

REMARKS: _____

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 73-85-02 DIST 2

HWY 73 STR SITE 5-29

West Catfish Creek Structure Replacement

CONT 91-07

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FOUNDATION INVESTIGATION REPORT
For
West Catfish Creek Structure Replacement
W.P. 73-85-02; Str. Site 5-29
Highway 73, District 2, London

INTRODUCTION

This report contains the results of a Foundation Investigation carried out for the proposed structure replacement and detour at the above location. The fieldwork was carried out from 89-03-21 to 89-03-30. The fieldwork consisted of four sampled boreholes and 6 dynamic cone penetration tests of which 4 were adjacent to the boreholes. The borings were advanced by hollow and solid stem augers (57 mm I.D. and 121 mm O.D. respectively), and BX casing (60 mm I.D.), using a machine mounted on a truck.

Sampling was performed to a maximum depth of 27.3 m to elevation 238.9 and the cone tests to a maximum depth of 4.5 m to elevation 261.7 m.

SITE DESCRIPTION

The site is located approximately 2 km north of Lyons on Highway 73 in the Township of South Dorchester. West Catfish Creek lies in a spillway separating the St. Thomas and Norwich till moraine's. The land use in the immediate vicinity is agricultural and the terrain is relatively flat at the site.

SUBSURFACE CONDITIONS

General

The subsoil was found to consist of a heterogeneous mixture of clayey silt, sand and gravel. This deposit extended from the bottom of the fill or beneath the surficial material to the end of the sampled boreholes and in borehole 1 to the sandy silt at elevation 240.6 m (25.6m below the surface). The sandy silt was encountered to the end of sampling of borehole 1. Although no sampling was carried out off the road along the proposed detours, surficial material is likely to consist of 0.6 to 1.0 m of topsoil.

The plan and location of borings and the stratigraphical profile are shown on Drawing 738502-A in the attached Appendix. The obtained field and laboratory test results are plotted on the Record of Borehole sheets also in the Appendix of this report. A brief description of the different soil types is given below:

Gravelly Sand (Fill)

This material was found from the road surface (shoulder) to the top of the Heterogeneous mixture of clayey silt, sand and gravel at elevation 265.9 in borehole 4 to 264.2 in borehole 2. The material ranged in thickness from $0.8 \pm$ m to $2.1 \pm$ m. The fill consisted of gravelly sand, trace of silt, trace of clay.

The natural moisture content (w) of the fill as determined by a laboratory test was 4.5%. The grain size distribution test indicated 26% gravel, 62% sand, 9% silt and 3% clay. The denseness of the material ranged from loose to compact.

Heterogeneous Mixture of Clayey Silt, Sand and Gravel

The main deposit is a glacial deposit consisting of a heterogeneous mixture of clayey silt, sand and gravel. This deposit was found beneath the surficial material off the road and under the fill along the road to the end of sampling excluding borehole 1 where sandy silt was encountered at elevation $240.6 \pm$ m.

The physical properties of the material as determined by the field and laboratory tests are as follows:

	<u>Range</u>
Natural Moisture Content (w)	10-27%
Liquid Limit (w_L)	24.5-38.5%
Plastic Limit (w_p)	12.5-22%

The N-blows from the standard penetration tests averaged at 30, ranging from 11 to 55 with occasional tests indicating over a hundred at the end of the deep boreholes. Based on these values the consistency of the glacial till ranged

from stiff to hard. The grain size distribution is shown on Figure 1 in envelope form. Figure 2 indicates that the majority of the material plots as a clayey silt of low plasticity with one test indicating a silty clay of intermediate plasticity.

Sandy Silt

Beneath the heterogeneous mixture at approximate elevation 240.6 m in borehole 1 a deposit of sandy silt of low plasticity was found to the end of the borehole. A laboratory test indicated that the natural moisture content (w) was 14%, liquid limit (w_L) 13.5%, plastic limit (w_p) 12.5%. Plotted on the plasticity chart this indicates a silt of low plasticity (ML). The grain size distribution test shows no gravel, 11% sand and 89% silt and clay.

