



Ministry
of
Transportation

Tony

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

RPN

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 120-87-01 DIST 9
HWY 416/417 STR SITE

Ramp 417 EB - 416 SB
(Station 15+780 to Station 16+220)

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FOUNDATION INVESTIGATION REPORT
For
Ramp 417 EB - 416 SB
(Station 15+780 to Station 16+220)
WP 120-87-01
District 9, Ottawa

INTRODUCTION

This report summarizes the results of a geotechnical site investigation implemented for stability and settlement analysis of the aforementioned ramp. The investigation was carried out between 88 07 26 and 88 07 27 and consisted of six sampled boreholes accompanied with two dynamic cone tests. The boreholes ranged in depth from 0.3 m to 9.2 m below existing ground surface and were advanced using hollow stem continuous flight augers. Bedrock outcrops were present from Station 15+960 to the southern limit of the site.

SITE DESCRIPTION AND GEOLOGY

Located in the City of Nepean, Ottawa-Carleton Municipality, the site traverses an area that spans from Hwy. 417, approximately 0.5 km west of the existing Acres Road and turns to parallel the existing Acres Road approximately 0.25 km west.

The north-western portion of the site is used primarily for agriculture and consists of low lying flat terrain. Bedrock outcrops populate the southern portion of the site. This general area is used for grazing cattle.

A swampy bog and lagoon zone is present in a depression adjacent to an existing fault scarp that separates the two distinct areas previously described. The fault scarp is located at approximate station 15+960.

Physiographically, the site lies in the area known as the Ottawa Valley Clay Plains founded in the Lowlands of the St. Lawrence. The deposit consists of clay plains interrupted by ridges of rock or sand. Fault scarps are also evident within the area, an illustration of the numerous normal faults that dominate the region.

The bedrock in the area is of the Gull River Formation of the Middle Ordovician Period. It consists of interbedded silty dolostone, shaley limestone and fine grained quartz sandstone. The overburden was deposited during and immediately following the Wisconsin glaciation at which time the area was depressed from the effect of the glaciation. Following the retreat of the glacier, the brackish waters of the Champlain Sea flooded the area and then gradually receded as the land rebounded with the deposition of sediments to its present level.

SUBSURFACE CONDITIONS

General

Subsoil conditions change dramatically from one area of the site to another. A prominent fault scarp separates the varying subsurface conditions. Northwest of the scarp, overburden consists of 2.0 m to 7.0 m of clayey silt with interbedded silty sand overlying a minimum thickness of 1.4 m of a heterogeneous mixture of silt, sand and gravel (glacial till). Bedrock or perhaps boulders, a possible constituent of the till deposit, was inferred at locations where the augers met practical refusal. South of the scarp, bedrock outcrops are scattered throughout the area.

The boundaries between the various soil types, in situ and laboratory test results as well as stabilized ground water levels, are shown on the attached Record of Borehole Sheets in the Appendix. A plan of the site illustrating the locations and elevations of the boreholes and subsoil stratigraphical sections are also provided on Dwg. 1208701-A.

A detailed description of the subsurface conditions encountered is given below.

Clayey Silt with interbedded Silty Sand

This surficial deposit of clayey silt with interbedded silty sand extends for a maximum thickness of 7.0 m. The interbedded silty sand exists as seams of a few millimetres in thickness to layers up to 100 mm in thickness and is generally of a loose relative density. Atterberg Limits testing were performed in the laboratory to evaluate the behaviour of the cohesive portion of the deposit and the results are plotted on Figure 1 and tabulated in Table 1 below:

Table 1

	<u>Range</u>	<u>Avg.</u>
Natural Moisture Content (w%)	27-39	33
Liquid Limit (w _L %)	21.5-34	27.4
Plasticity Index (I _p %)	9-19	13.5
Liquidity Index (I _L)	1.0-1.7	1.5

The results reveal that the cohesive soil is of low plasticity and that the in situ moisture contents generally exceed the liquid limit of the soil.

Grain size distribution curves for the deposit as determined by mechanical analyses are provided on Figure 2.

The undrained shear strength of the soil as determined by in situ vane tests produced values in the 40 to 50 kPa range. Based on these values, it can be concluded that the cohesive soil is of a soft to firm consistency. However, it should be reminded that these values are not necessarily indicative of the true shear strength in view of the presence of the silty sand seams. In consideration of this, a value of 40 kPa has been selected for design purposes.

Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)

Underlying the clayey silt with interbedded silty sand exists a cohesionless glacial deposit consisting of a heterogeneous mixture of silt, sand and gravel. This deposit has a relative density ranging from compact to very dense but is generally dense.

Grain size distribution curves for the deposit are provided on Figure 3 in the Appendix.

Bedrock

Bedrock outcrops exist predominantly south of Station 16+000. Bedrock can be inferred to exist at an approximate elevation of 56 to 57 m between Stations 15+800 and 15+850. At the location of BH R3, bedrock can be inferred to exist at an approximate elevation of 61.8 m. No rock cores were obtained.

