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DIST. 19 REGION

W.P. No. 2704-86-02

CONT. No. 90-452

W. O. No.

STR. SITE No.

HWY. No. Rossport Patrol Yard

LOCATION

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 90-452



Ministry of
Transportation and
Communications

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Note: For purposes of the contract, this report supersedes all other Foundation Reports prepared by, or for the Ministry in connection with the above-mentioned project.

EXPLANATION OF TERMS USED IN REPORT

2

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:

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
γ_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_a	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	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						

FOUNDATION INVESTIGATION REPORT
for
Rossport Patrol Yard Garage Extension
W.P. 2704-86-02
Hwy. 17, District 19, Thunder Bay

INTRODUCTION

This report summarizes the foundation investigation for the above project. The field work was carried out from 88 02 18 to 88 02 19 utilizing a continuous flight auger machine, equipped with 82 mm I.D. hollow stem augers and a diamond drill core barrel.

The investigation consisted of 4 sampled boreholes and 4 dynamic cone penetration tests. The boreholes ranged from 4.7 to 8.7 m in depth.

Bedrock was sampled in one borehole and groundwater levels were measured in open holes at each borehole location.

Site Description

The site is located on highway 17, 190 km east of Thunder Bay.

The surrounding landscape is fairly flat, sloping gently downwards from north to south to the shores of Lake Superior.

Subsurface Conditions

The subsurface conditions can generally be described as 2.0 m of silty sand fill overlying alternating layers of clay and silty sand. Bedrock was encountered in all boreholes from 4.7 m to 8.7 m below the surface.

The boundaries of the subsoil types, laboratory test results and groundwater levels are shown on the Record of Borehole log sheets contained in the Appendix. The locations and elevations of the boreholes, along with the stratigraphical profile are shown on Drawing 27048602-A.

The various soils encountered at this site are described as follows:

Sand some silt (Fill)

The parking lot of the patrol yard is composed of sand fill.

The material is non-cohesive, contains some silt and cobbles and ranges from 2.1 to 2.7 m in thickness.

Based on 'N' values of the Standard Penetration Test, the material is in a loose to compact state.

Clay some silt

Underlying the sand fill is a layer of very soft to firm clay (based on 'N' values). It contains some silt, a trace of sand, and occasional sand seams. It was encountered at two different elevations during the investigation.

Typical laboratory values are as follows:

	<u>Range (%)</u>	<u>Average (%)</u>
Water Content (w)	31 - 49	40
Liquid Limit (w_L)	43 - 57	50
Plastic Limit (w_P)	17 - 28	21

Based on the above values, this material may be classified as a clay with intermediate to high plasticity.

Figure 1 illustrates a typical plasticity chart for this material, while Figure 2 represents a typical grain size distribution, based on representative samples obtained from the site.

Sand some silt

Underlying the clay layer is a thin sand layer that ranges in thickness from 0.9 m to 2.8 m.

This material is generally non-cohesive, however clay seams were encountered in boreholes 2 and 4. Silt seams were also encountered in varying locations.

This material also occurs immediately above bedrock, below a clay layer.

Based on 'N' values, it is in a loose to compact state in the upper layer and loose to very dense state above bedrock.

It should be noted that this material will 'boil' if subjected to an unbalanced static head.

Bedrock

Bedrock was cored in borehole #2. It has been classed as pink granite. Probable bedrock was encountered in the remaining holes as indicated on the Record of Boreholes log sheets contained in the Appendix.

For a complete geological description, refer to the Appendix.(Table 1)

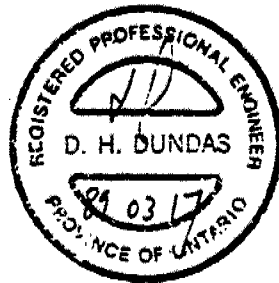
Groundwater

Groundwater levels were measured in open boreholes with elevations ranging from 185.5 m to 186.5 m. From the information available, the water table is estimated to be at elevation 186.5 m. Seasonal variations in groundwater elevations can be expected.

