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GEOCRES No. 30M15-62

DIST. 7 REGION

W.P. No. 7-79-12

CONT. No. 83-67

W. O. No.

STR. SITE No. 21 RW

HWY. No. 8 35A15

LOCATION Proposed Retaining Wall

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry of  
Transportation and  
Communications

# foundation investigation and design report

ENGINEERING MATERIALS OFFICE  
PAVEMENT & FOUNDATION DESIGN SECTION

WP 7-79-12 DIST 7  
HWY 35/115 STR SITE 21 RW

Proposed Retaining Wall  
Third Line Connection

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## FOUNDATION INVESTIGATION REPORT

For

Proposed Retaining Wall  
Third Line Connection  
W. P. 7-79-12, Site 21 RW  
Highway 35/115, District 7, Port Hope

### INTRODUCTION

This Report summarizes the factual information obtained from a foundation investigation program performed at the above-mentioned site and provides detailed recommendations pertaining to the retaining wall foundations and related earthworks. The fieldwork was carried out on 81 05 20 and 81 09 09, and consisted of advancing 4 sampled boreholes by means of continuous flight augers for depths ranging from 9.4 to 12.3 metres below ground surface.

### SITE DESCRIPTION AND GEOLOGY

The site is located off the existing Highway 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 surficial deposit of silty sand to sand, and explored to a maximum depth of 11.1 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 No. 77912-A.

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

##### Silty Sand to Sand

The surficial deposit overlying most of the site consists of a silty sand to sand with gravel ranging in depths from 0.6 to 1.8 metres. Interpretation of Standard Penetration Test 'N' values and augering operations indicate a compact average denseness for this deposit.

##### Glacial Till

The predominate deposit underlying the site and explored for depths ranging from 7.8 to 11.1 metres is an overconsolidated glacial till consisting of a heterogeneous mixture of sand, silt,

clay with varying amounts of gravel. Occasional distinct seams and layers of sand, silty clay, and gravel were encountered throughout this relatively incompressible deposit. Typical gradation curves for representative samples from this deposit are plotted in envelope form on Figure 1. In general, the plasticity of the fine grained matrix material for this deposit ranged from nil to slight, with slightly higher plasticity values obtained at the north end of the site.

Based on interpretation of S. P. T. 'N' values generally in excess of 100 blows per 0.3 metres, the denseness of this deposit is assessed as very dense.

#### Groundwater

Overnight stabilized borehole water levels were encountered within the glacial till deposit at elevations ranging from 116.6 to 117.4 for the 3 southerly boring locations, and at elevation 120.8 at the northerly borehole location. This localized elevated water table reflects increased drainage associated with the highway collector ditch beside the borehole. In general, the water table at the time of investigation, is assumed to have a fairly level gradient across the site (approximate elevation 117.0) with a high localized condition in the highway ditch area.

#### DISCUSSION AND RECOMMENDATIONS

As part of the proposed widening of Highway 35/115, a 3-span overpass structure is contemplated to carry Highway 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 necessary.

A 108 metre long retaining wall is required to minimize property acquisition in the south-east quadrant of the new intersection. The top of retaining wall will vary to a maximum height of 5.0 metres above 3rd Line profile grade with a maximum sloping surcharge of 2.5 metres behind the wall.

Recommendations pertaining to the foundations of the retaining structure and related earthworks are summarized as follows.

In consideration of the competent overconsolidated nature of the glacial till deposit cantilever retaining wall foundations can be founded on shallow spread footings. Spread footings founded with a minimum 1.3 metres earth cover in front of the wall can be designed assuming the following O. H. B. D. C. loading conditions:

Factored Capacity at U. L. S.	1000 kPa
Capacity at S. L. S. Type II	400 kPa

Earth pressures should be computed as per Subsection 6.6.1.2 of the O. H. B. D. C. Manual. In addition, the effects due to the sloping surcharge of the ground behind the retaining wall, as well as the use of heavy vibratory compaction equipment, should also be taken into account in the computation of earth pressures.

Resistance to sliding of the spread footings can be calculated assuming a coefficient of friction of 0.55 ( $\phi_f = 29^\circ$ ) for ultimate limit state and a coefficient of friction of 0.7 ( $\phi = 35^\circ$ ) at the serviceability limit state Type II.

Temporary cut slopes in the till material should remain stable at 1:1 geometry. If steeper slopes are contemplated, an extensive slope protection scheme will have to be incorporated during construction for footing excavation and placement. No stability problems are anticipated for permanent cut slopes constructed to a 2:1 geometry.

No major dewatering problems are anticipated for footing excavations due to the moderately imperious nature of the subsoil. Groundwater seepage can be controlled by perimeter ditches and pumping from sumps. To facilitate lowering of the groundwater table, it is recommended that cuts and ditching/drainage works for the relocated 3rd Line be carried out prior to excavations for the retaining wall footings.

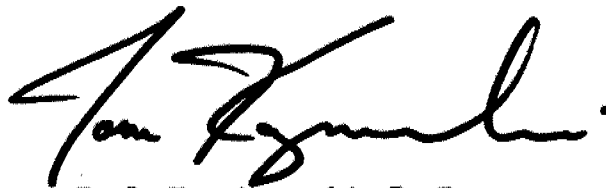
In addition, care should be exercised to prevent loosening of the foundation base after excavation due to surface runoff action and/or construction activity.

#### MISCELLANEOUS

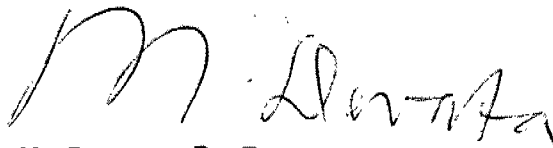
The fieldwork for this investigation was carried out under the supervision of Mr. Z. Mabraïdopoulos, Student Technician, utilizing equipment owned and operated by Master Soil Ltd., Toronto.



The preliminary letter of foundation recommendations dated 81 10 30 and this report were written by Mr. T. J. Kazmierowski, Foundations Engineer, and reviewed by Mr. M. Devata, Senior Foundations Engineer.