DISCUSSION AND RECOMMENDATIONS

It is proposed to construct the 417 EB to 416 SB ramp as a component of the major Hwy. 416-417 interchange. The ramp extends from Station 15+600 to Station 16+380 and involves fills varying in heights up to 8.0 metres.

Subsoil conditions vary across the site of the proposed ramp in view of the presence of a fault scarp at approximately Station 15+960. The fault scarp is a derivative of the normal faulting zones characteristic of the Ottawa Valley. Bedrock is exposed at the southern, higher elevation fault block while a maximum 9.2 m of overburden exists at the northwestern, low lying fault block.

The major geotechnical items of concern include the stability and settlement of the ramp fills. These areas are addressed below.

Stability

Stability computations were carried out to evaluate the effect of the ramp fills to the overall stability and to examine the internal stability of the fill material. Bishop's total stress analysis was implemented incorporating a minimum factor of safety of 1.3. The properties of the fill material, subsoil, surface geometry and ground water elevations used in the computations and applicable to the area northwest of the fault scarp where overburden was encountered is shown on Figure 4. Based on the analyses, it can be concluded that fills up to 8.0 metres in height and overlying the overburden as illustrated, will be stable provided they are constructed with standard 2H:1V slopes. Analysis was also implemented for fills exceeding 8.0 metres in height. For fills exceeding 8.0 metres nominal mid-height stabilizing berms will be required in the transverse direction. The berm length requirements for various heights of fill are also illustrated on Figure 5 in the Appendix. Berms should be constructed with a nominal slope such that surface run-off does not pond on the berm.

For fills placed in the areas of the bedrock outcrops, the internal stability of the fills govern the analyses. It can be concluded from the analysis that fills upto 8.0 metres in height are stable provided they are constructed with standard

2H:1V slopes. For fills exceeding 8.0 metres, stability of the fills will be obtained by constructing nominal midheight 2.0 metre berms.

Any localized softened and/or surficial organic soil should be removed within the planned limits of the fill prior to its placement. In addition, any large accumulations of water such as the existing lagoon shall be pumped prior to fill placement. The fills should be placed and compacted according to MTO Standards.

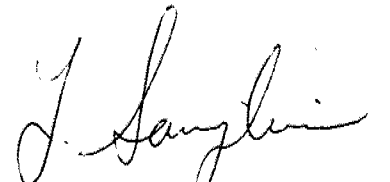
Settlements

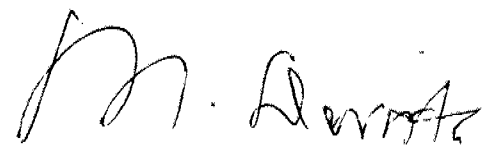
Based on settlement analysis of similar deposits of the clayey silt with interbedded silty sand seams in the surrounding area, the majority of settlement induced by the placement of the fill over this deposit will be due to the recompression of the native soil and hence, "immediate" in nature - i.e. will occur during or immediately following construction. It is anticipated that the magnitude of this settlement will range from 50 mm to 100 mm for heights of fill of 8 to 10 m respectively. Settlements due to primary consolidation will produce a further 25 mm to 50 mm of consolidation settlement. Due to the relative smaller magnitude, the time rate of this settlement was not calculated. In addition, settlements within the fill can be expected to accumulate to approximately 75-100 mm within the fill. Consequently, to minimize post construction maintenance it is recommended that fills be placed as far in advance of paving as scheduling and economics permit.