MISCELLANEOUS

The field work for this report was conducted under the supervision of R. Otway, Foundation Engineer, using equipment rented from Dominion Soil Investigation Inc., Thunder Bay.

The report was written by R. Otway and reviewed M. Devata, Chief Foundation Engineer (East).



D. H. Dundas

D. H. Dundas, P. Eng.
Sr. Foundations Engineer

M. Devata

M. Devata, P. Eng.
Chief Foundations Engineer

APPENDIX

RECORD OF BOREHOLE No 1

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-A ORIGINATED BY RO
 DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger COMPILED BY RO
 DATUM Geodetic DATE 88 02 18 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT		UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	Wp W WL	WATER CONTENT (%) 20 40 60		
188.5	Ground Level												
0.0	Sand Some Silt Cobbles						188	Augered through Frozen Ground					
186.4	Loose (Fill)		1	SS	8								
2.1	Clay Some Silt Trace Sand		2	SS	5		186					18.9	0 2 29 69
			3	SS	1								
			4	TW	PH								
	Sand		5	SS	8		184						
	Intermediate to High Plasticity Very Soft to Firm		6	SS	1								0 2 48 50
181.0			7	SS	1		182						
7.5	Sand, Some Silt		8	SS	7								9 42 44 5
179.8	Tr. Clay, Tr. Grav. Loose						180						
8.7	Probable Bedrock End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-A ORIGINATED BY RO
 DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger COMPILED BY RO
 DATUM Geodetic DATE 88 02 19 CHECKED BY DD

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
188.6	Ground Level																
0.0	Sand Some Silt Cobbles						188										
186.5	Compact (Fill)		1	SS	15												
2.1	Clay, Some Silt Occ. Sand Seams		2	SS	4		186										
185.2	High Plasticity, Soft																0 2 32 66
3.4	Sand, Some Silt Trace Gravel		3	SS	5												
183.9	Trace Clay, Loose						184										
4.7	Probable Bedrock End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