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



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

APPENDIX



# RECORD OF BOREHOLE No 1

METRIC

W P 7-79-12 LOCATION Co-ords N 4866 405.3; E377 055.6 ORIGINATED BY Z. M.  
DIST 7 HWY 35/115 BOREHOLE TYPE Hollow Stem Augers COMPILED BY T. J. K.  
DATUM Geodetic DATE 81 09 09 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										10 20 30									
123.0	Ground Surface																										
0.0	Topsoil		1	SS	20		122										0 45 49 6										
121.2	Sandy silt, trace of clay Compact		2	SS	64												12 47 29 12										
1.8	Gravel		3	SS	50/5	cm	120										10 53 28 9										
	(Glacial Till)		4	SS	75																						
	Silty sand varying amounts of gravel		5	SS	87																						
			6	SS	100	15 cm	118																				
	trace of clay		7	SS	50/5	cm	116										15 38 35 12										
	occasional thin layers of sand		8	SS	133	28 cm	114																				
113.4	Very Dense		9	SS	127																						
9.6	End of Borehole																										

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 2

METRIC

W P 7-79-12 LOCATION Co-ords N 4 866 400.0; E 377 093.0 ORIGINATED BY Z. M.  
DIST 7 HWY 35/115 BOREHOLE TYPE Hollow Stem Augers COMPILED BY T. J. K.  
DATUM Geodetic DATE 81 09 09 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
123.4	Ground Surface																
122.8	Silty sand compact																
0.6			1	SS	43												19 46 24 11
	(Glacial Till)		2	SS	110	23 cm	122										
			3	SS	50	8 cm	120										7 51 33 9
	Gravel																
	Silty sand, trace of clay		4	SS	100	13 cm											
							118										
	Varying amounts of gravel		5	SS	100	20 cm											
	Very dense																
	silty clay		6	SS	30	5 cm	116										
114.1	silty sand		7	SS	50	8 cm											
9.3	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 3

METRIC

W P 7-79-12 LOCATION Co-ords N 4 866 381.2; E 377 116.4 ORIGINATED BY Z. M.  
DIST 7 HWY 35/115 BOREHOLE TYPE Hollow Stem Augers COMPILED BY T. J. K.  
DATUM Geodetic DATE 81 09 09 CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
124.3	Ground Surface																
0.0	Sand with gravel some silt Compact		1	SS	100/25 cm		124										
122.9			2	SS	47												
1.4	(Glacial Till)		3	SS	100/15 cm		122										
			4	SS	100/10 cm		120										27 31 31 11
	Silty clay some sand		5	SS	100/15 cm		118										3 46 40 11
	Silty sand trace clay		6	SS	100/15 cm		116										
	Varying amounts of gravel		7	SS	100/15 cm												
	Very Dense		8	SS	100/13 cm		114										4 49 37 10
	Fine silty sand		9	SS	100/15 cm												
112.0																	
12.3	End of Borehole																

+3, x5 : Numbers refer to  
Sensitivity.

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 4 (Formerly BH 4) METRIC

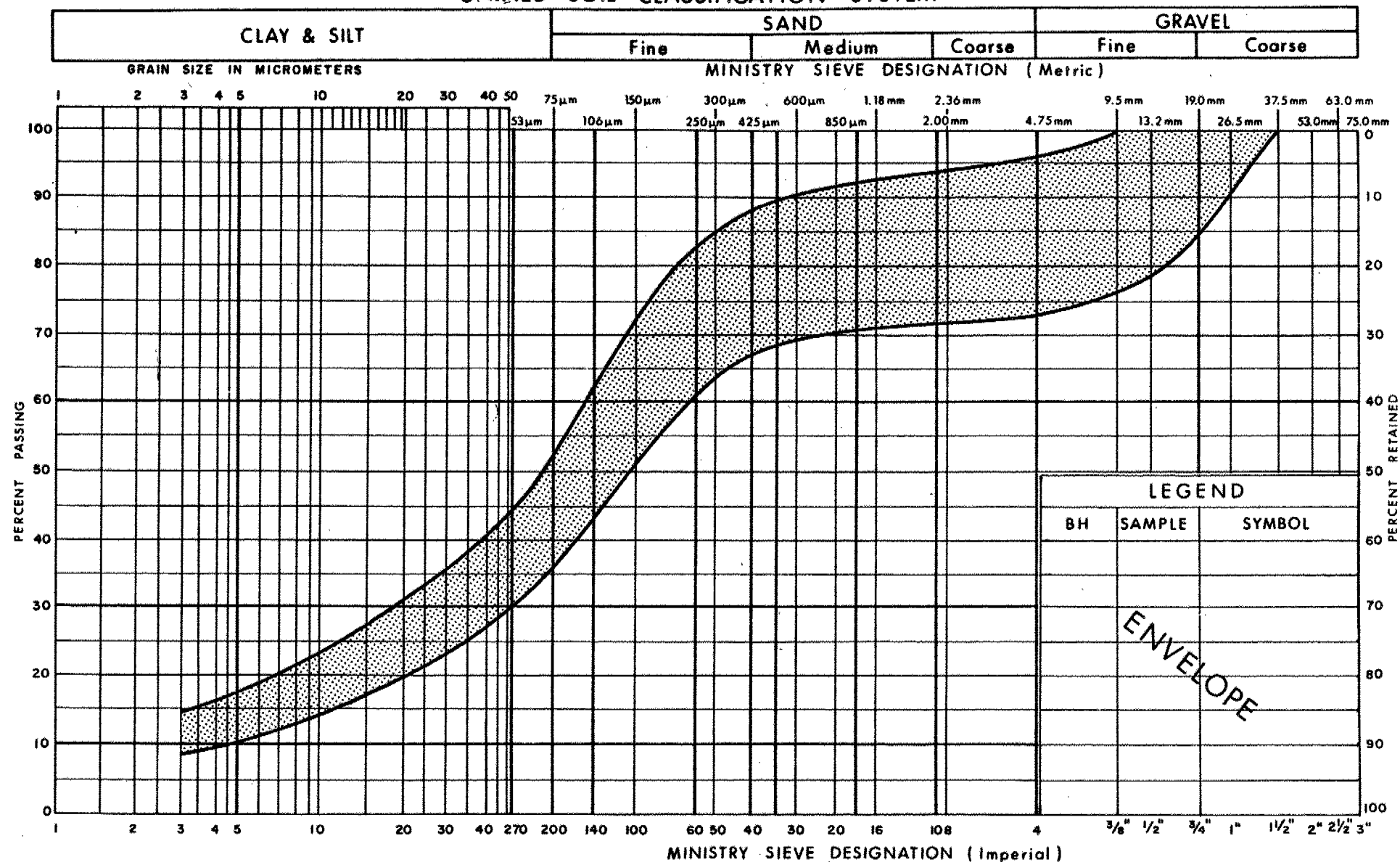
W P 7-79-12 LOCATION Co-ords 4 866 390.0 N; 377 035.0 E ORIGINATED BY Z. M.  
DIST 7 HWY 35/115 BOREHOLE TYPE Solid Stem Flight Augers COMPILED BY Z. M.  
DATUM Geodetic DATE 81 05 20 CHECKED BY G