MISCELLANEOUS

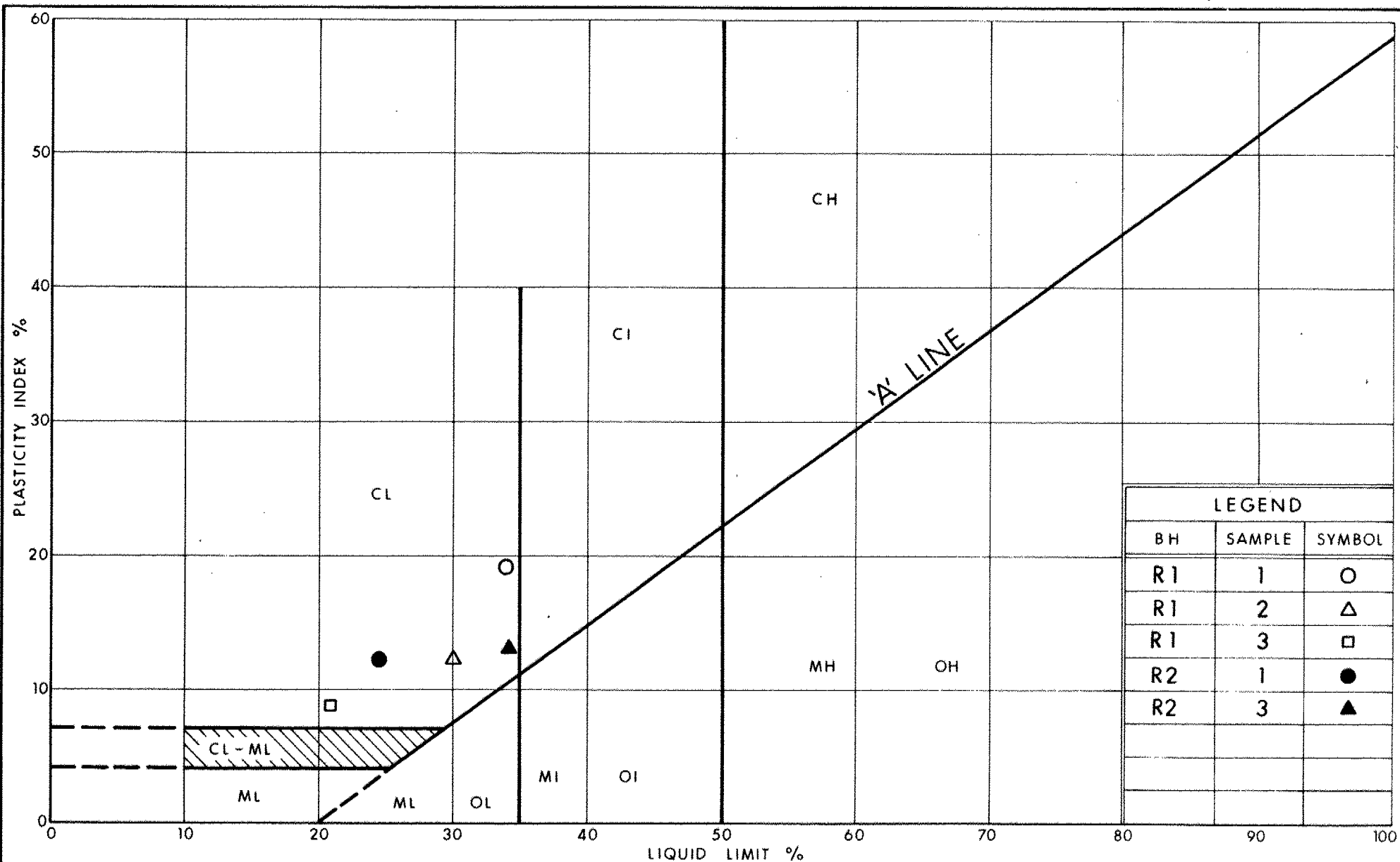
The fieldwork for this investigation was carried out under the supervision of J. Fellenius and M. Schnarr, Student Engineers, utilizing equipment owned and operated by Marathon Drilling Co. This report was written by T. Sangiuliano and reviewed by M.S. Devata, Chief Foundation Engineer.




T. Sangiuliano, P.Eng.
Foundation Engineer


M.S. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX



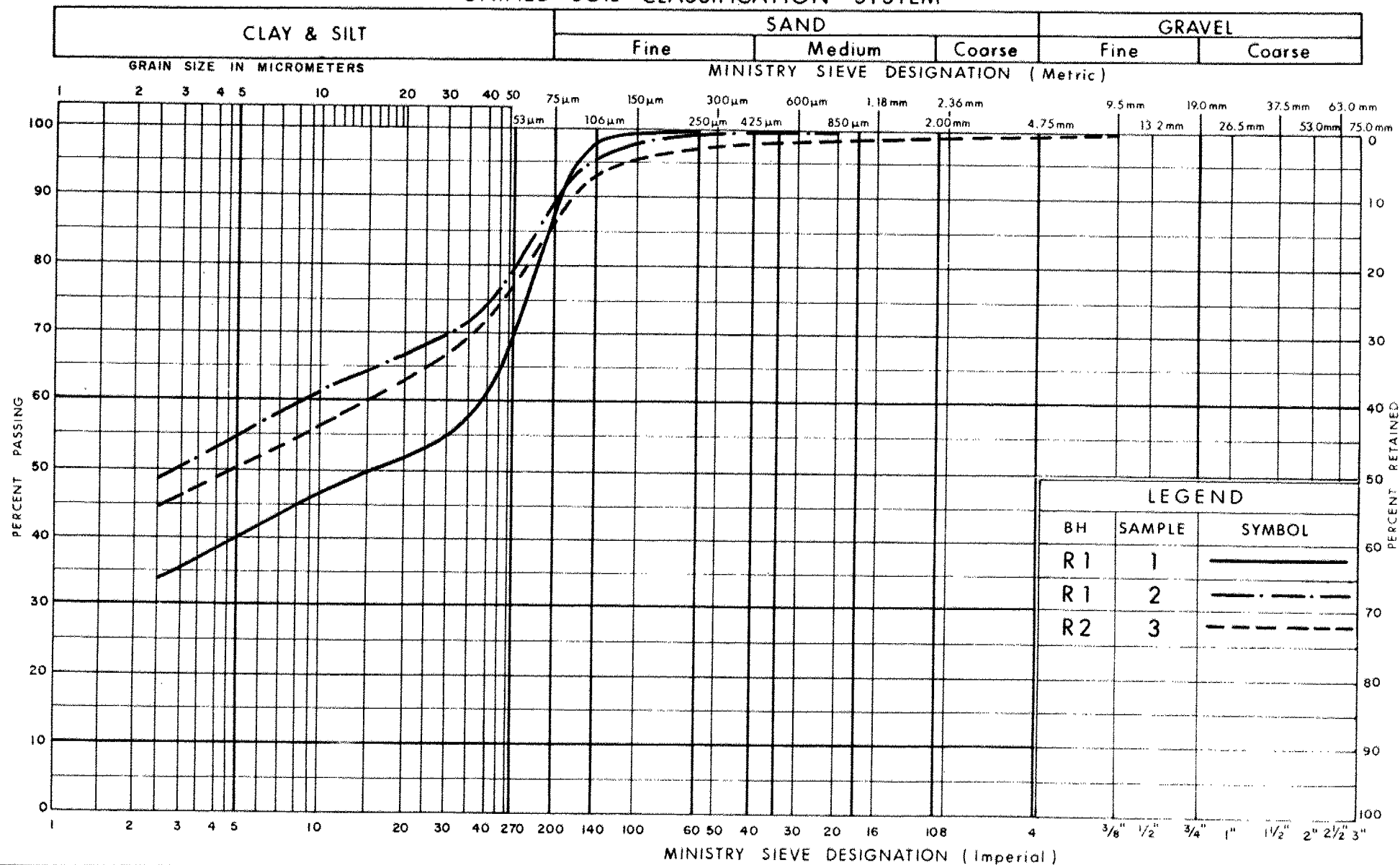
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PLASTICITY CHART CLAYEY SILT, WITH INTERBEDDED SILTY SAND

