

GEOCRES No. 30M11-189DIST. 6 REGION _____

W.P. No. _____

CONT. No. _____

W. O. No. 89-11008

STR. SITE No. _____

HWY. No. _____

LOCATION MTO District 6 Service
Building Addition &No of PAGES - Renovations

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____REMARKS: _____



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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WO 89-11008

DIST 6

HWY N/A

STR SITE N/A

Proposed Addition and Renovations
MTO District 6 Service Building
Kipling Avenue & Belfield Road

DISTRIBUTION

Ed Shedler (3)
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FOUNDATION INVESTIGATION REPORT
For
Proposed Addition and Renovations
MTO District 6 Service Building
Kipling Avenue & Belfield Road
WO 89-11008
District 6, Toronto

INTRODUCTION

This report summarizes the results obtained from a foundation investigation conducted at the aforementioned site. It is proposed to extend the existing single level services building at the District Services Branch yard by constructing an addition approximately 12 m by 42.5 m on the north side of the existing structure. The addition will be located at approximate mid-length of the existing structure as illustrated in Figure 1. It is understood that the extension will also be a single level structure.

Discussion and recommendations pertaining to the subsurface conditions present at the site, structure foundations, slab on grade construction and other related earthworks are provided in the scope of this report.

SITE DESCRIPTION AND GEOLOGY

The site is located immediately north of the existing District 6 Services Building garage within the District Services Branch yard. The District yard is located at the northeast quadrant of the Kipling Ave. - Belfield Road intersection in the City of Etobicoke. The site is bounded to the north by CNR railroad tracks, used predominantly by the GO transit system. A two level office building is located approximately 20 m west of the services garage and a single level services building is located approximately 30 m south of the garage. The area between the buildings and throughout the remaining District 6 yard is paved and serves as roadways and parking.

Physiographically, the site lies in the area known as the Peel Plain. The Peel Plain consists of a bevelled till plain with a gently undulating rolling surface and limited relief. The till plain was desposited as a result of the advance and retreat of the Wisconsinan ice sheet present during the Pleistocene epoch (over 5000 years ago).

FIELD INVESTIGATION

The fieldwork for the investigation was carried out between 89 10 20-21 and consisted of 2 sampled boreholes advanced to depths of 8.1 metres. Hollow stem auger equipment was used to advance the boreholes. Subsoil samples were retrieved at 0.7 m intervals for the surficial 4.6 m and at 1.5 m intervals thereafter in accordance with the Standard Penetration Test (ASTM D1586). All samples were identified in the field and then returned to the laboratory for applicable testing.

Groundwater levels were obtained in the open boreholes at the time of the investigation. The boreholes were backfilled upon completion of the fieldwork. The elevations of the boreholes were provided by Central Region Surveys and Plans.

LABORATORY ANALYSES

To identify the behaviour, gradation and property of the soil, the following laboratory tests were conducted:

- 1) Atterberg Limits
- 2) Natural Moisture Contents
- 3) Grain Size Distributions
- 4) Bulk Densities

SUBSURFACE CONDITIONS

Subsoil conditions are generally uniform across the site. Underlying the asphaltic surface of approximately 250 mm thickness and a 500 mm granular base consisting of crusher run limestone, the native surficial deposit spread across the site consists of a clayey silt with some sand and trace of gravel. The deposit was explored to a maximum depth of 8.1 metres.

The boundaries between the various soil types, in situ and laboratory test results as well as groundwater levels established at the time of investigation,

are shown on the attached Record of Borehole sheets in the Appendix. A plan of the site illustrating the locations of the boreholes is provided in Figure 1.

Clayey Silt, some Sand, trace Gravel (Glacial Till)

The native surficial deposit at the site consists of a clayey silt with some sand and a trace of gravel. Occasional random sand seams a few millimetres in thickness are also present in the deposit. The deposit is generally oxidized (brown in colour) for its surficial 4 metre thickness and unoxidized (grey in colour) below that depth. The full extent of the deposit was not penetrated within the scope of the investigation. As mentioned earlier, the deposit was explored to a maximum depth of 8.1 metres.

The deposit exhibits a cohesive behaviour and to evaluate the plasticity of the soil, Atterberg Limit Tests were conducted on the fine grained portion of the deposit. The results are plotted in Figure 2 in the Appendix and summarized in Table 1 below:

Table 1 - Clayey Silt

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content (w%)	10-10.5	3
Liquid Limit (w _L %)	20-21.5	3
Plastic Limit (w _p %)	12-12.5	3
Unit Weight	19.9-22	3
'N' values - Standard Penetration Test	11-82	16

The test results reveal that the deposit is primarily of low plasticity. Natural moisture contents were typically lower than the plastic limit of the soil.

Grain size distribution curves for the deposit as determined by mechanical sieve analysis and hydrometer analysis are provided in Figure 3 in the Appendix. The results reveal silt percentages ranging from 49 to 51, clay percentages ranging from 21 to 23 and the remainder composed of sand and gravel.

Standard Penetration tests carried out in this deposit revealed 'N' values ranging from 11 blows/0.3 m to 82 blows/0.3 m. In general, however, N values were in the 20 blows/0.3 m to 30 blows/0.3 m range. Consequently, the consistency of the soil derived from these N values ranges from stiff to hard but is generally very stiff.