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	Wp	W	Wl		
121.9	Ground surface															
0.0	(Glacial Till)		1	SS	23											12 33 39 16
	Silt to silty clay		2	SS	75											41 34 24 1
	of low plasticity		3	SS	78											
	and sand with		4	SS	115											11 45 30 14
	varying amounts of		5	SS	107	20 cm										
	gravel		6	SS	90											
	Brown		7	SS	63											
	Grey		8	SS	44											
	Silty sand layers		9	SS	85											
	throughout															
	Hard															
110.8			10	SS	134											
11.1	End of Borehole															

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation and  
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**GRAIN SIZE DISTRIBUTION**  
**SILTY SAND, TRACE OF CLAY & VARYING AMOUNTS OF GRAVEL**  
 (Glacial Till)

FIG No 1

W P 7-79-12

## 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 BOREHOLE 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 'A' 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 CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

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

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	50mm	50 - 300mm	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 HYDRAULICALLY
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
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

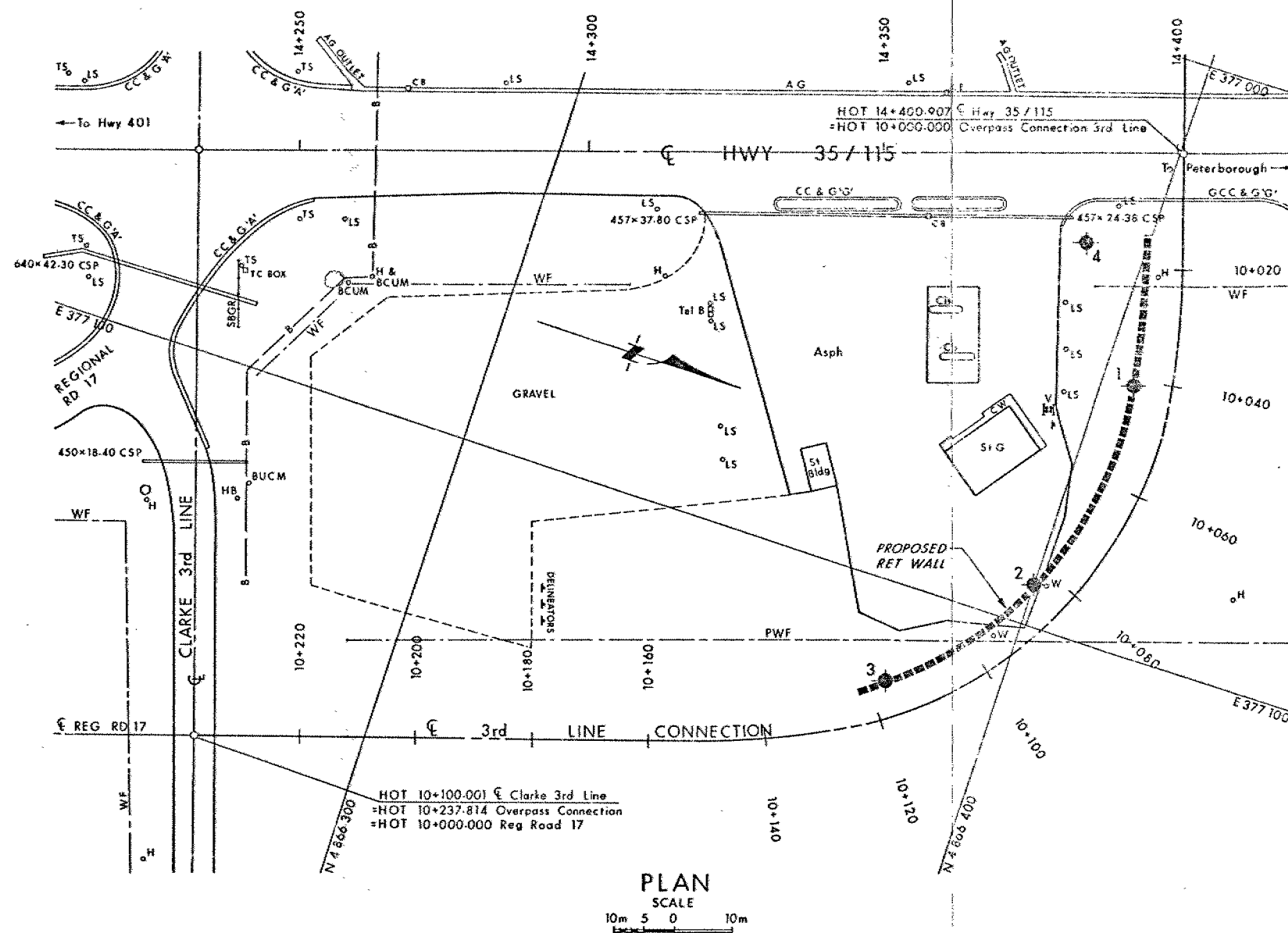
### MECHANICAL PROPERTIES OF SOIL

$m_v$	$kPa^{-1}$	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	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
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	$kg/m^3$	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	$kN/m^3$	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	$kg/m^3$	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	$kN/m^3$	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	$kg/m^3$	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	$kN/m^3$	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	$kg/m^3$	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	$m^3/s$	RATE OF DISCHARGE
$\gamma_d$	$kN/m^3$	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	$kg/m^3$	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	$kN/m^3$	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	$kg/m^3$	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	$kN/m^3$	SEEPAGE FORCE
$\gamma'$	$kN/m^3$	UNIT WEIGHT OF SUBMERGED SOIL						