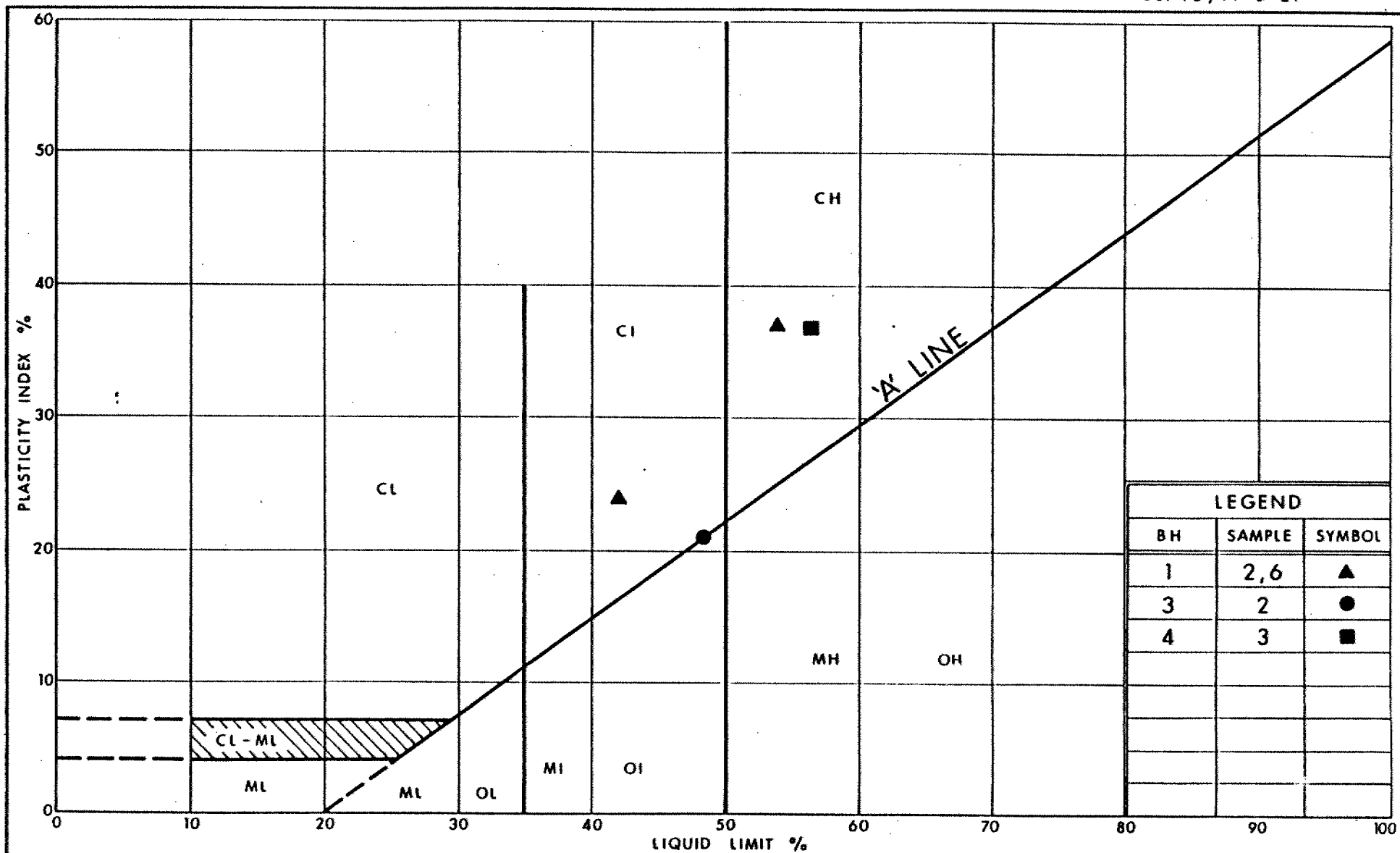
RECORD OF BOREHOLE No 4

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-1
 DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger ORIGINATED BY RO
 DATUM Geodetic DATE 88 02 19 COMPILED BY RO
 CHECKED BY 22

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	Wp	W	WL		
188.5	Ground Level															
0.0	Sand Some Silt Cobbles Compact (Fill)		1	SS	24		188	Augered through Frozen Ground								
185.8			2	SS	15		186									
2.7	Clay, Some Silt Trace Sand, Interm. to High Plasticity Very Soft		3	SS	2		184									0 4 36 60
184.1			4	TW	PH		184									0 5 48 47
4.4	Sand Some Silt Occ. Clay Seams Compact		5	SS	22		182									0 22 59 19
181.8			6	SS	10											
6.7	Clay, Some Silt High Plasticity Very Soft		7	SS	10											
180.1			8	SS	1											
8.4	Probable Bedrock End of Borehole		9	SS	N/A											

OFFICE REPORT ON SOIL EXPLORATION



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PLASTICITY CHART
CLAY, SOME SILT
INTERMEDIATE TO HIGH PLASTICITY

FIG No 1

W P 2704-86-02



GRAIN SIZE DISTRIBUTION
CLAY, SOME SILT
INTERMEDIATE TO HIGH PLASTICITY

W P 2704 - 86 - 02

DESCRIPTION OF ROC6 CORE - WP 2704-86-02

CORE RECOVERY				CORE DESCRIPTION	
HOLE #	DEPTH (m)	%CR*	%RQD*	DEPTH (m)	DESCRIPTION
2	7.01- 8.23	90	44	7.01- 8.23	GRANITE, mottled orange pink to moderate pink; dense, fine grained, massive; strong to very strong rock; slightly weathered to unweathered; close to very close spaced fractures (near horizontal).