GROUNDWATER CONDITIONS

Observation of the groundwater level was carried out by measuring the water level in the open boreholes. Measurements obtained at the time of investigation revealed levels at an elevation ranging from 155.5 m to 155.4 m which corresponds to depths ranging from 2.1 to 2.2 metres below the existing ground surface. Groundwater levels, however, are subject to seasonal fluctuations and hence can vary from the values given in this report.

DISCUSSION AND RECOMMENDATIONS

It is proposed to construct a 12 m by 42.5 m extension north of the existing District 6 Services Building garage located at the District Services Branch yard. It is understood that the existing one-level steel-frame brick structure is founded on spread footings in the surficial native subsoil. Conventional slab-on-grade construction appears to have been placed at the structure location. There are no signs of distress evident on the building garage structure nor the slab-on-grade that can be associated with an unsounded substructure.

Recommendations pertaining to the following geotechnical considerations are provided in the scope of this report.

- 1) Structure Foundations
- 2) Floor Slabs and Permanent Drainage

1) Structure Foundations

In consideration of the competent subsoil conditions at the site, proposed structure walls and columns can be founded on conventional spread footings. Recommended bearing capacities and founding elevations are provided in Table 2 below:

Table 2 - Shallow Foundations

	Founding Elevation	Bearing Capacity at S.L.S. Type II	Factored Capacity at U.L.S.
<u>Structure</u>	<u>(m)</u>	<u>(kPa)</u>	<u>(kPa)</u>
Strip & Column Footings	≤156.1	250	375

Settlements induced as the result of the application of the recommended bearing pressures will be as a result of the recompression of the soil and expected to be less than 25 mm total and 20 mm differential. These settlements will be immediate in nature and hence will occur during or immediately following construction.

To protect the founding soil from frost penetration and the resulting heave and disturbance that can result, the underside of all footings should be provided with a minimum 1.2 metres of earth cover or insulation with adequate thermal resistance.

All loosened and/or organic material or any fill material present at the founding elevation shall be removed and replaced with mass concrete or compacted granular material. In addition, it is recommended that a concrete working slab be provided immediately following excavation to protect the bearing surface from the effects of weathering and other disturbances.

During footing excavation, caution must be exercised to avoid any undermining of existing footings.

Dewatering problems are not anticipated during footing excavation in view of the impervious nature of the surficial till deposit. Conventional sump pump methods will suffice in discharging any localized seepage and/or surface water that may accumulate in the excavation trenches.

2) Floor Slabs and Permanent Drainage

Slab-on-grade construction may be used on the clayey silt subgrade surface provided that all loosened and/or organic material present at the subgrade surface is removed. Total and differential settlements of the clayey silt subgrade are expected to be negligible for bearing pressures summarized in Table 2.

A vapour barrier consisting of at least 200 mm of 20 mm clear crushed stone or equivalent free-draining material shall be installed under the floor slab. The vapour barrier material shall be compacted in accordance with OPSS 501 series which indicates a target compaction of 100% of the maximum dry density.

Under slab and perimeter foundation drainage is recommended even though the amount of seepage water to be collected is expected to be minimal.

Underslab drains should be set midway between column bays in one direction. The drainage system should consist of a drainage tile (100 mm diameter weeping tile or equivalent perforated pipe) surrounded by a suitable soil filter or geotextile filter fabric). The perforated pipe is to drain to a positive sump and since the water can develop its own gradient, a minimum drain slope should suffice.

Perimeter foundation drainage should consist of a drainage system composed of a weeping tile-filter system as described above in conjunction with underslab drainage. In addition, foundation walls should be damproofed using a bitumen membrane or equivalent. The backfill to the foundation walls shall be free draining material such as MTO granular 'A' or granular 'B' and compacted to 98% Standard Proctor density. Hand controlled light compaction equipment shall be used within 2 m of the foundation wall.

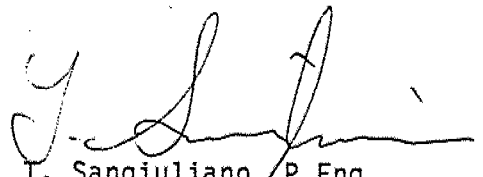
Underslab drains and perimeter foundation drains shall be designed as separate systems and hence shall not be connected.


MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of T. Sangiuliano, Foundation Engineer utilizing equipment owned and operated by Marathon Drilling.