**METRIC**

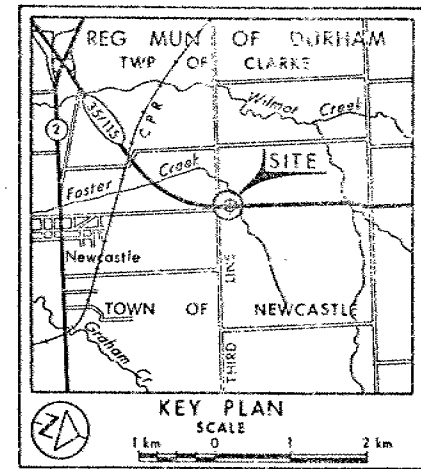
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN.  
STATIONS ARE IN  
KILOMETRES + METRES

CONT No  
WP No 7-79-12

PROPOSED RETAINING WALL  
(AT THIRD LINE CONNECTION)  
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



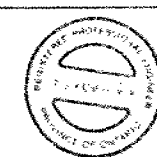
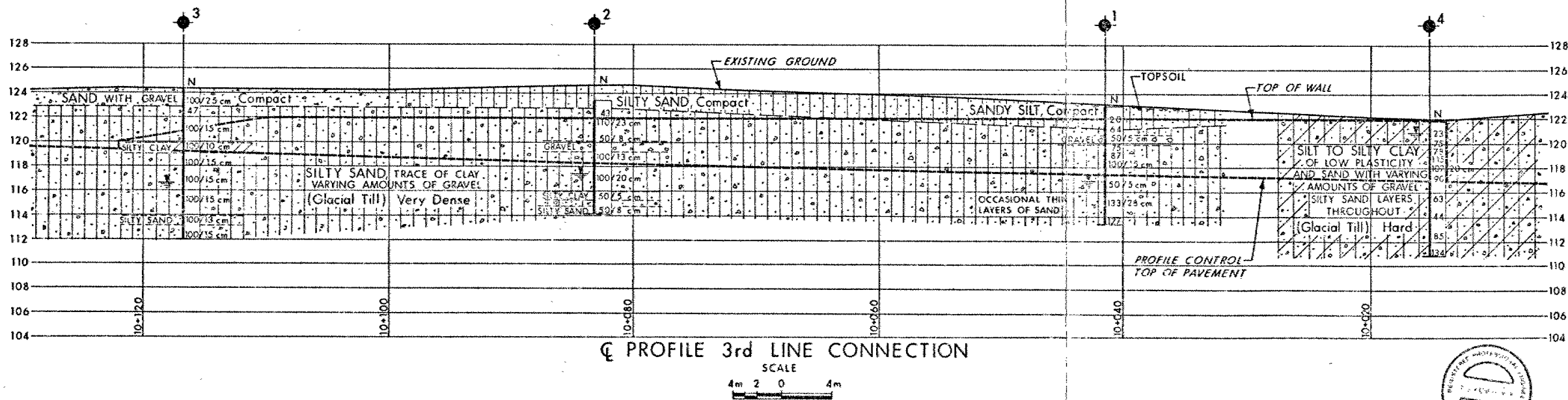
**LEGEND**

- 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 09
- W.L. for B.H. #4, 1981 05

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	123.0	4 866 405.3	377 055.6
2	123.4	4 866 400.0	377 093.0
3	124.3	4 866 381.2	377 116.4
4	121.9	4 866 390.0	377 035.0