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

1../1

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 2704-86-02

DIST 19

HWY 17

STR SITE

Rosspport Patrol Yard Garage Extension

CONT 90-A52

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DISCUSSION AND RECOMMENDATIONS

It is proposed to construct a 2-bay garage extension on the west end of the building. In addition, the existing office on the east end of the building will be demolished and replaced with a 2-storey office/lunchroom. The existing building is supported on piers.

The general soil stratigraphy in the area consists of alternating layers of soft clay and silty sand. Based on 'N' values, the soil does not show any consistent increase in bearing capacity with depth. The presence of the soft clay presents problems for founding the structure on spread footings, as excessive settlement can be expected.

The water table is located approximately 2.0 m below the ground surface. Any excavations for strip footings would require dewatering, as footings must be located a minimum of 2.2 m below ground level for frost protection purposes.

With these factors in mind, the following recommendations are proposed:

Structure Recommendations

OPTION 1 - Reinforced Concrete Caissions

It is recommended to support the structure on 600 mm diameter concrete caissions, founded on bedrock.

The following O.H.B.D.C. values may be used for design:

Factored Capacity	S.L.S.
<u>at U.L.S.</u>	<u>Type II</u>
1700 kN	will not govern

To facilitate construction of the caissons, a temporary liner is recommended. The caisson shall be cleaned out prior to placing of concrete. Concrete may be placed by tremie methods to seal the bottom of the caisson. The liner may then be pumped out and the caisson completed by conventional methods.

OPTION II - End Bearing Piles

As an alternative to concrete caissons, the structures may be supported on steel H-piles driven to bedrock. The following O.H.B.D.C. values may be used for design.

	Factored Capacity at U.L.S.	S.L.S. Type II
310 HP 79	1150 kN	900 kN
310 HP 110	1600 kN	1150 kN

For estimating purposes, pile lengths may be determined utilizing a final tip elevation of 179.8 m.

Frost Protection

A minimum of 2.2 m of earth cover or equivalent to the base of the pile cap, is required for frost protection.

Other Recommendations

The concrete floor slabs should be constructed on 200 mm of well-compacted granular material. The Ontario Building Code Act states that this material shall consist of coarse clear material, containing not more than 15% by weight of material passing the 2.0 mm sieve.

Well-compacted granular material should be used as backfill for excavations.