GROUNDWATER CONDITIONS

Due to the short duration of the field investigation, no stabilized water levels were taken with the exception of borehole 1. Borehole 1 indicated the groundwater level to be about 2.1 below the road at approximate elevation 264.1 m. The following creek water levels have been recorded:

March, 1989	264.1
October 27, 1988	263.3
April 4, 1989	263.5

The groundwater level will most likely vary seasonally and with the level in the creek.

DISCUSSION AND RECOMMENDATIONS

It is proposed to replace the existing structure along the same alignment and location by a single span concrete Rigid Frame or Concrete Beam Structure, with a grade raise of $0.6\text{m}\pm$. A detour is planned for either the west or east side 25 m from the centreline of Highway 73, using corrugated steel pipes and a maximum grade raise of 3.55 m at the creek.

Proposed Structure Replacement

It is recommended that the abutments of the proposed single span structure be founded on spread footings at Stations $14+775\pm$ and $14+785\pm$. These footings could be placed as follows:

- a) placed below the existing spread footings (assumed elevation 262 m).
- b) mass concrete or well compacted Granular 'A' could be placed from the bottom of excavation (existing footing elevation) to elevation 263 m on to which the footings could be founded.

It is estimated that the footings will achieve a safe bearing capacity of 300 kPa, for the alternatives above. For the purposes of the O.H.B.D.C., the following design values are recommended:

Factored Capacity at U.L.S. : 450 kPa

Capacity at S.L.S. Type II : 300 kPa

Earth pressure acting on abutments retaining walls and proposed culverts (see below) should be computed as per subsection 6.6.1.2.2. of the O.H.B.D.C. A yielding foundation condition may be assumed. The following properties of granular backfill may be used for computations:

Granular 'A': $\gamma = 22.8 \text{ kN/m}^3$, $\phi = 35^\circ$, $K_a = 0.271$

Granular 'B': $\gamma = 21.2 \text{ kN/m}^3$, $\phi = 30^\circ$, $K_a = 0.333$

For purposes of computing friction resistance to lateral forces the shearing resistance against sliding between the underside of concrete footings and the foundation soil may be assumed to be 0.60. It is further recommended that the surface be roughened before placing of the lean concrete mixture at the base of the footing excavation, so as to increase the bond and resistance to sliding.

For frost protection the base of the footings should have a minimum of 1.2 m of earth cover.

Proposed Detour

The proposed corrugated steel pipes should have a bedding in accordance with M.T.O. OPSD 802.01 and the backfilling in accordance with OPSD 803.03. It is important that the culvert be compacted spontaneously on either side. The invert level should be determined by hydrological requirements with all surficial and any soft to firm material removed.

The existing glacial till has a consistency of very stiff to hard, therefore the underlying deposit is not expected to settle any significant amount with a grade raise of 3.55 m.

Granular material should be used as fill up to 0.5 m above the water table. From 0.5 m below to 0.5 m above the water table Granular 'A' should be used as fill.

Dewatering

Concrete should be placed in the 'dry'. Dewatering is not anticipated to be a major problem although a dewatering scheme will be required for footing excavations below the groundwater level. This could be achieved by sump-pumping. It is also recommended that 15 cm of lean concrete should be poured at the bottom of the footing excavation immediately after completion so as to guard against softening of the foundation material from the effects of weathering, seepage and surface water.

Approach Embankments

Topsoil and surficial material should be removed prior to placing any fill. The fill should consist of well compacted acceptable material.

The side and forward slopes should not be steeper than two horizontal to one vertical designed and constructed in accordance with the appropriate Ministry Standards.

Settlements along the existing alignment with a grade raise of 0.6m± (and along the detour) are likely to be extremely small.

No undue settlements are anticipated during or after construction of the structure foundations since the load required to cause unacceptable settlement would be much greater than the recommended values for factored bearing capacity at U.L.S. (O.H.B.D.C. subsection 6.5.3.2.).