**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 30415-62

HWY No 35/115 DIST 7  
SUBMITTAL CHECKED DATE 1981 11 26 SITE 21-RW  
DRAWN BY CHECKED 11/28/81 Dwg 77912-A

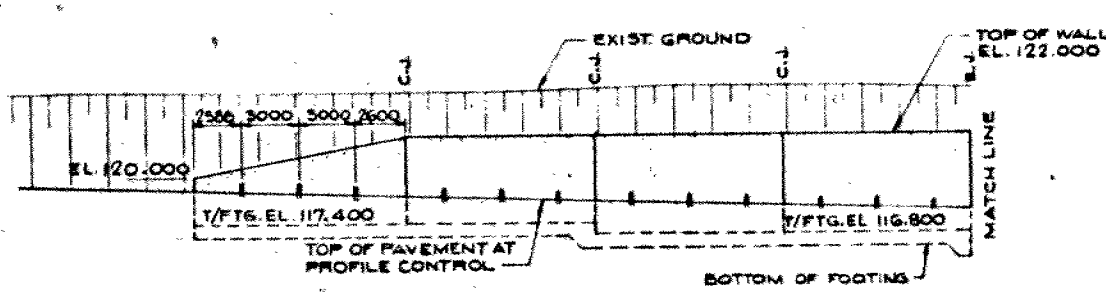
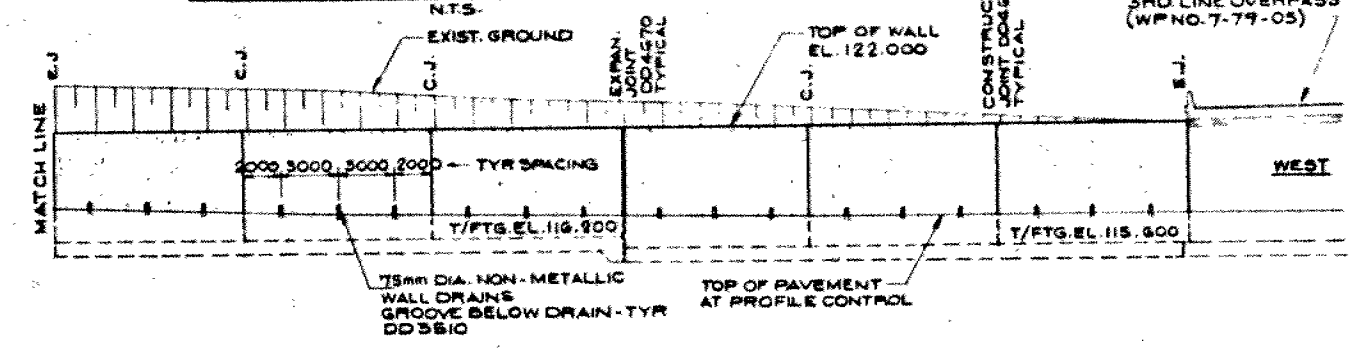
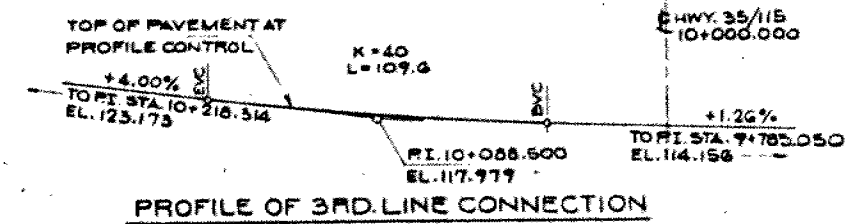
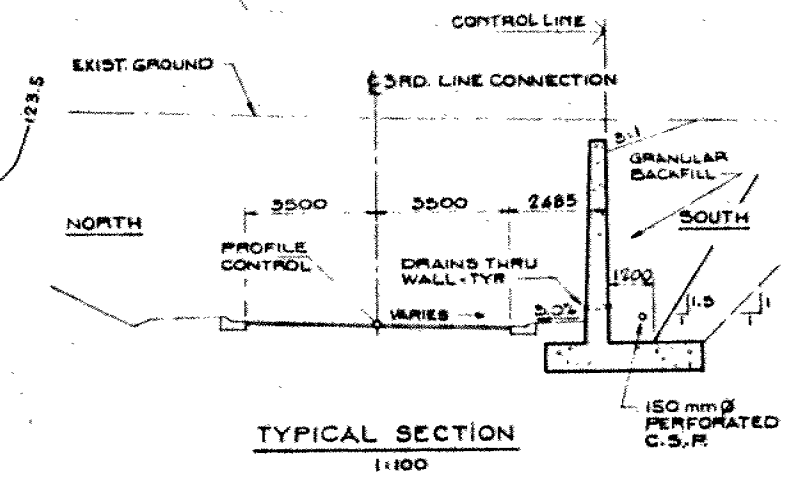
DISTRICT 7		
CONT No WP No 7-79-12		
RETAINING WALL AT 3RD LINE OVERPASS AND HWY. 35/115 GENERAL ARRANGEMENT		SHEET
<b>PARKER</b> CONSULTANTS Consulting Professional Engineers Hamilton · London · Ottawa · Jarvis		

# METRIC

DIMENSIONS ARE IN MILLIMETRES  
UNLESS OTHERWISE SHOWN.  
ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES.

## GENERAL NOTES

- CLASS OF CONCRETE**  
RETAINING WALL 30 MPa  
FOOTING 20 MPa
- CLEAR COVER TO REINFORCING STEEL**  
FOOTINGS 100 ± 25mm  
RETAINING WALL - FRONT FACE 80 ± 20mm  
- BACK FACE 70 ± 20mm
- REINFORCING STEEL**  
REINFORCING STEEL SHALL BE GRADE 400  
EXCEPT AS NOTED.  
BARS MARKED WITH SUFFIX C SHALL BE  
COATED BARS.
- CONSTRUCTION**



CONCRETE QUANTITIES ARE LISTED  
BELOW FOR THE APPROPRIATE  
CONCRETE LUMP SUM TENDER ITEM

CONCRETE QUANTITIES	
CONCRETE IN RETAINING WALL	292 m³



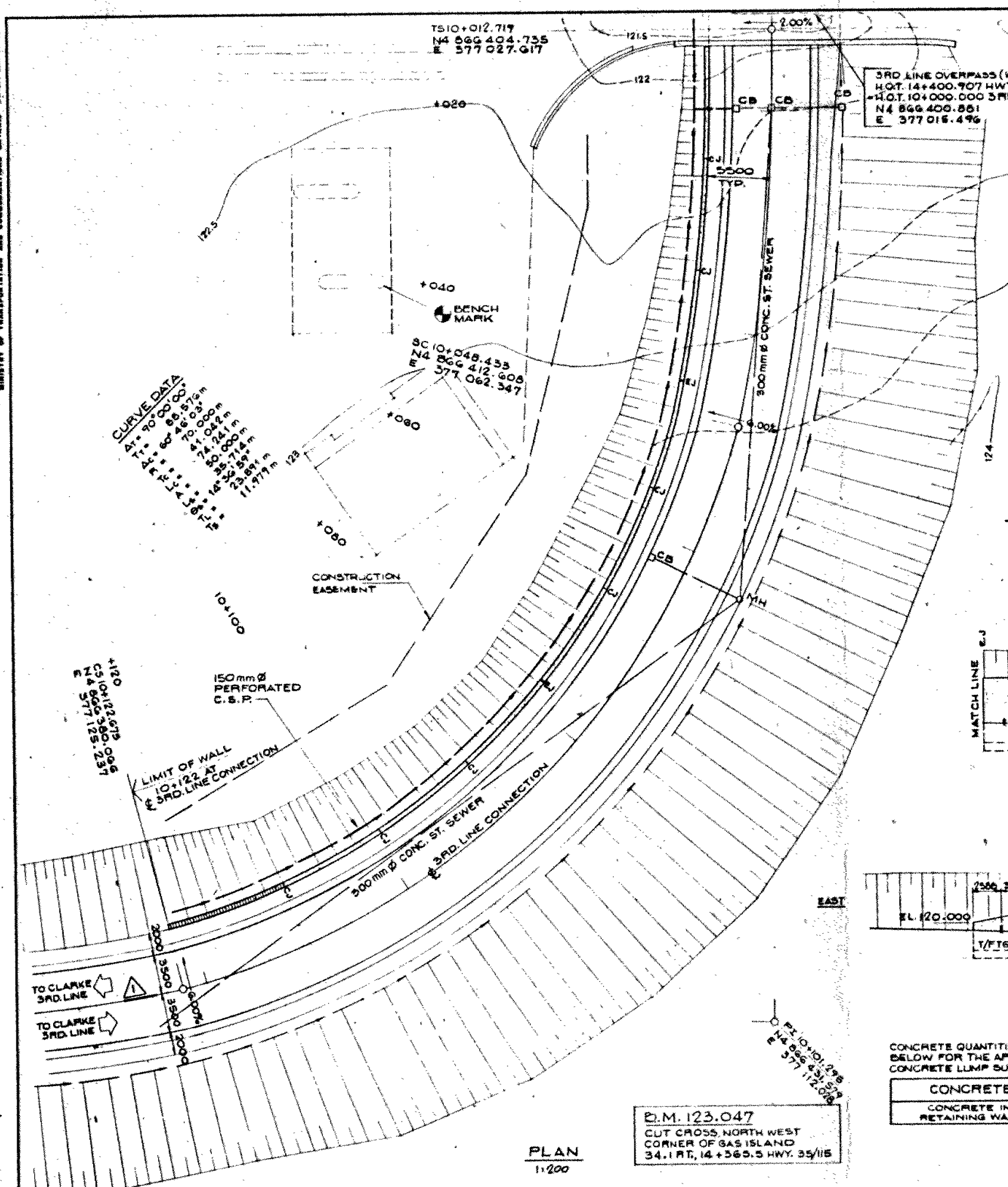
DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