MISCELLANEOUS

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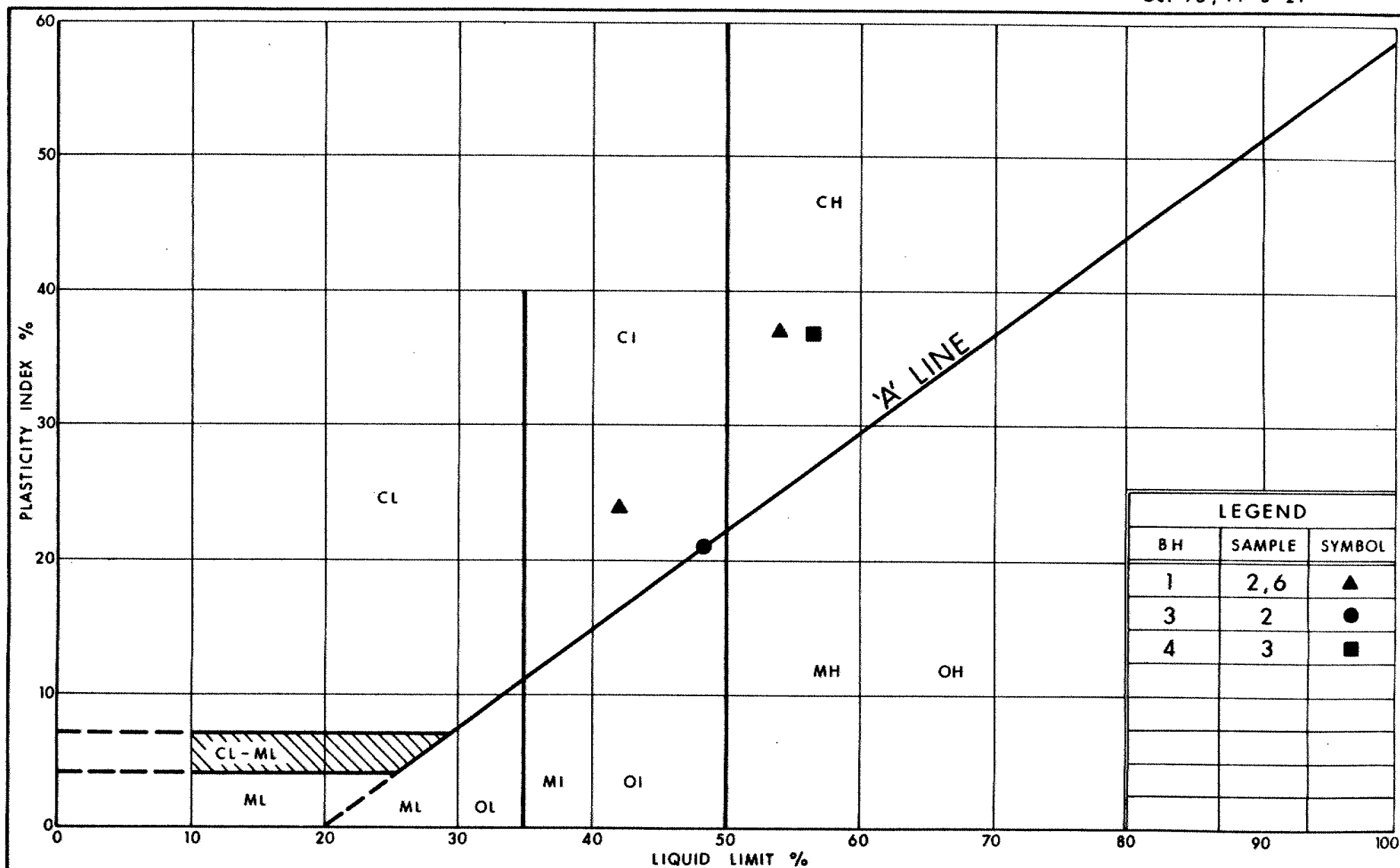
A handwritten signature in cursive script, appearing to read 'R. J. Otway'.

R. J. Otway, P.Eng.
Foundation Engineer

A handwritten signature in cursive script, appearing to read 'M. S. Devata'.

M. S. Devata, P.Eng.
Chief Foundation Engineer (East)

APPENDIX



Ministry of
Transportation

Ontario

PLASTICITY CHART
CLAY, SOME SILT
INTERMEDIATE TO HIGH PLASTICITY

FIG No 1

W P 2704-86-02



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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

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	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 ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-A
 DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger
 DATUM Geodetic DATE 88 02 18
 ORIGINATED BY RO
 COMPILED BY RO
 CHECKED BY DD

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 KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
188.5	Ground Level													
0.0	Sand Some Silt Cobbles						188							
186.4	Loose (Fill)		1	SS	8									
2.1	Clay Some Silt Trace Sand		2	SS	5		186						18.9	0 2 29 69
			3	SS	1									
			4	TW	PH									
	Sand		5	SS	8		184							
	Intermediate to High Plasticity Very Soft to Firm		6	SS	1									0 2 48 50
181.0			7	SS	1		182							
7.5	Sand, Some Silt		8	SS	7									9 42 44 5
179.8	Tr. Clay, Tr. Grav. Loose						180							
8.7	Probable Bedrock End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 2