FIG No 1

W P 120-87-01

UNIFIED SOIL CLASSIFICATION SYSTEM



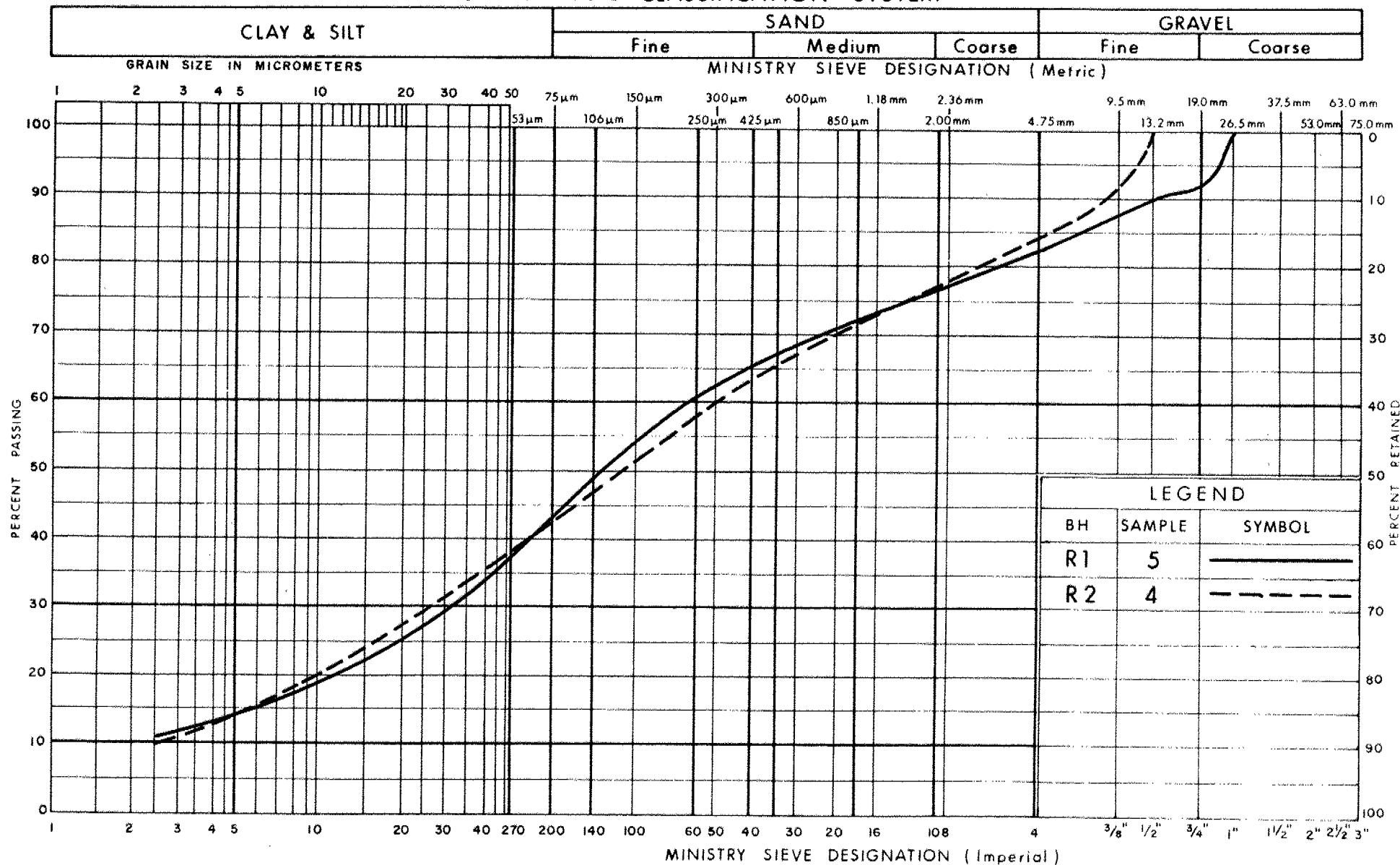
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GRAIN SIZE DISTRIBUTION
CLAYEY SILT, WITH INTERBEDDED SILTY SAND