- LIST OF ABBREVIATIONS**  
T/FTG. TOP OF FOOTING  
I.F. INSIDE FACE  
O.F. OUTSIDE FACE

- LIST OF DRAWINGS**  
1. GENERAL ARRANGEMENT  
2. DETAILS

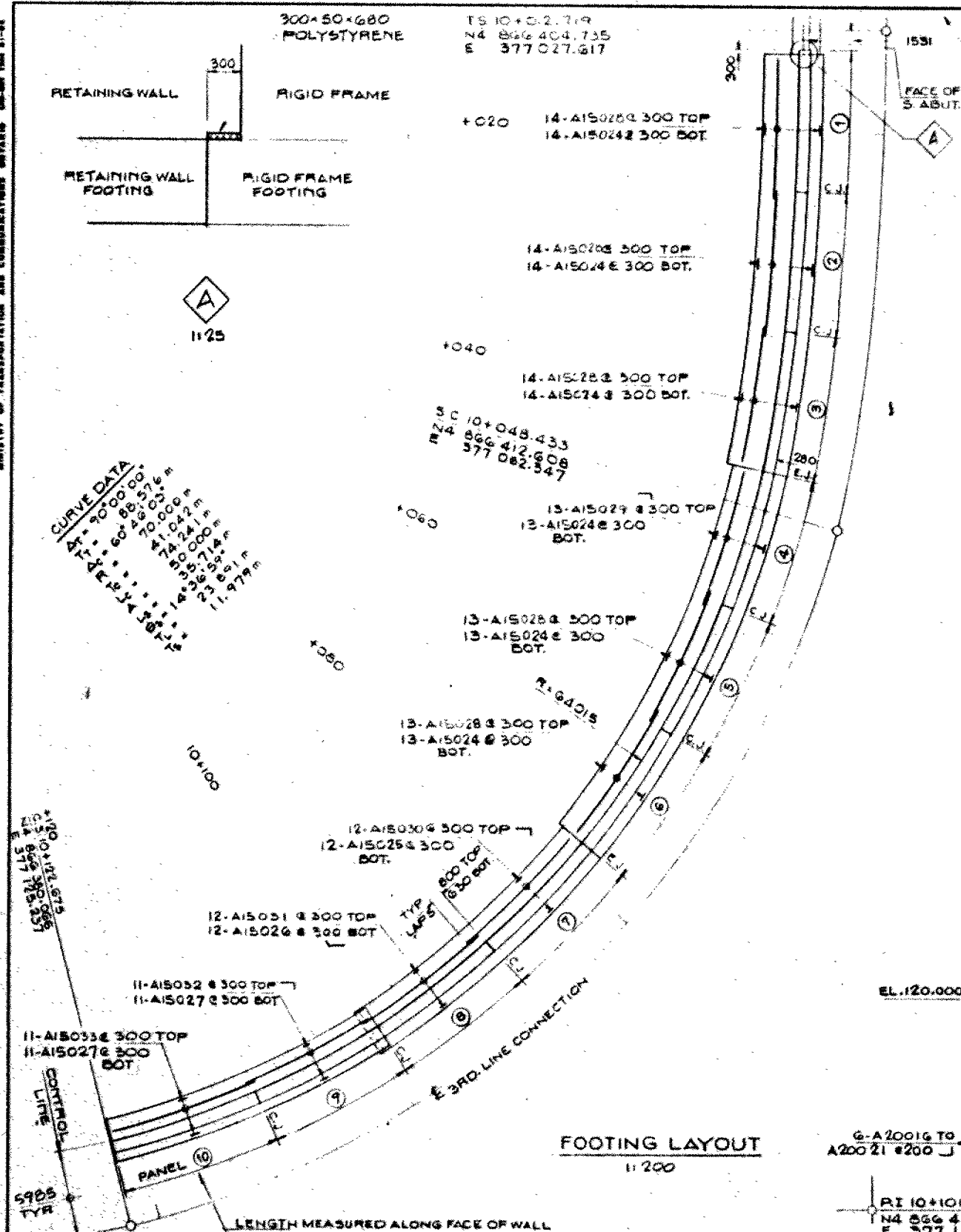
JUN - 2 1982

REVISIONS	DATE	BY	DESCRIPTION	DATE
DESIGN	J.C.L.	CHECK D.C.C.	LOADING	
DRAWING	G.S.N.	CHECK D.C.C.	SITE No 21-RW	DWB



PLAN  
1:200

B.M. 123.047  
CUT CROSS NORTH WEST  
CORNER OF GAS ISLAND  
34.1 RT, 14+565.5 HWY. 35/115



3RD. LINE OVERPASS (W.P. NO. 7-79-05)  
 H.O.T. 14+400.907 HWY. 35/13  
 H.O.T. 10+000.000 3RD. LINE CONNECTION  
 N+ 866 400.881  
 E 377 015.496