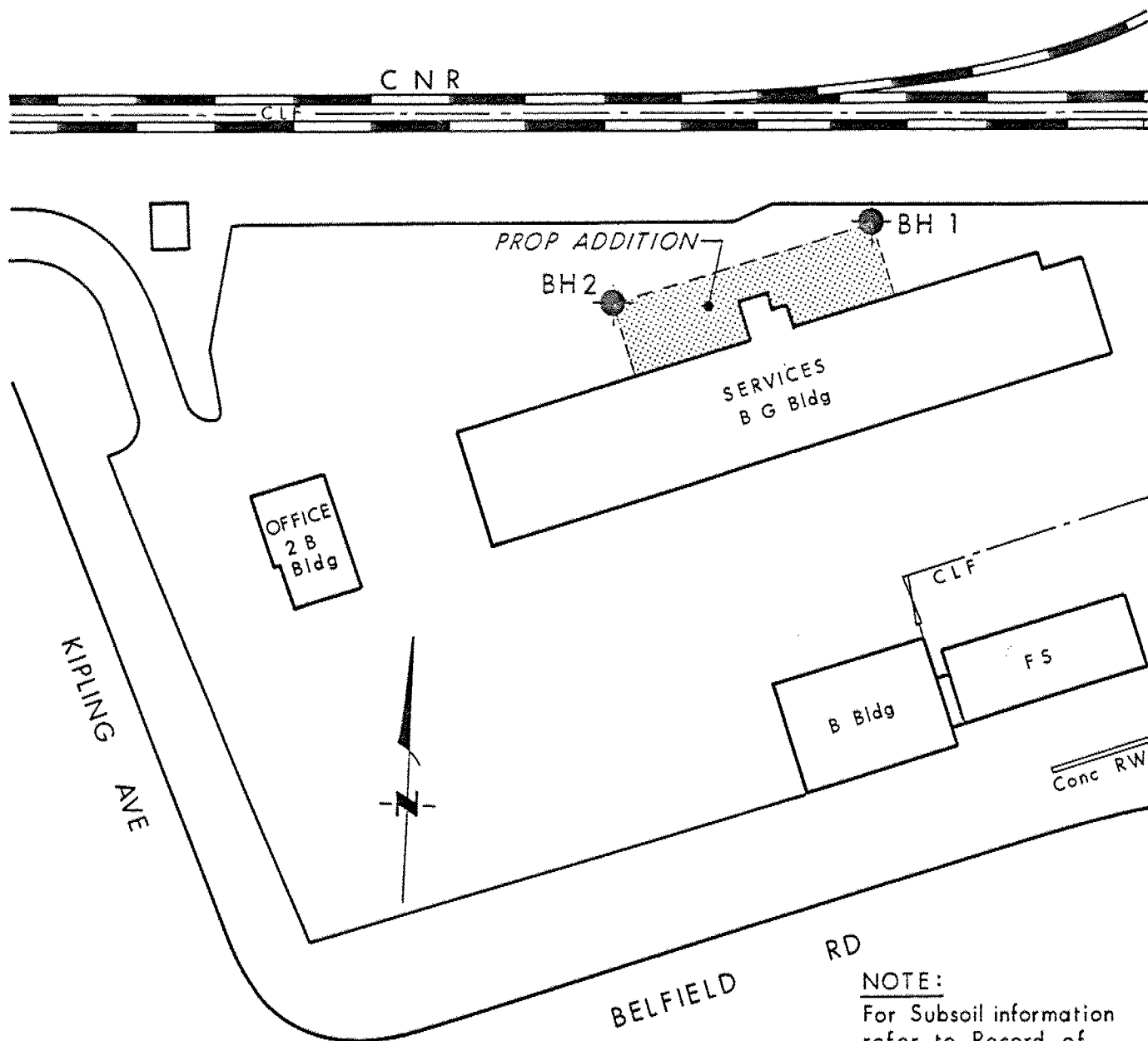
The project was carried out by T. Sangiuliano, Foundation Engineer, under the general supervision of Dr. B. Iyer, Senior Foundation Engineer. The report was written by T. Sangiuliano, reviewed by Dr. B. Iyer and approved by Mr. M.S. Devata, Chief Foundation Engineer.