Scour Protection


Scour protection for the footings and abutments should be utilized for this structure. Rip-rap may be used for protection of the river bed and embankments. This rip-rap should be placed so as to be effective from the creek bed to a height of 0.3 m above the high water level and for a span of 5 m up and down stream of the structure.

MISCELLANEOUS

The fieldwork for this investigation was carried out by Mr. P. Dubé, Trainee Engineer. The fieldwork was carried out under the supervision of Mrs. P. Marks, Foundation Engineer, who also prepared this report. The equipment used for the field investigation was owned and operated by London Soil. The entire project was carried out under the general supervision of Mr. P. Payer, Senior Foundation Engineer. The report was reviewed by M. Devata, Chief Foundation Engineer.

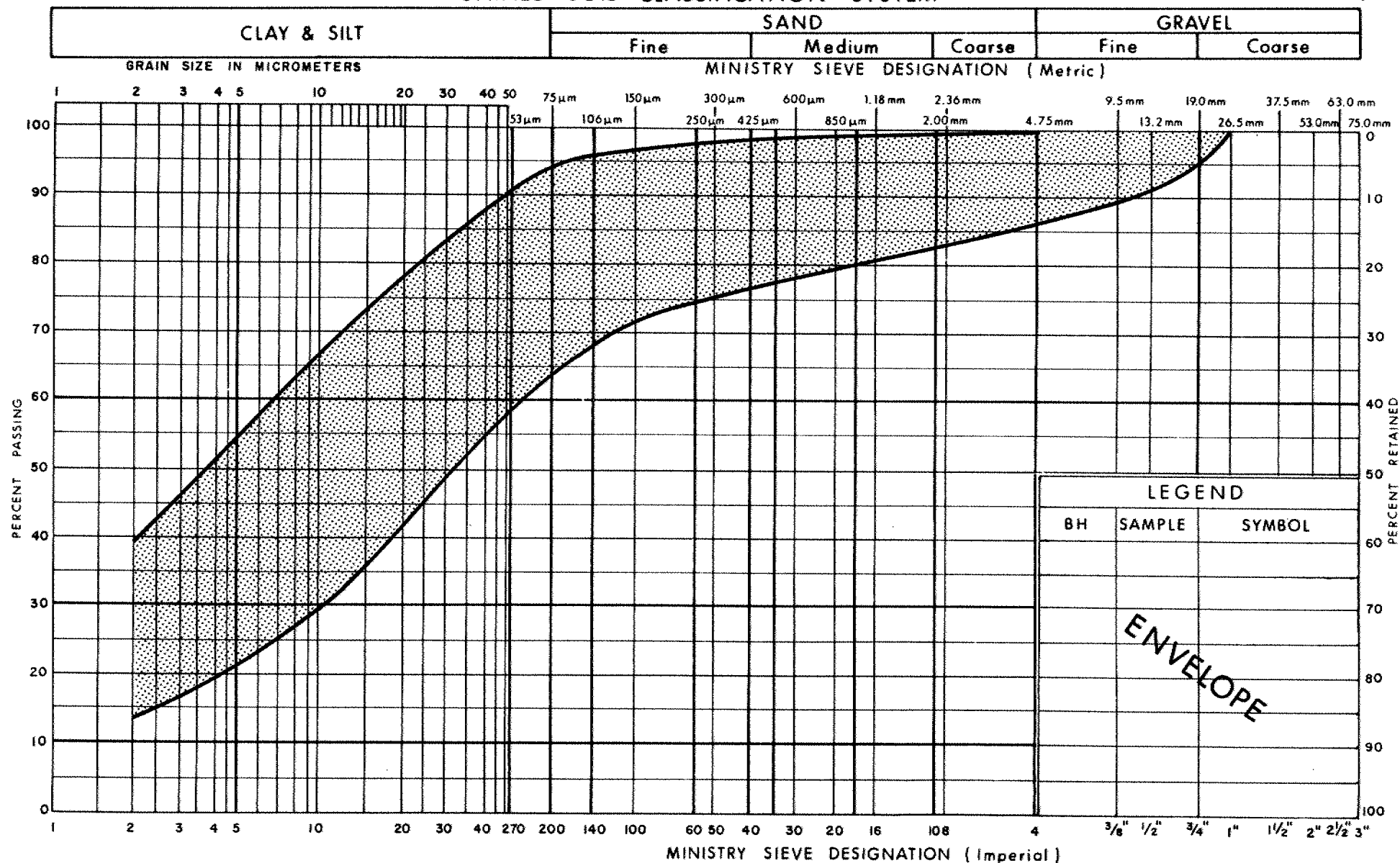



P. Marks, P.Eng.
Foundation Engineer


M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM

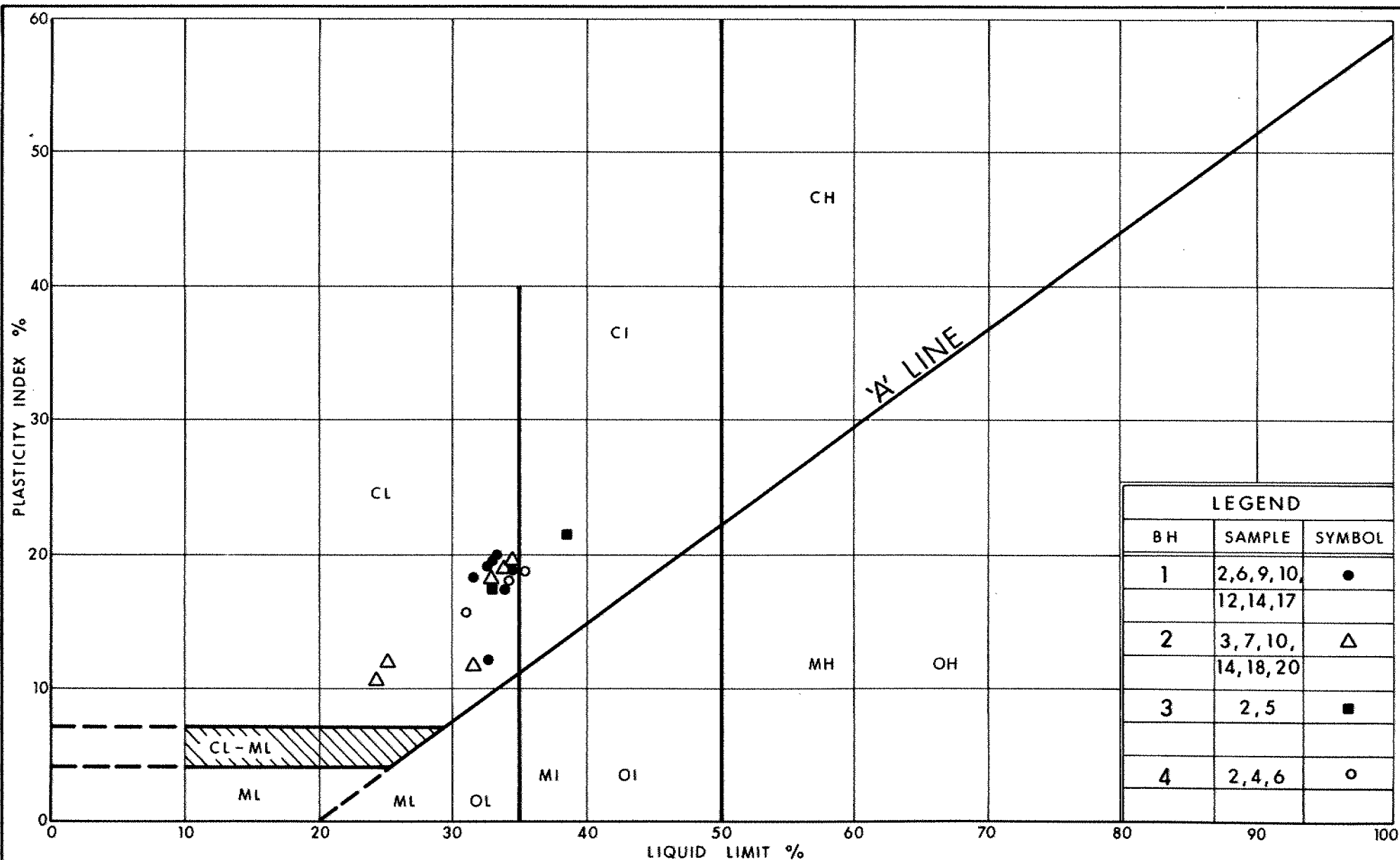


Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
HET MIXTURE OF
CLAYEY SILT, SAND & GRAVEL (Glacial Till)