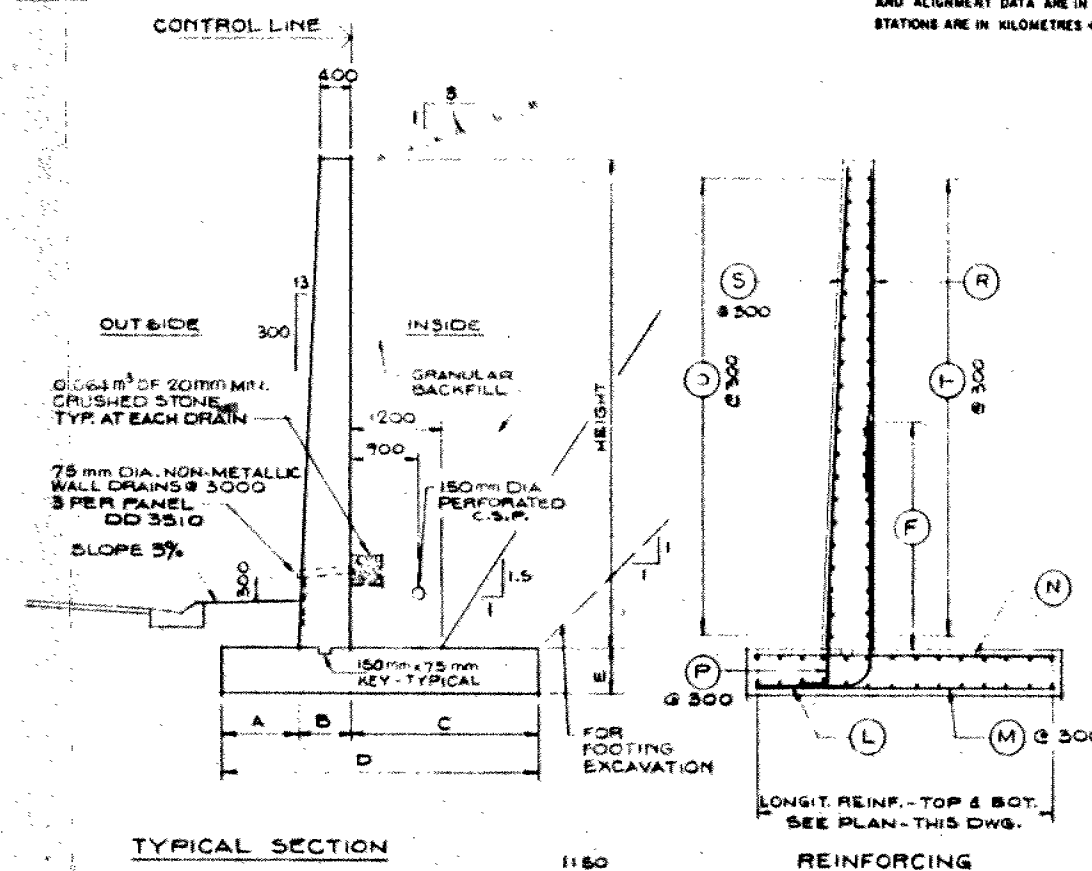
**METRIC**

DIMENSIONS ARE IN MILLIMETRES  
UNLESS OTHERWISE SHOWN.  
ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES

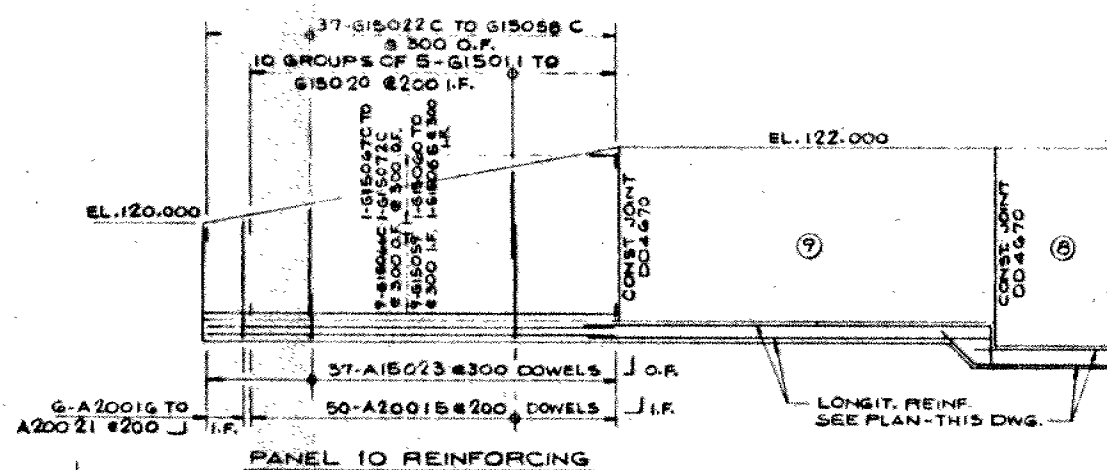
CONT No  
WP No 7-79-12

RETAINING WALL  
AT 3rd. LINE OVERPASS AND HWY. 35/115  
DETAILS

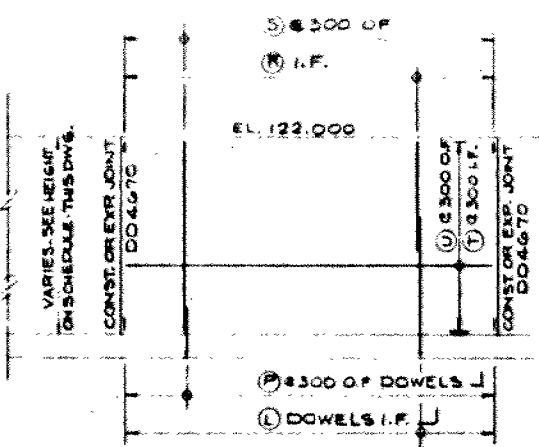
**PARKER**  
**CONSULTANTS**



TYPICAL SECTION



## PANEL 10 REINFORCING



TYPICAL REINFORCING - PANELS 1 TO 9

[illegible]