T. Sangiuliano, P.Eng.
Foundation Engineer

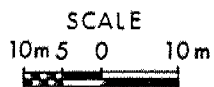

M.S. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX



MTD DISTRICT 6 SERVICE BUILDING
PATROL YARD AT KIPLING AVE & BELFIELD RD

PLAN

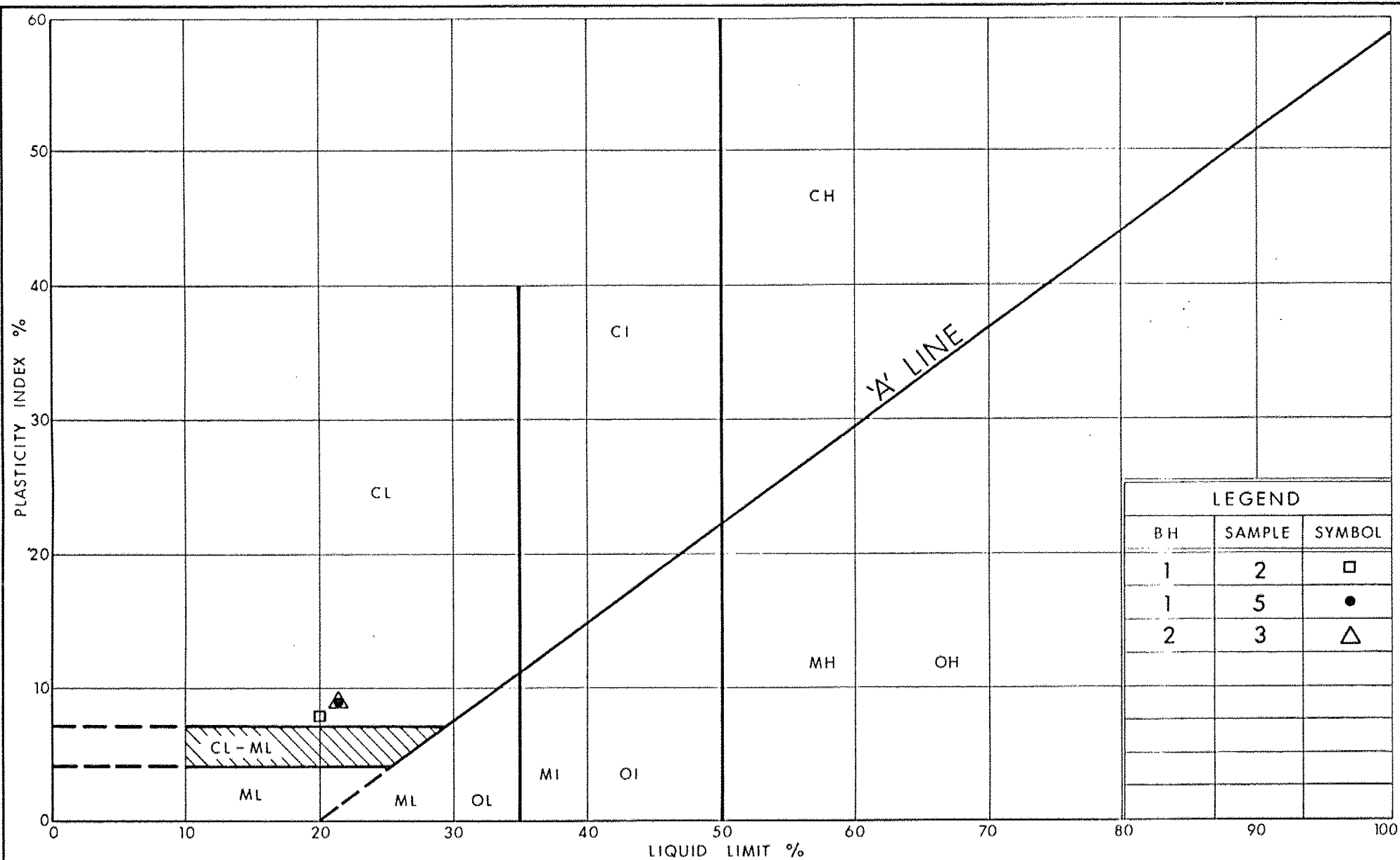


Geocres No 30M11-189

W O 89-11008

Dist 6

Figure No 1



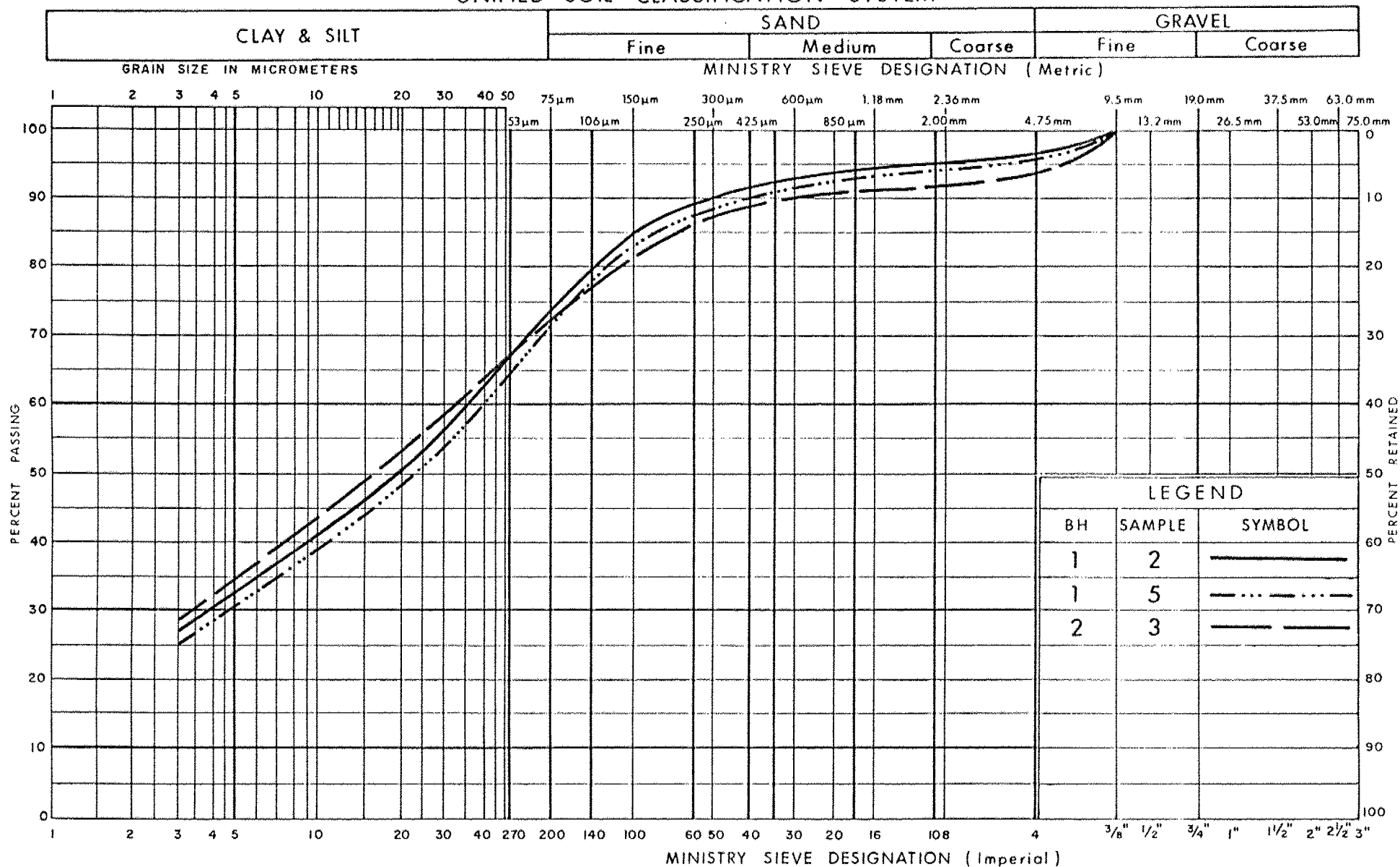
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PLASTICITY CHART
CLAYEY SILT, SOME SAND, TRACE GRAVEL
(Glacial Till)