FIG No 1

W P 73-85-02



Ministry of
Transportation

Ontario

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

FIG No 2

W P 73-85-02

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:

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
f_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^3	SEEPAGE FORCE
γ'	kn/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

METRIC

W P 73-85-02 LOCATION Station: 14 + 788.4; offset 5.3 Rt of ☞ ORIGINATED BY PD
 DIST 2 HWY 73 BOREHOLE TYPE Continuous Flight Auger (S.S.); BX Casing & Cone COMPILED BY PM
 DATUM Geodetic DATE 89 03 21 to 23 Test CHECKED BY W

OFFICE REPORT ON SOIL EXPLORATION

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			20 40 60 80 100	100					
266.2	Road Surface												
0.0	Gravelly Sand, Trace Silt, Trace Clay (Fill) Compact		1	SS	16								
264.6	Trace of Organics		2	SS	6								
1.6			3	SS	14								7 18 61 14
			4	SS	42								
			5	SS	42								
			6	SS	33								3 6 (91)
			7	SS	34								
			8	SS	26								
			9	SS	25								1 5 (94)
			10	SS	30								
			11	SS	28								
			12	SS	20								
			13	SS	22								3 6 (91)
			14	SS	20								
	Heterogeneous Mixture of Clayey Silt		15	SS	18								
	Sand and Gravel		16	SS	22								
	(Glacial Till)		17	SS	13								
			18	SS	46								2 5 (93)
			19	SS	39								
			20	SS	100/15 cm								
240.6	Stiff / Hard												
25.6	Sandy Silt Very Dense												
238.9			21	SS	99								0 12 (88)
27.3	End of Borehole												

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 2

METRIC

W P 73-85-02 LOCATION Station: 14 + 770.7; offset 5.3 Lt. of 4
 DIST 2 HWY 73 BOREHOLE TYPE Continuous Flight Auger (H.S.) & Cone Test ORIGINATED BY PD
 DATUM Geodetic DATE 89 03 28 to 29 COMPILED BY PM
 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
266.3	Road Surface											
0.0	Gravelly Sand											
	Trace Silt											
	Trace Clay (Fill)											
264.2	Loose		1	SS	8							26 62 9 3
2.1	Trace of Organics		2	SS	6							
			3	SS	5							
			4	SS	42							
			5	SS	41							
			6	SS	37							
			7	SS	33							
			8	SS	22							0 6 (94)
			9	SS	26							
			10	SS	16							
			11	SS	21							
			12	SS	23							
			13	SS	18							
			14	SS	14							
	Heterogeneous Mixture of Clayey Silt		15	SS	28							
	Sand and Gravel		16	SS	33							
	(Glacial Till)		17	SS	45							
	Stiff to Hard		18	SS	40							
			19	SS	55							
			20	SS	100/13 cm							13 19 44 24
239.9	End of Borehole		21	SS	100/15 cm							
26.4	* Water level not Established											

+3, x5: Numbers refer to Sensitivity
 20
 15
 10
 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 3

METRIC

W P 73-85-02 LOCATION Station: 14 + 788.1; offset 24.8 m Lt. of E ORIGINATED BY PD
 DIST 2 HWY 73 BOREHOLE TYPE Continuous Flight Auger (S.S.) & Cone Test COMPILED BY PM
 DATUM Geodetic DATE 89 03 29 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
265.3	Ground Surface										
0.0	Trace of Organics		1	SS	13	*	264	Pre-augered			0 6 (94)
	Heterogeneous Mixture of Clayey Silt Sand and Gravel		2	SS	21						
	(Glacial Till)		3	SS	52						
			4	SS	38						
			5	SS	35						
260.3	Stiff to Hard		6	SS	34						1 6 (93)
5.0	End of Borehole										
	* Water level not Established										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