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

JUN - 2 1982

REVISIONS				
DATE	BY	DESCRIPTION		
DESIGN	J.C.L.	CHECK	D.C.C.	LOADING --- DATE
DRAWING	G.E.M.	CHECK	J.C.L.	SITE No. 21-438 INWS 2

# memorandum



To: Mr. W.L. Lin  
Design Engineer (Central)  
Operating Section  
Structural Office

Date: 82 06 23

From: Pavement & Foundation Design  
Room 315, Central Building  
Downsview, Ontario

Re: Retaining Wall at Third Line Overpass  
W.P. 7-79-12, Site: 21-RW  
Hwy. 35/115, District 7

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We have reviewed the final bridge plan drawings for the above-mentioned site and feel it is advisable to place the retaining wall footings on a thin pad of lean concrete or mat of well compacted Granular 'A' to prevent loosening of the founding soil during construction.

In addition, under the list of drawings, space should be left for the Borehole location and Soil Strata Drawing.

A handwritten signature in black ink, appearing to read "Tom Kazmierowski".

Tom Kazmierowski, P. Eng.  
Foundations Engineer

TK/syc

# memorandum



To: Mr. W. L. Lin  
Design Engineer (Central)  
Operating Section (West Building)

Date: January 13, 1982

From: Pavement and Foundation Design Section  
Rm. 315, Central Building

Re: Third Line Overpass at Hwy. 35/115  
W.P. 7-79-12, Site 21-RW-P1  
District 7

We have reviewed the General Arrangement Drawing for the above mentioned structure and provide the following comment.

Upon excavation for the footing of the retaining wall, it may be advisable to recommend placing a lean concrete pad or compacted granular "A" mat to prevent loosening of the bearing soil during construction.

H. Sturm  
Engineer in Training

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

HS/ba

# memorandum



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

Date: 81 10 30

From: Pavement & Foundation Design Section

Re: Proposed Retaining Wall 3rd Line Connection  
Site 21RW, W. P. 7-79-12  
Highway 35/115, District 7, Port Hope

We have now completed the fieldwork and preliminary analysis 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 retaining wall foundations and the related earthworks. The complete foundation investigation and design report will be forwarded upon completion of laboratory testing and drafting requirements.

## Subsurface Condition

Uniform subsurface conditions were encountered across the site. The surficial deposit overlying most of the site consists of a compact silty sand to sand with gravel ranging in depths from 0.6 to 1.8 metres. The predominant deposit underlying the site and explored to a maximum depth of 12.3 metres is an overconsolidated glacial till ranging from a slightly plastic silty clay and sand to a silty sand, trace of clay with varying amounts of gravel. Occasional distinct seams and layers of sand, silty clay and gravel were encountered throughout this relatively incompressible deposit. Based on Standard Penetration Test 'N' values generally in excess of 100 blows per 0.3 metres and interpretation of augering operations, the overall denseness of this deposit is assessed as hard.

Stabilized borehole water levels were encountered within the till deposit at depths ranging from 5.9 to 7.7 metres (corresponding to approximate elevations of 118.7 to 116.6 respectively). A higher level (elevation 120.9) was recorded in one boring at the Highway 115/35 east ditch line, which reflects increased runoff from the roadway structure resulting in a localized high groundwater condition.

## Discussion and Recommendations

As part of the relocation of the 3rd Line Concession Road to accommodate widening of Highway 35/115, a 108 metre long retaining wall is proposed to minimize property acquisition in the south-east quadrant of the new intersection. The top of retaining wall will vary to a maximum height of 5.0 metres above 3rd Line profile grade with a maximum sloping surcharge of 2.5 metres behind the wall.

Recommendations pertaining to the foundations of the retaining structure and related earthworks are summarized as follows.

In consideration of the competent overconsolidated nature of the glacial till deposit cantilever retaining wall foundations can be founded on shallow spread footings. Spread footings founded with a minimum 1.3 metres earth cover in front of the wall can be designed assuming the following O. H. B. D. C. loading conditions:

Factored Capacity at U. L. S. 1000 kPa

Capacity at S. L. S. Type II 400 kPa

Earth pressures should be computed as per Subsection 6.6.1.2 of the O. H. B. D. C. Manual. In addition, the effects due to the sloping surcharge of the ground behind the retaining wall, as well as the use of heavy vibratory compaction equipment, should also be taken into account in the computation of earth pressures.

Resistance to sliding of the spread footings can be calculated assuming a coefficient of friction of 0.55 ( $\phi_f = 29^\circ$ ) for ultimate limit state and a coefficient of friction of 0.7 ( $\phi = 35^\circ$ ) at the serviceability limit state Type II.

Temporary cut slopes in the till material should remain stable at 1:1 geometry. If steeper slopes are contemplated, an extensive slope protection scheme will have to be incorporated during construction for footing excavation and placement.

No major dewatering problems are anticipated for footing excavations due to the moderately imperious nature of the subsoil. Groundwater seepage can be controlled by perimeter ditches and pumping from sumps. To facilitate lowering of the groundwater table, it is recommended that cuts and ditching/drainage works for the relocated 3rd Line be carried prior to excavations for the retaining wall footings.

In addition, care should be exercised to prevent loosening of the foundation base after excavation due to surface runoff action and/or construction activity.

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, P. Eng.,  
Foundations Engineer