<u>Capacity at S.L.S. Type II (kPa)</u>
N. Abutment	750	500
S. Abutment (without subexcavation)	750	500
S. Abutment (with subexcavation)	500	335
Piers	750	500

Earth pressure should be computed as per Subsection 6.6.1.2.2 of the O.H.B.D.C. Manual.

Resistance to sliding of the spread footings can be calculated assuming an adhesional value of 100 kPa between the base of the footing and the undisturbed glacial till.

The underside of all footing elements should be provided with a minimum 1.5 metres of earth cover for frost protection purposes.

No major dewatering difficulties are anticipated for footing excavations due to the moderately impervious nature of the subsoil. Groundwater seepage can be controlled by perimeter ditches and pumping from corner sumps.

No stability problems are anticipated for cut slopes constructed to a 2:1 geometry.

We trust the information provided is sufficient in scope for your immediate design requirements. Should further discussion be warranted, please feel free to contact this Section.



T.J. Kazmierowski
Foundations Engineer

TJK:ea

cc: G.C.E. Burkhardt
R.D. Gunter
F. Norman
D.E. Thrasher
K. Bassi
B.J. Giroux
R. Hore