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-A ORIGINATED BY RO
DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger, BXL Rock Core COMPILED BY RO
DATUM Geodetic DATE 88 02 18 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		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	20 40 60 80 100	W _p	W	W _L		
188.1	Ground Level						188	SHEAR STRENGTH kPa		WATER CONTENT (%)				
0.0	Sand Some Silt Cobbles Compact (Fill)		1	SS	14		186	Augered through Frozen Ground						
185.7			2	SS	2		184							
2.4	Sand, Some Silt Occ. Silt and Clay Seams Very Loose to Compact		3	SS	4		182							
182.9			4	SS	16									
5.2	Clay, Some Silt High Plasticity Very Soft		5	SS	1									
181.1	Sand Some Silt		6	SS	110/	15 cm								
7.0	Granite Bedrock		7	BXL RC	REC 90%		180							
179.9	Sound													RQD=44%
8.2	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-A ORIGINATED BY RO
 DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger COMPILED BY RO
 DATUM Geodetic DATE 88 02 19 CHECKED BY DD

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					
188.6	Ground Level																
0.0	Sand Some Silt Cobbles																
186.5	Compact (Fill)		1	SS	15												
2.1	Clay, Some Silt Occ. Sand Seams		2	SS	4												
185.2	High Plasticity, Soft																
3.4	Sand, Some Silt Trace Gravel		3	SS	5												
183.9	Trace Clay, Loose																
4.7	Probable Bedrock End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

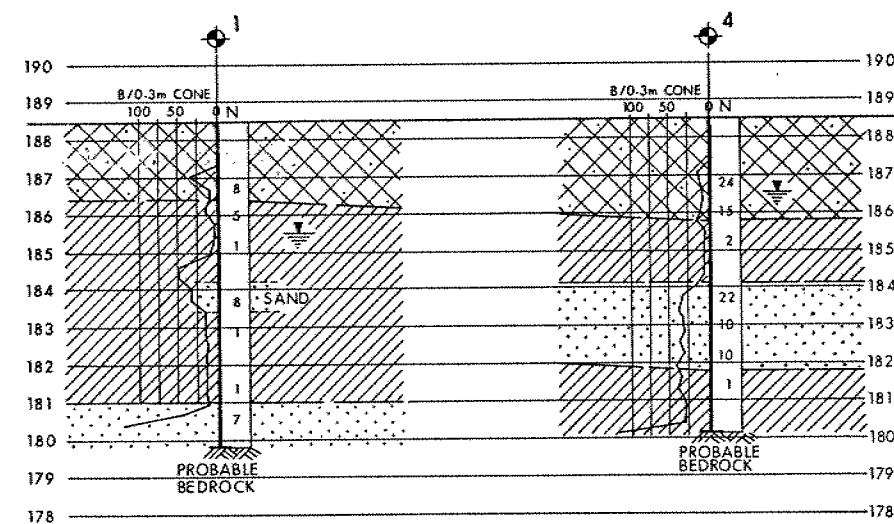
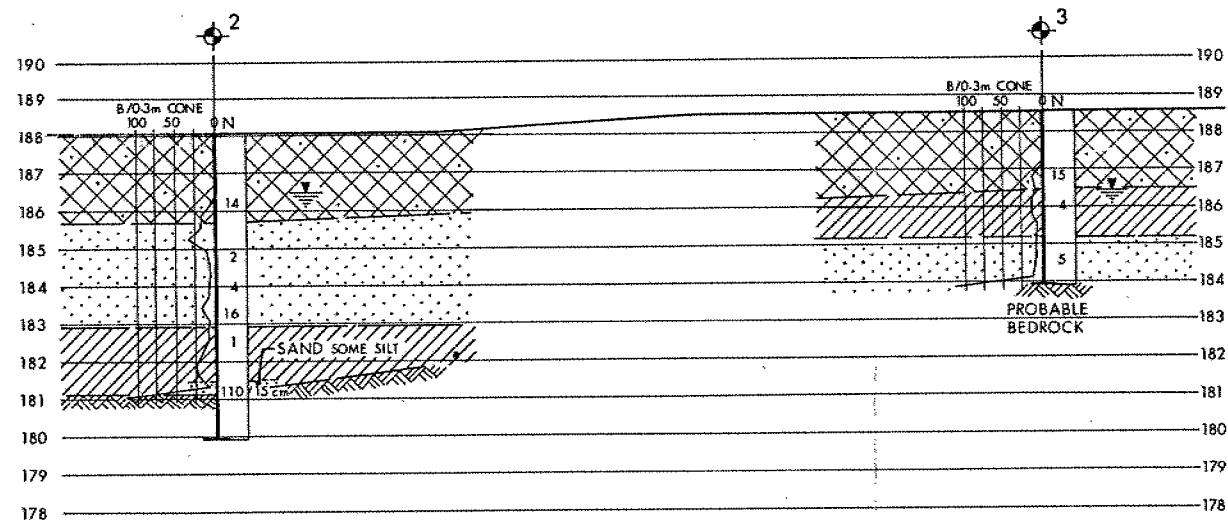
RECORD OF BOREHOLE No 4