FIG No 2

W P 120-87-01

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

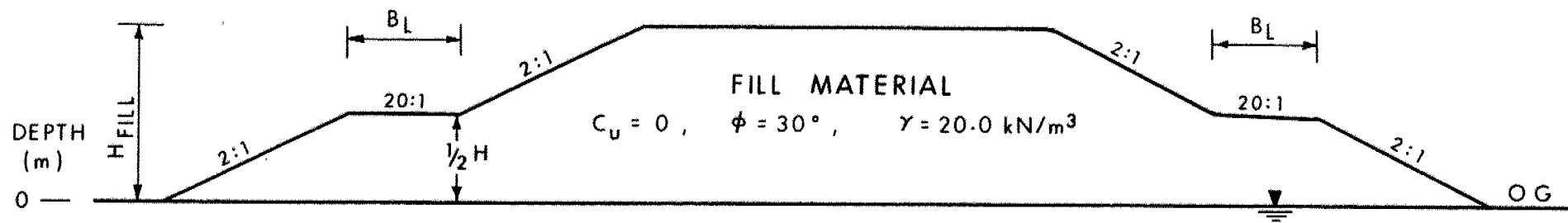
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GRAIN SIZE DISTRIBUTION

HET MIXTURE OF SILT, SAND & GRAVEL (Glacial Till)

FIG No 3

W P 120-87-01



CLAYEY SILT
WITH INTERBEDDED SILTY SAND
 $C_u = 40 \text{ kPa}$, $\phi = 0$
 $\gamma' = 9.2 \text{ kN/m}^3$

7

HET MIXTURE OF SILT, SAND & GRAVEL (Glacial Till)

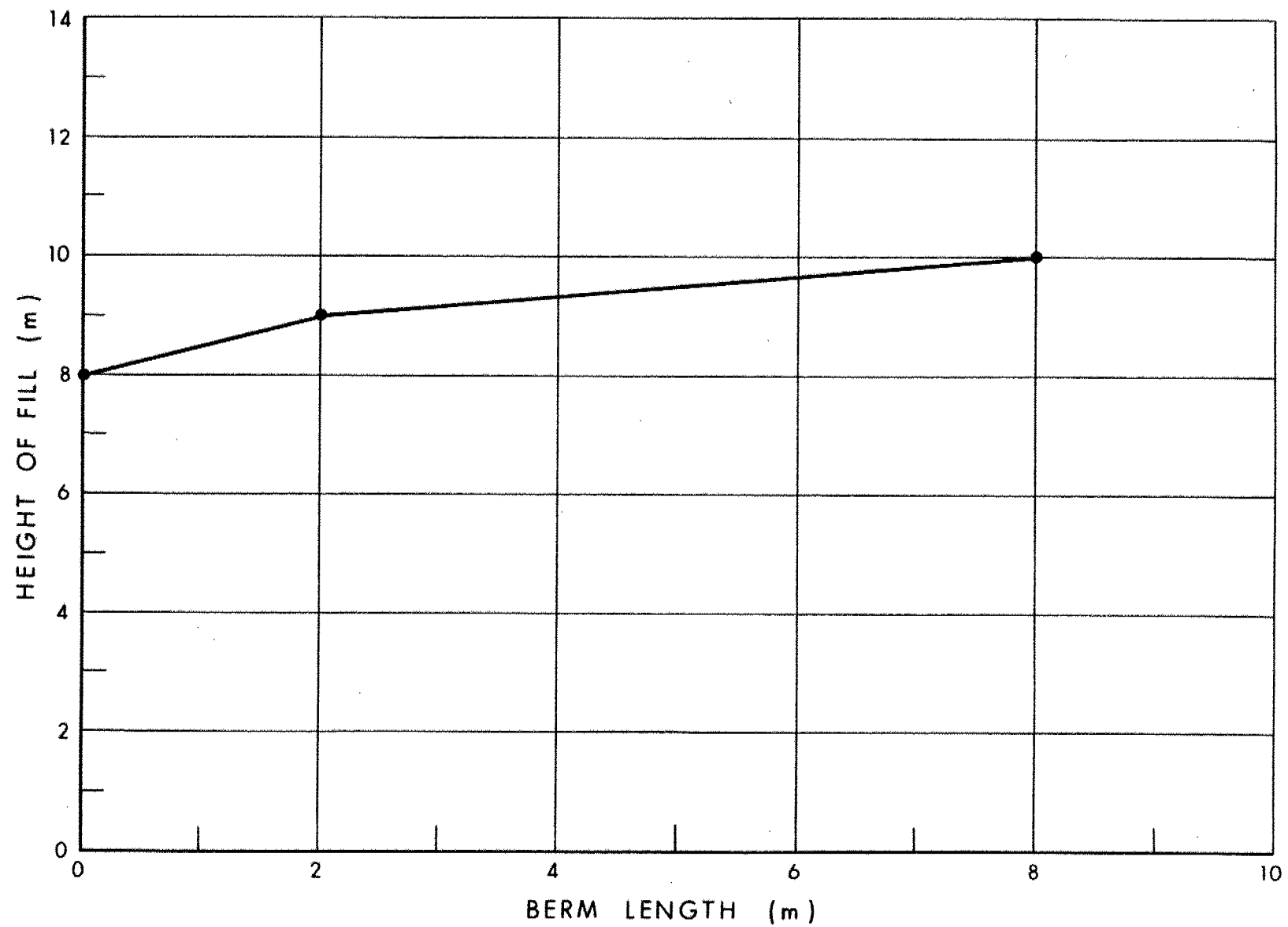
$C_u = 0$, $\phi = 30^\circ$, $\gamma' = 11.0 \text{ kN/m}^3$