FIG No 2

WO 89-11008

UNIFIED SOIL CLASSIFICATION SYSTEM

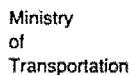


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GRAIN SIZE DISTRIBUTION
CLAYEY SILT, SOME SAND, TRACE GRAVEL
(Glacial Till)

FIG No 3

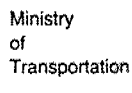
W O 89-11008



METRIC

WO 89-11008 LOCATION See Figure 1 ORIGINATED BY TS
DIST 6 HWY N/A BOREHOLE TYPE H.S. Auger COMPILED BY TS
DATUM Geodetic DATE 89 10 20 CHECKED BY _____

[illegible]



METRIC

W O 89-11008 LOCATION See Figure 1 ORIGINATED BY TS
DIST 6 HWY N/A BOREHOLE TYPE H.S. Auger COMPILED BY TS
DATUM Geodetic DATE 89 10 21 CHECKED BY _____

[illegible]

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

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

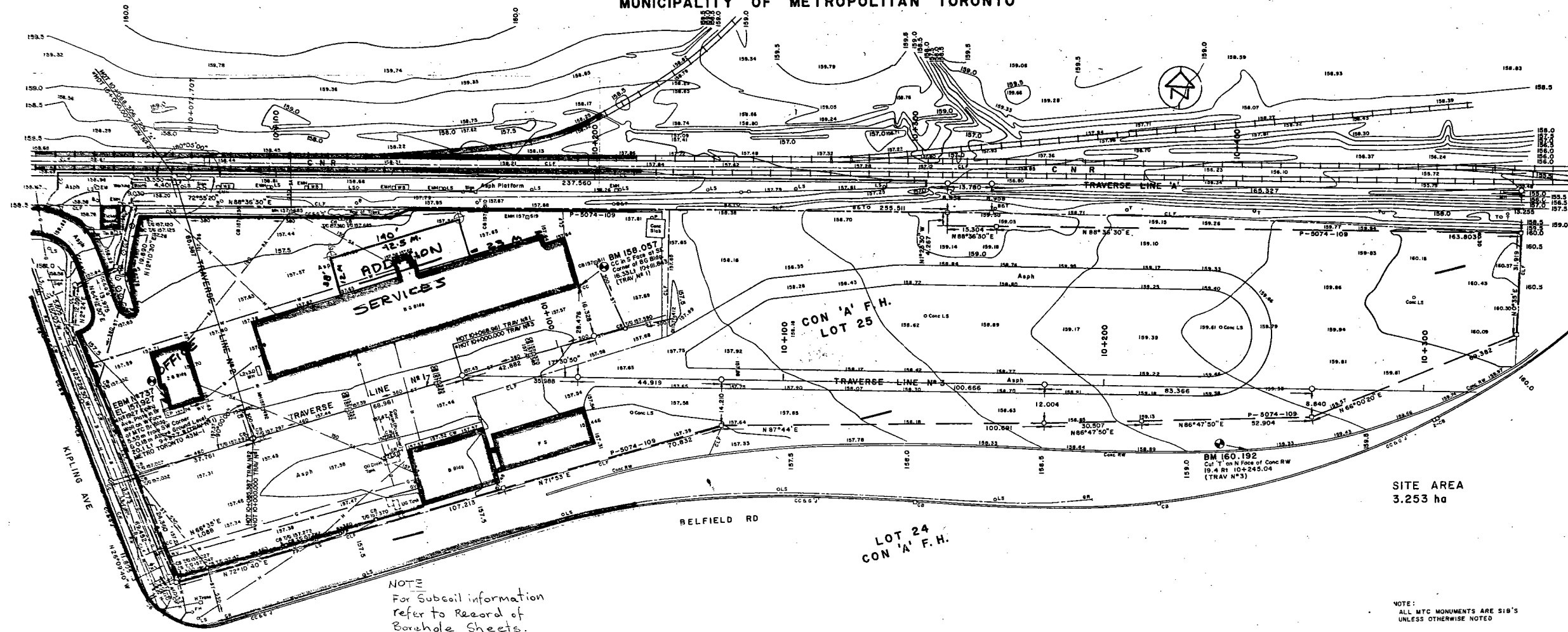
MECHANICAL PROPERTIES OF SOIL

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'_{v0}	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						