METRIC

W P 2704-86-02 LOCATION Rossport Patrol Yard - See Dwg. 27048602-A ORIGINATED BY RO
 DIST 19 HWY 17 BOREHOLE TYPE Cone Test - Hollow Stem Auger COMPILED BY RO
 DATUM Geodetic DATE 88 02 19 CHECKED BY DD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
188.5	Ground Level													
0.0	Sand Some Silt Cobbles Compact (Fill)		1	SS	24		188							
185.8			2	SS	15		186							
2.7	Clay, Some Silt Trace Sand, Interm. to High Plasticity Very Soft		3	SS	2		184							0 4 36 60
184.1			4	TW	PH		184							0 5 48 47
4.4	Sand Some Silt Occ. Clay Seams Compact		5	SS	22		182							0 22 59 19
181.8			6	SS	10									
6.7	Clay, Some Silt High Plasticity Very Soft		7	SS	10									
180.1			8	SS	1									
8.4	Probable Bedrock End of Borehole		9	SS	N/A									

OFFICE REPORT ON SOIL EXPLORATION

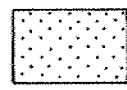


SECTIONS
SCALE
4m 2 0 4m Hor
2m 1 0 2m Vert

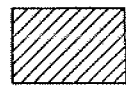
SOIL STRATIGRAPHY LEGEND



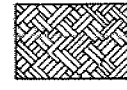
SAND
SOME SILT, COBBLES
Loose to Compact
(FILL)