(NTS)

RAMP FILL - STABILITY ANALYSIS

W P 120-87-01

FIG 4



W P 120-87-01

FIG 5

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 (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 - 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

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 = $\frac{c_u}{\tau_r}$

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

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	KN/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	KN/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	KN/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	KN/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}	KN/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^2	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No R1

METRIC

W P 120-87-01 LOCATION Co-ords. N 5 022 460.4; E 358 088.3
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger & Cone Test
 DATUM Geodetic DATE 88 07 26
 ORIGINATED BY JF
 COMPILED BY TS
 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				
66.0	Ground Surface															GR SA SI CL
0.0																
	Clayey Silt With Interbedded Silty Sand Grey Soft to Firm		1	SS	2											0 13 55 32
			2	SS	1											0 10 43 47
			3	TW	PH											
			4	SS	2											
59.0	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Very Dense		5	SS	80											17 39 34 10
7.0																
57.6																
8.4	End of Borehole (Auger Refusal) Probable Bedrock															

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No R2

METRIC

W P 120-87-01 LOCATION Co-ords. N 5 022 444.3; E 358 134.4
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger & Cone Test
DATUM Geodetic DATE 88 07 26

ORIGINATED BY JF
COMPILED BY TS
CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH kPa						WATER CONTENT (%)
65.8	Ground Surface													
0.0	Clayey Silt With Interbedded Silty Sand Very Soft to Firm		1	SS	5									
			2	SS	2									
			3	TW	PH									
59.7	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Compact to Very Dense		4	SS	15								0 12 46 42	
6.1			5	SS	15								15 42 35 8	
			6	SS	25	7 cm								
56.6	End of Borehole (Auger Refusal) Probable Bedrock													
9.2														

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No R3

METRIC

W P 120-87-01 LOCATION Co-ords. N 5 022 424.8; E 358 178.7 ORIGINATED BY MS
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TS
DATUM Geodetic DATE 88 07 27 CHECKED BY

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	W _p	W	W _L		
65.5	Ground Surface																
0.0	Clayey Silt With Interbedded Silty Sand Grey, Soft		1	SS	4												
63.5																	
2.0	Het. Mixture of Silt Sand, Gravel and Boulders (Glacial Till)		2	GS	-												
61.8																	
3.7	End of Borehole Auger Refusal Probable Bedrock																

RECORD OF BOREHOLE No R4

METRIC

W P 120-87-01 LOCATION Co-ords. N 5 022 371.4; E 358 265.7 ORIGINATED BY MS
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TS
 DATUM Geodetic DATE 88 07 27 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20					
68.5	Ground Surface												
0.0													
68.2	Clayey Silt		1	CS	-	*							
0.3	End of Borehole (Auger Refusal) Probable Bedrock												
	* Borehole Dry												

RECORD OF BOREHOLE No R5

METRIC

W P 120-87-01 LOCATION Co-ords. N 5 022 340.2; E 358 303.1 ORIGINATED BY MS
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TS
 DATUM Geodetic DATE 88 07 27 CHECKED BY

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
69.6	Ground Surface																
0.0	Heterogeneous Mixture of Silt, Sand, Gravel and Boulders (Glacial Till)		1	CS	-	*											
67.8																	
1.8	End of Borehole (Auger Refusal) Probable Bedrock * Borehole Dry																