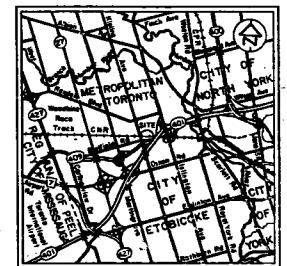
GEO TWP ETOBICOKE
CITY OF ETOBICOKE
MUNICIPALITY OF METROPOLITAN TORONTO



SITE AREA
3.253 ha

FOUNDATION
W.O. 89-11008

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



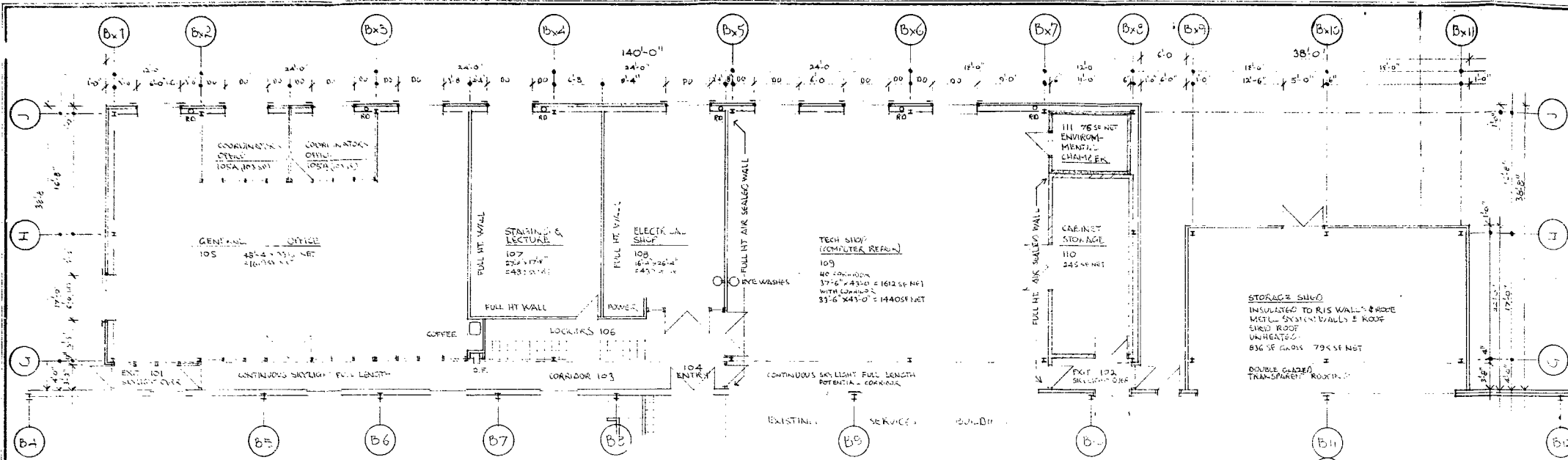
KEY PLAN
1.0 Km 2.0 Km

SITE INFORMATION		
DATE	TYPE	DATE
OTHER		
PLUMBING		
WELL	PUMP	SEPTIC TANK
DEPTH	MAKE	SIZE
STATIC LEVEL	TYPE	TYPE
CASING SIZE	TANK CAP	FIELD
RATE OF PUMPING		
DATE	REVISIONS AND ADDITIONS	
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ENGINEERING AND RIGHT OF WAY OFFICE SURVEYS AND PLANS SECTION		
PATROL FACILITY SITE PLAN		
PATROL YARD AT KIPLING AVE AND HWY 401		
LOTS 24 & 25 CON 'A' F.H. CITY OF ETOBICOKE MUN OF METROPOLITAN TORONTO		
SCALE 5m 10m	DISTRICT 6 - TORONTO	REGION CENTRAL
WP/WO WO 85-27088/D	PROFILE	PLAN 8-80-113
SURVEY 85.12		PLAN 86.02
SITE		PLAN H-80-5

GALLANT ARCHITECT INC

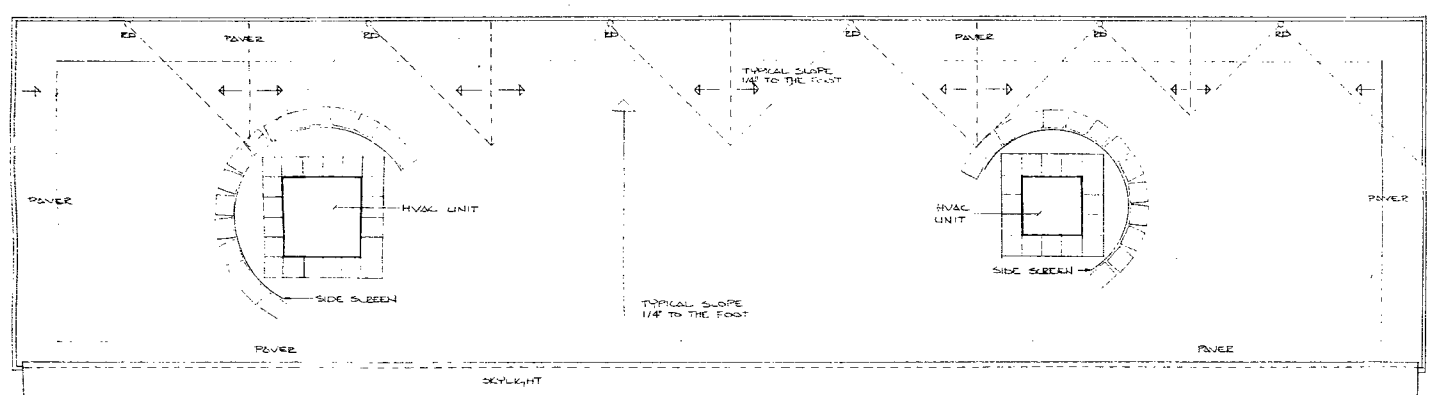
70 SIMCOE STREET NORTH
OSHAWA, ONTARIO L1G 4S2
TELEPHONE: (416) 434-3770