METRIC

W P 73-85-02 LOCATION Station: 14 + 732.0; offset 5.3 m Lt. of G ORIGINATED BY PD
 DIST 2 HWY 73 BOREHOLE TYPE Continuous Flight Auger (H.S.) & Cone Test COMPILED BY PM
 DATUM Geodetic DATE 89 03 30 CHECKED BY /

OFFICE REPORT ON SOIL EXPLORATION

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								
266.7	Road Surface												
0.0	Gravelly Sand, Trace Silt, Trace Clay (Fill) Loose												
265.9													
0.8	Heterogeneous Mixture of Clayey Silt Sand and Gravel (Glacial Till)		1	SS	13								
			2	SS	11								
			3	SS	17								
			4	SS	44								
			5	SS	38								
261.7	Stiff to Hard		6	SS	50								
5.0	End of Borehole												
	* Water level not Established												

+³, x⁵: Numbers refer to Sensitivity
 20
 15
 10

RECORD OF BOREHOLE No 5

METRIC

W P 73-85-02 LOCATION Station: 14 + 789.0; offset 4.9 m Lt. of E ORIGINATED BY PD
DIST 2 HWY 73 BOREHOLE TYPE Cone Penetration Test COMPILED BY PM
DATUM Geodetic DATE 89 03 30 CHECKED BY ME