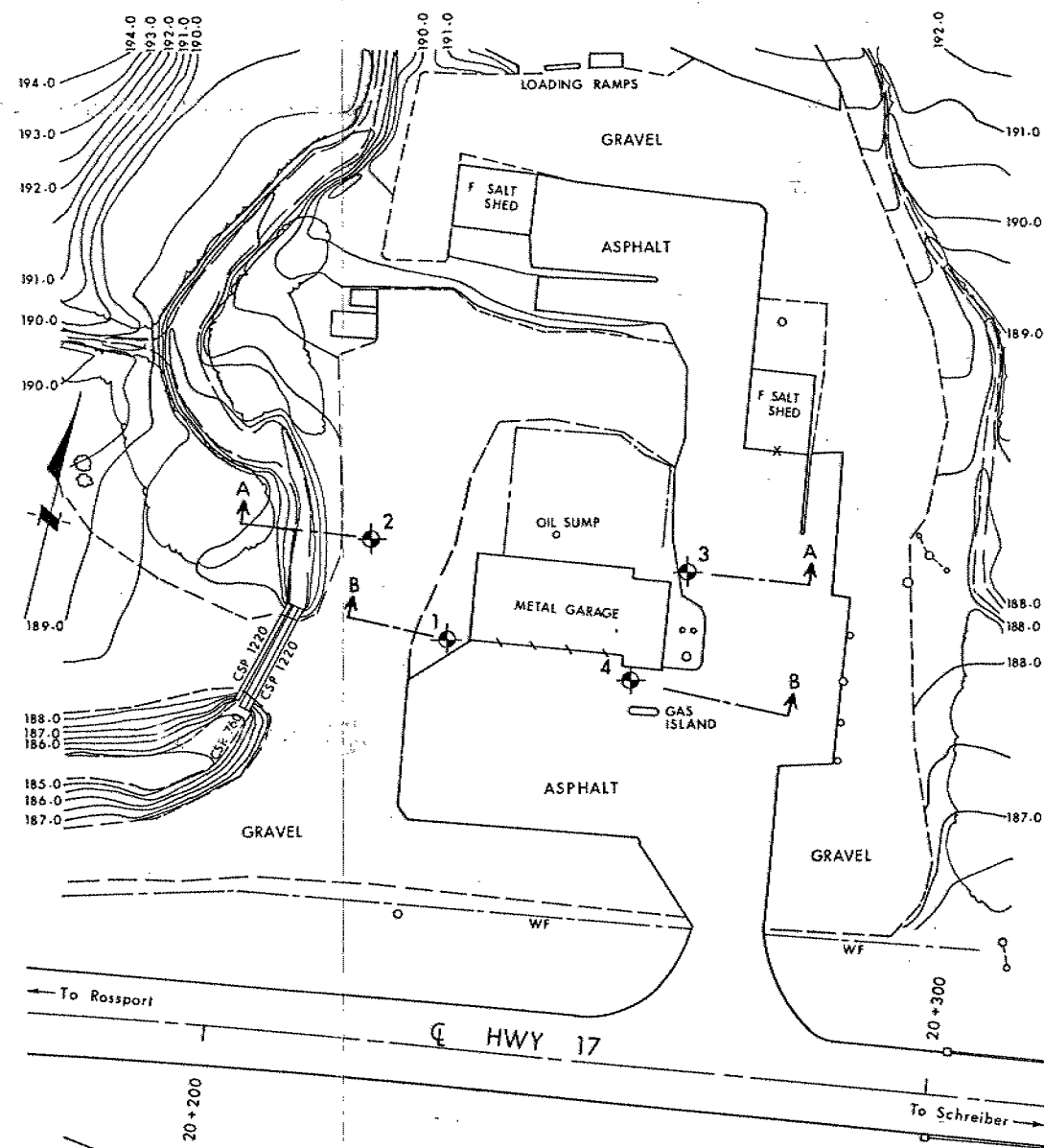
SAND
SOME SILT, TRACE CLAY
TRACE GRAVEL
OCCASIONAL SILT SEAMS
OCCASIONAL CLAY SEAMS
Very Loose to Compact



CLAY
SOME SILT, TRACE SAND
INTERMEDIATE TO HIGH PLASTICITY
OCC SAND SEAMS
Very Soft to Firm



GRANITE BEDROCK
Sound



PLAN
SCALE
10m 5 0 10m

METRIC

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

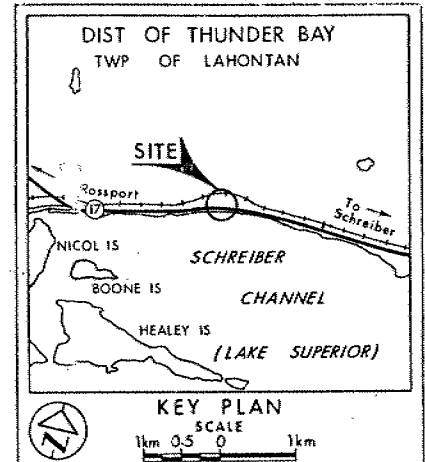
CONT No
WP No 2704-86-02

ROSSPORT PATROL YARD

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 02

No	ELEVATION		
1	188.5		
2	188.1		
3	188.6		
4	188.5		

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 42D-13

HWY No 17	CHECKED	DATE 88 07 12	DIST 19
SUBM'D RO	CHECKED	DATE 88 07 12	SITE
DRAWN DT	CHECKED	DATE 88 07 12	DWG 27048602-A

REF No H-465-17-1, 88 02