OFFICE REPORT ON SOIL EXPLORATION

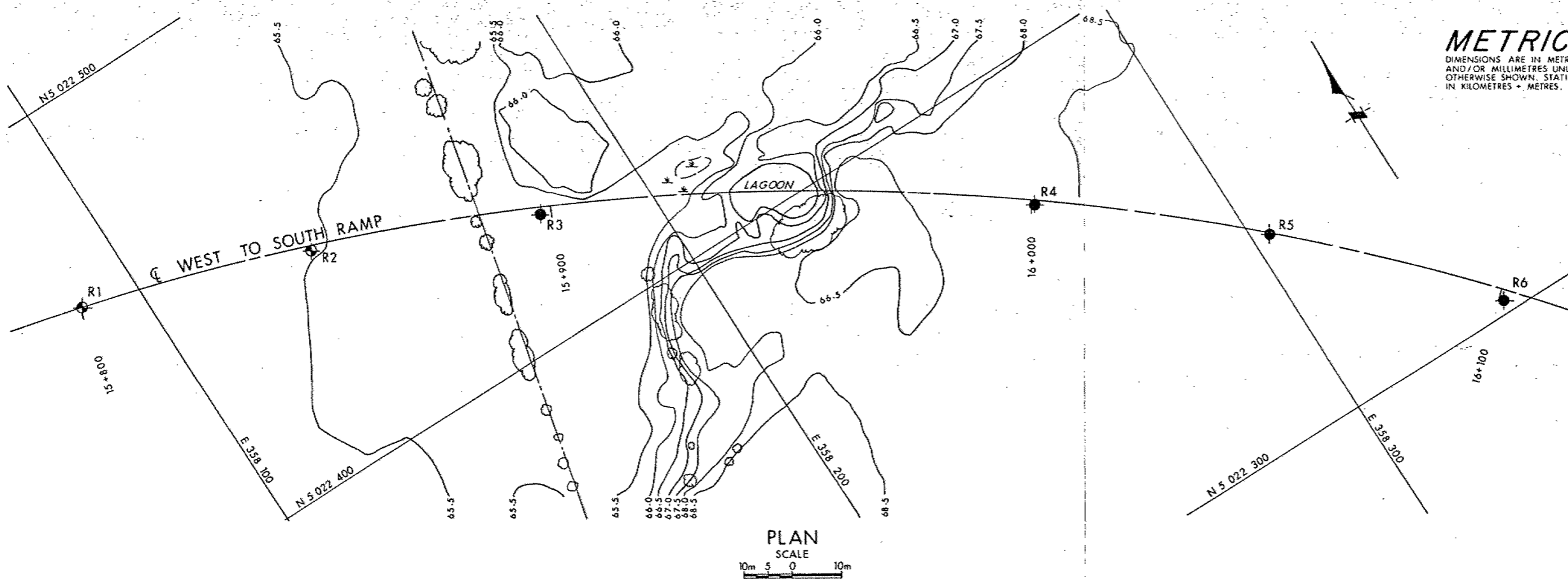
RECORD OF BOREHOLE No R6

METRIC

W P 120-87-01 LOCATION Co-ords. N 5 022 302.9; E 358 337.1
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM Geodetic DATE 88 07 27
 ORIGINATED BY JF
 COMPILED BY TS
 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
68.3	Ground Surface															
0.0	Clayey Silt		1	CS	-	*										
68.0																
0.3	End of Borehole (Auger Refusal) Probable Bedrock)															
	* Borehole Dry															

OFFICE REPORT ON SOIL EXPLORATION



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

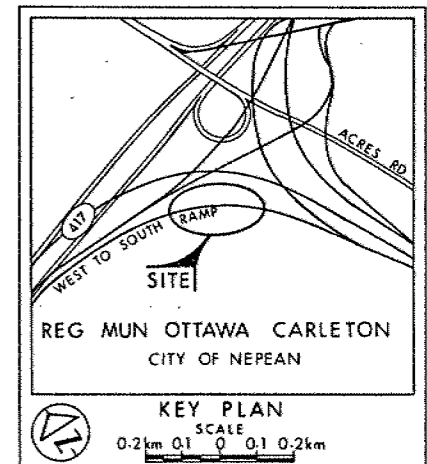
CONT No
WP No 120-87-01

RAMP 417 EB TO 416 SB

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 88 07

No	ELEVATION	CO-ORDINATES NORTH	EAST
R1	66.0	5 022 460.4	358 088.3
R2	65.8	5 022 444.3	358 134.4
R3	65.5	5 022 424.8	358 178.7
R4	68.5	5 022 371.4	358 265.7
R5	69.6	5 022 340.2	358 303.1
R6	68.3	5 022 302.9	358 337.1