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

METRIC

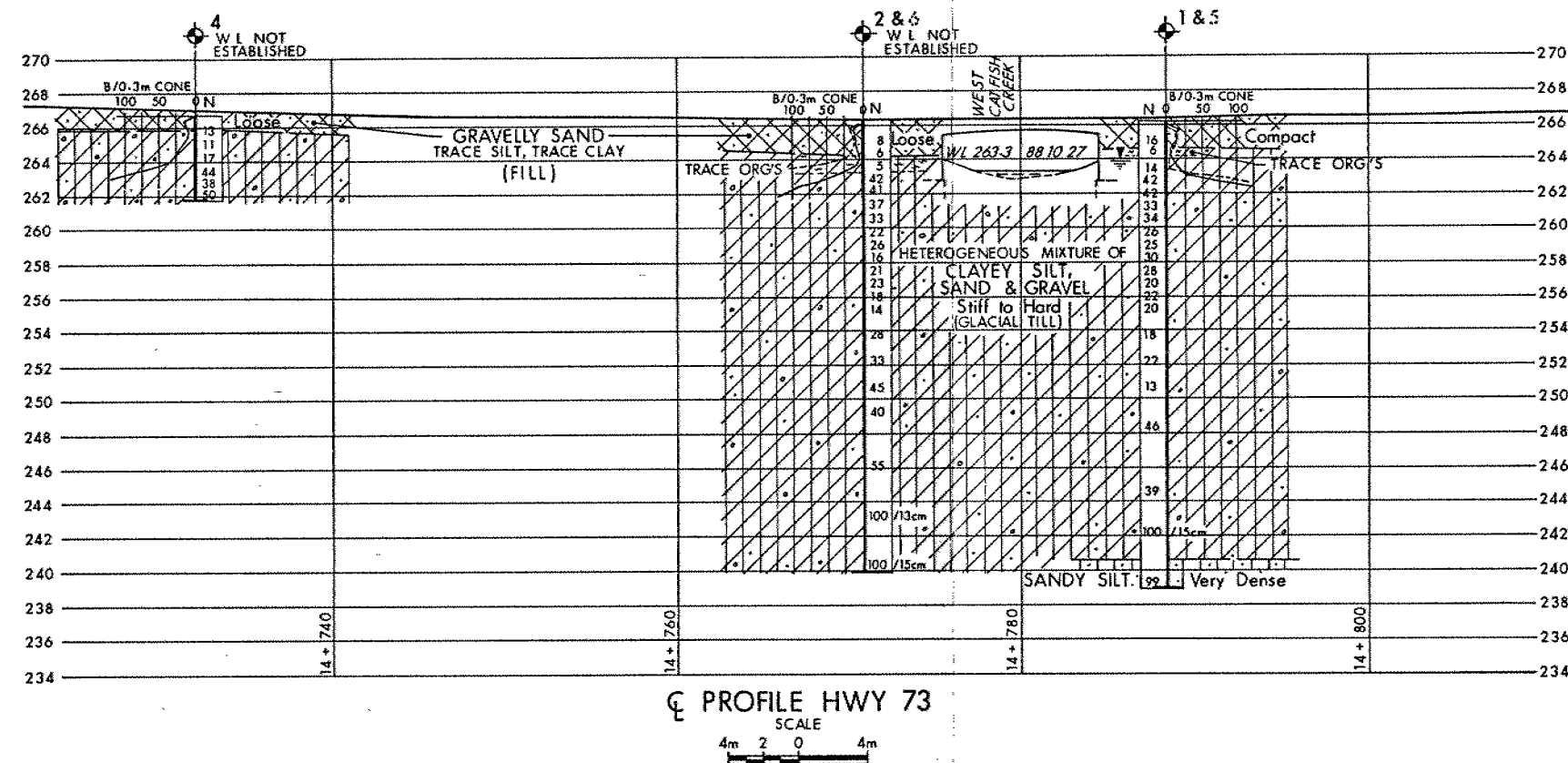
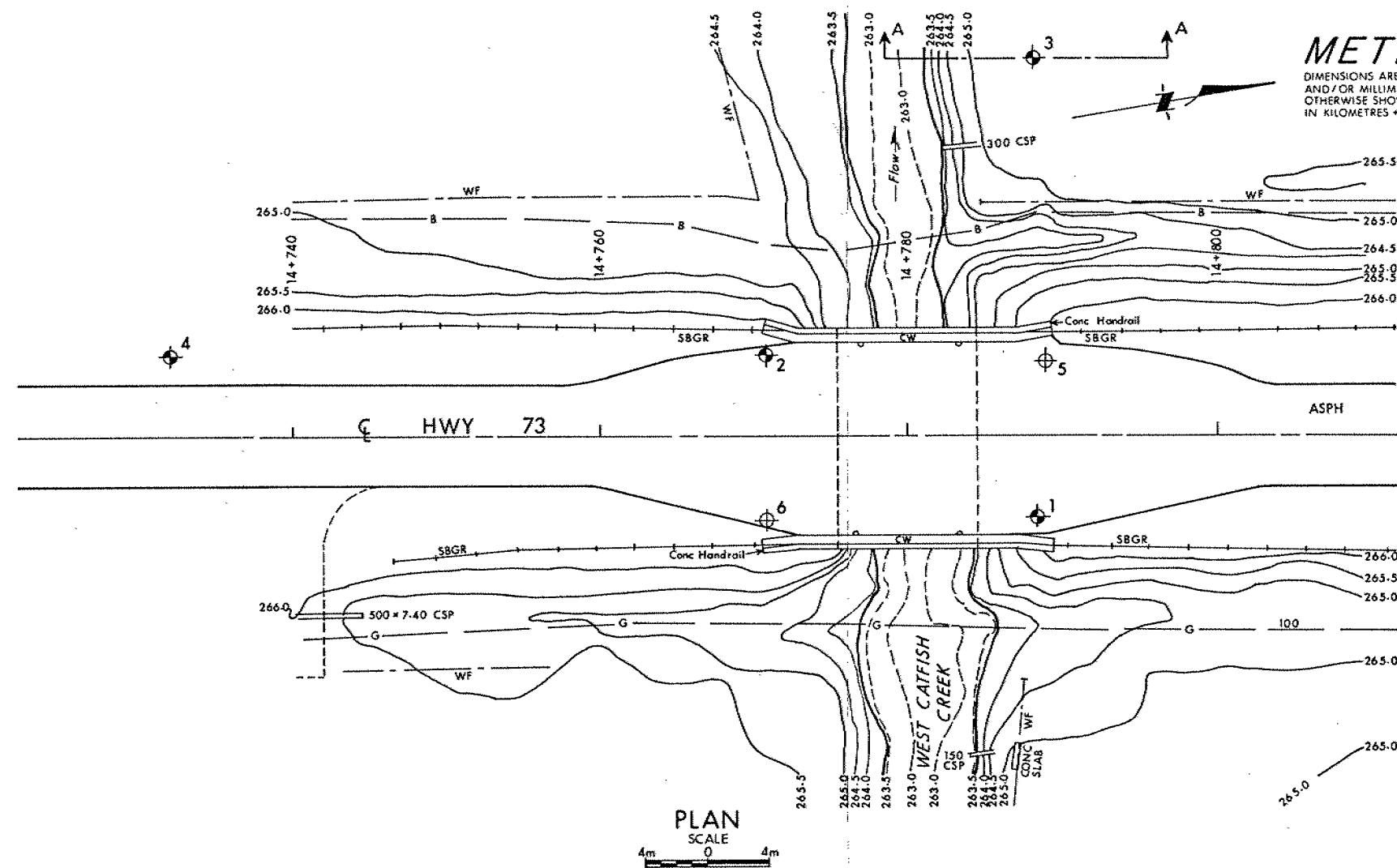
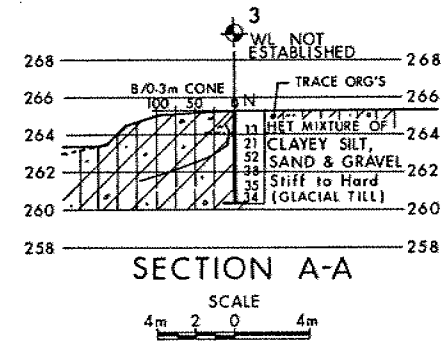
W P 73-85-02 LOCATION Station: 14 + 770.7; offset 5.5 m Rt. of C ORIGINATED BY PD
 DIST 2 HWY 73 BOREHOLE TYPE Cone Penetration Test COMPILED BY PM
 DATUM Geodetic DATE 89 03 30 CHECKED BY Me