EXIST. AREAS
NEW BUILDING ADDITION
5474 SF
STORAGE SHED ADDITION
835 SF



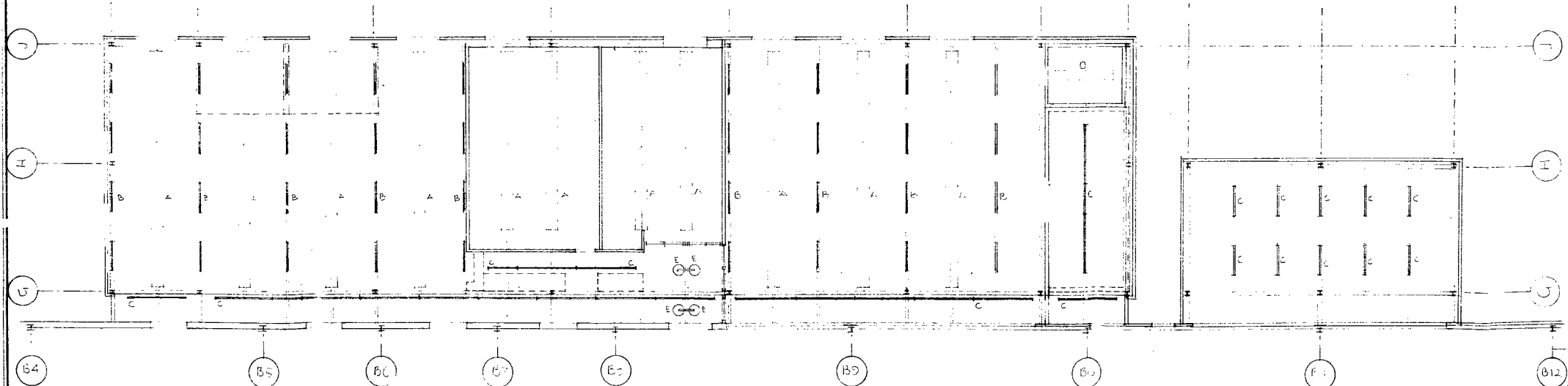
FLOOR PLAN

STORAGE SHED



ROOF PLAN

EXISTING SERVICES BUILDING



REFLECTED CEILING PLAN

SPECS:

- Substrate: 1-1/2" fluted acoustic deck with acoustic inserts sloped to drain.
- Roof 1. Tapered fibre glass roof insulation cross-sloped over deck in "crickets".
- 2. 12 mm gypsum board deck.
- 3. EPDM membrane.
- 4. Flash at skylight to seal with glass 6" x 6" metal upstand at roof edge. Flash below upstand to wall air/vapour barrier (metal liner panel). Flash over upstand to overlap siding flash at HVAC ducts through roof - no other penetrations except possibly one 1" gas fuel pipe and two power lines.
- 5. Terraflx DC1166 geotextile drainage course.
- 6. A" Type 4 E.E.P. 68 p.s.i. under equipment, 38 p.s.i. elsewhere.
- 7. Filter fabric.
- 8. Ballast.
- 8.1 2' x 2' pavers on E.E.P. pedestals for 4' around perimeter and around HVAC equipment and as ballast for sight screens.
- 8.2 Gravel elsewhere.
- 9. Counterflashing - by siding man.

NO	REVISION	BY	DATE
A			
B			

CONTRACTOR TO VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ARCHITECT.
CONTRACTOR TO COORDINATE ALL DIMENSIONS ON THE WORK.
DO NOT SCALE PRINTS. WORK TO DIMENSIONS ONLY.

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STATUS
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REVISION NO
SET NO