NOTE

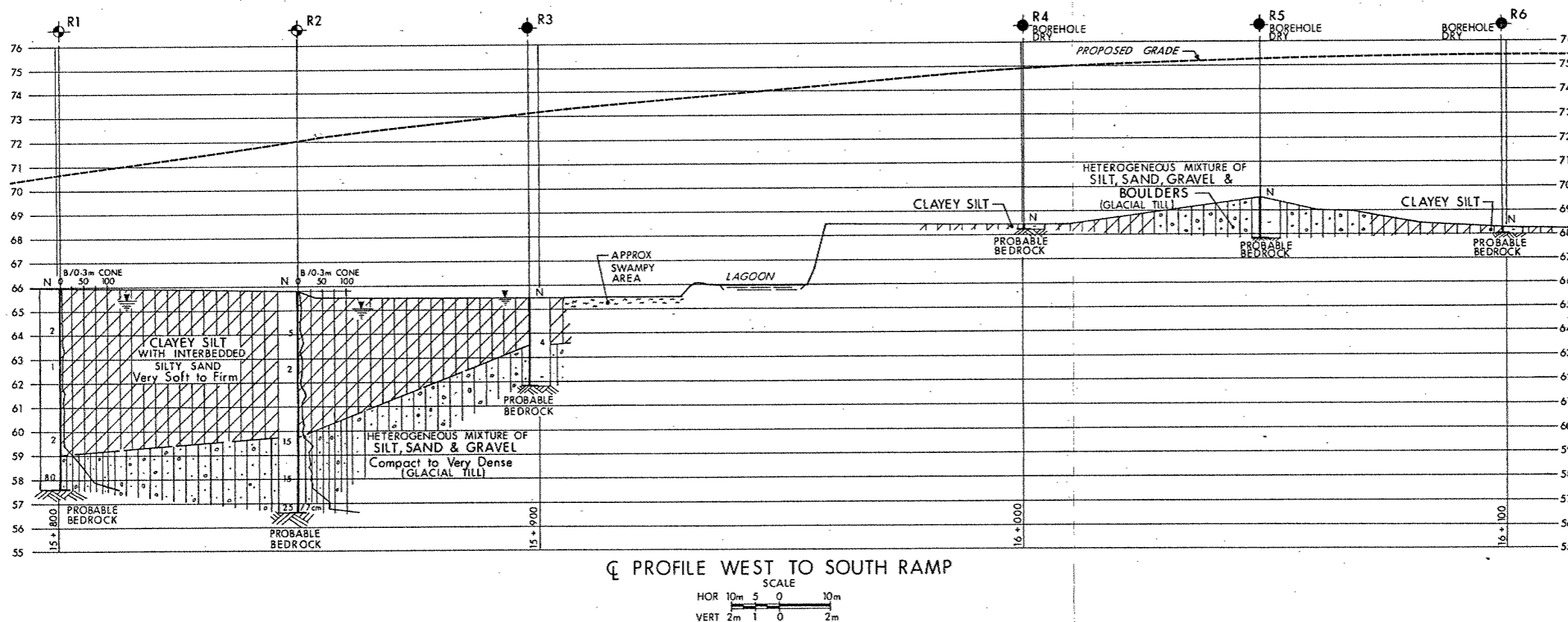
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION

Geocres No 31G5-154

HWY No 417	SUBMD TS	CHECKED	DATE 89 01 10	DIST 9
DRAWN DT	CHECKED	APPROVED	SITE	DWG 1208701-A



Q PROFILE WEST TO SOUTH RAMP

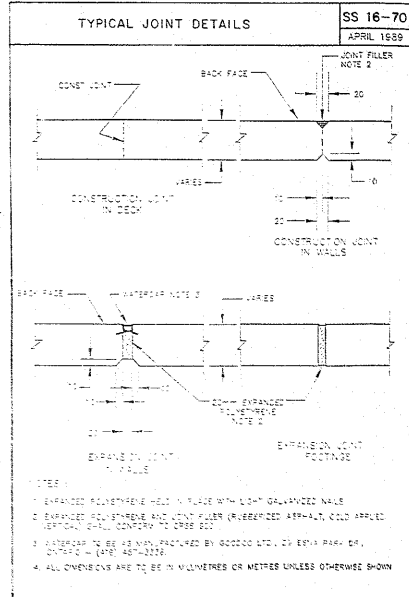
SCALE
HOR 10m 5 0 10m
VERT 2m 1 0 2m

[illegible]

LOCATION	MASS PER PALETTE - TONNES
PALLET A	0.048
PALLET B	0.359
PALLET C	0.452
PALLET D	0.103
PALLET E	0.038
TOTAL MASS PER SCHEDULE :	1.012

LOCATION	MASS PER PANEL-TOUNES
PANEL A	0.139
PANEL B	0.051
PANEL C	0.723
PANEL D	0.170
PANEL E	0.128
TOTAL MASS PER SCHEDULE	1.226

PREPARED BY: JERRY UH
CHECKED BY:
REVIEWED BY:



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION	DATE
DESIGN: SL	CHK	CODE	LOAD	DATE MAY 90
DRAWN: JP	CHK	SITE	STRUCT	SCHEME
				DWG 3