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								
266.3	Road Surface												
0.0	Presumed Gravelly Sand						266						
	(Fill)												
	Presumed Het. Mixture of Clayey Silt and Gravel						264						
263.3													
3.0	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to Sensitivity

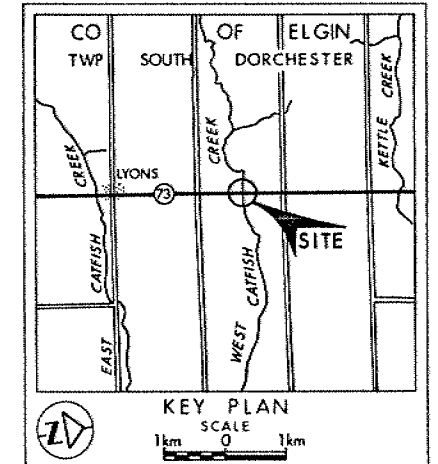
20
15
10
5 (%) STRAIN AT FAILURE



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

CONT No
WP No 73-85-02
WEST CATFISH CREEK
BORE HOLE LOCATIONS & SOIL STRATA

1
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)		
≡	WL at time of investigation 89 03		

No	ELEVATION	STATION	OFFSET
1	266.2	14+788.4	5.3 m RT
2	266.3	14+770.7	5.3 m LT
3	265.3	14+788.1	24.8 m LT
4	266.7	14+732.0	5.3 m LT
5	266.2	14+789.0	4.9 m LT
6	266.3	14+770.7	5.5 m RT

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 40115-25

HWY No 73	DIST 2
SUBMD PM [CHECKED] DATE 89 07 10	SITE 5-29
DRAWN DT [CHECKED] APPROVED	DWG 738502-A