PROJECT
MTO SERVICES
BUILDING ADDITION
AND RENOVATION

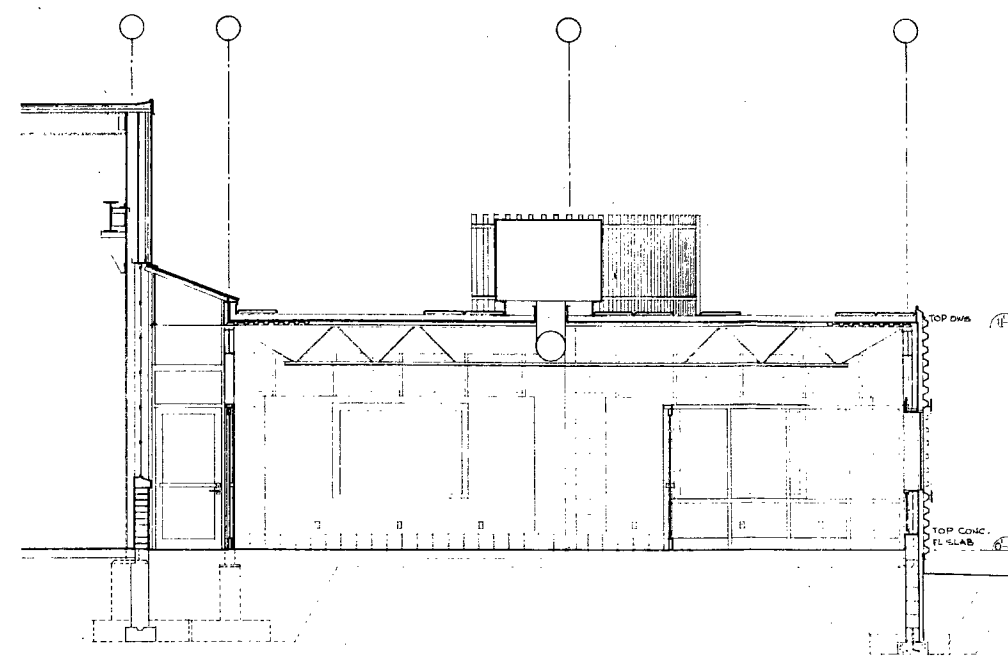
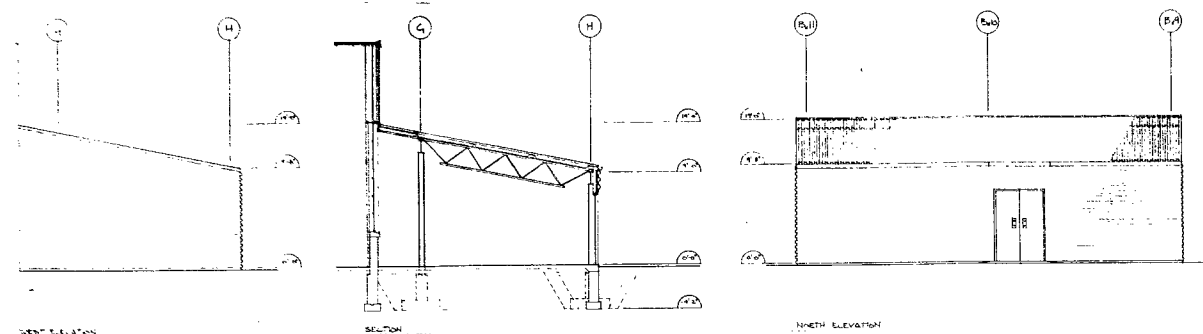
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PLANS

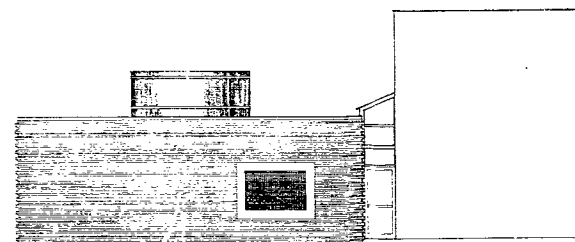
SHEET NO
SK. 01

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ARCHITECT
INC.**

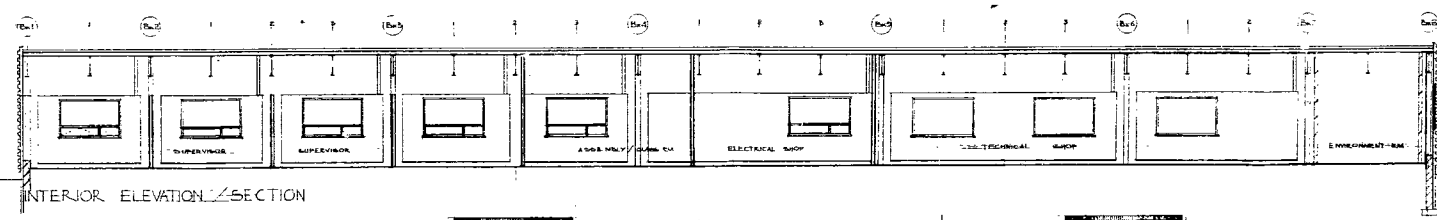
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OSHAWA, ONTARIO L1G 4S2
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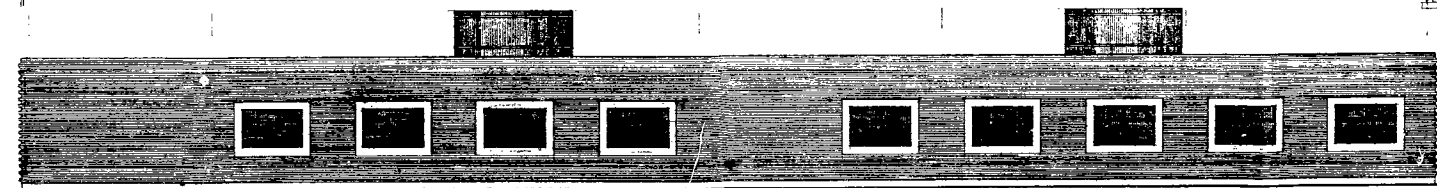
SECTION - NEW BUILDING - ANGLE



WEST ELEVATION



INTERIOR ELEVATION/SECTION



NORTH ELEVATION

NO.	REVISION	BY	DATE
A	DETAIL NO.		
B	SHEET NO. WHERE DETAILED		

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MTO SERVICES
BUILDING ADDITION
AND RENOVATION

PROJECT NO. G 8918

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CHECKED BY

SCALE AS SHOWN

DRAWING TITLE

SECTIONS,
ELEVATIONS

SHEET NO.

SK. 02