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DIST. 9 REGION

W.P. No. 2505-75-01

CONT. No. 77-408

W. O. No.

STR. SITE No.

HWY. No. 417

LOCATION Vehicle Inspection Station

No. of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FOUNDATION INVESTIGATION & DESIGN REPORT

W.P. 2505-75-01 DIST. 9

HWY. 417 STR. SITE N/A

Vehicle Inspection Station 1.0 Miles West of Hwy. 138

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INTRODUCTION

This Section carried out a subsurface investigation at the original location for a vehicle inspection station approximately one mile west of Highway 138 on Highway 417. A detailed report for this original location, containing all the factual information, as well as recommendations pertaining to the design of the vehicle inspection station (scales, approaches, building and earth embankments) was submitted on August 27, 1976 (Report No. W.P. 2505-75-01). The location of the vehicle inspection station has recently been revised; the new location will be 938 feet east of the former approved location.

In a memorandum dated November 16, 1976 Mr. T. C. Kingsland, Regional Structural Planning Engineer, requested our office to carry out the investigation for the relocated site.

A subsurface investigation was carried out by the Soil Mechanics Section at the relocated site. This report presents the factual data obtained from the recent investigation together with our recommendations for the design and construction of the vehicle inspection station.

This report supercedes the foundation investigation report for the initial location of the vehicle inspection station submitted on August 27, 1976.

SITE DESCRIPTION AND GEOLOGY

The site is located about 1 mile west of the intersection of Highway 138 and 417 to the north of Highway 417, WBL.

The site and surrounding area are flat and poorly drained. The area is used mainly for farmland and has been cleared of trees. At the time of the investigation the site was dry but available information indicates that the site is inundated with about 1 foot of surface water in the spring season.

Geologically, the site lies in the Winchester Clay Plains Region. The predominant deposit is a sensitive marine clay locally known as Leda Clay.

The clay was deposited by the late Champlain Sea. The cohesive deposit is underlain by a thin layer of glacial till which is underlain by limestone bedrock of the Trenton-Black River Formation, Ordivician Period.

FIELD AND LABORATORY WORK

The field work consisted of three sampled boreholes and one dynamic cone test. The investigation was carried out using a muskeg vehicle mounted drilling machine with hollow stem augers.

Disturbed samples were obtained using a 2" O.D. split spoon sampler. The split spoon was driven according to the specifications for the Standard Penetration Test with a driving energy of 350 ft-lb. per blow. Relatively undisturbed samples were recovered using 2" I.D. Shelby tubes. The Shelby tubes were pushed manually or hydraulically into the soil. Together with sampling, field vane tests were carried out to obtain in-situ undrained shear strengths of the cohesive stratum.

The locations and elevations of all the boreholes were surveyed by personnel from Kingston Region, Engineering Surveys Section and are shown on Dwg. 25057501-A.

Samples were visually examined and identified in the field and again in the laboratory. Laboratory tests were conducted on representative samples to determine:

- Atterberg Limits
- Natural Moisture Contents
- Bulk Densities
- Undrained Shear Strengths
- Consolidation Characteristics

The results of the field and laboratory tests are summarized in Record of Borehole Sheets and on the Plasticity Chart, Figure 1; on the Grain Size Distribution Curves, Figure 2; and on the Consolidation e - log P Curves, Figure 3.

SUBSURFACE CONDITIONS

General

Immediately below a thin cover of topsoil (approx. 1 foot thick) is a deposit of very soft to firm sensitive clay. This clay stratum varies in thickness from 34 to 40 feet. The clay overlies a 1 foot to 5 foot thick deposit of glacial till. According to available local geological information the glacial till is underlain by limestone bedrock.

The boundaries between the soil strata as determined by this investigation are shown in the Record of Borehole Log Sheets. A stratigraphical profile shown on Dwg. 25057501 - A is inferred from the borehole data.

A summary of the subsoil conditions is presented in the following paragraphs.

Clay

Under a thin cover of topsoil is a clay deposit. The clay stratum varies in thickness from 34 to 40 feet below ground surface. Immediately below the topsoil for a depth of 3 feet the clay is slightly desicated and has a mottled reddish brown to grey colour. The remainder of the deposit is generally grey in colour. Within this stratum random thin seams or pockets of silt and organics were encountered.

The physical properties of the clay deposit as determined by the field and laboratory testing are summarized below:

		Range	Average
Natural Moisture Content	(W)%	62 - 86	78
Liquid Limit	(W_L)%	60 - 80	69
Plastic Limit	(W_p)%	20 - 25	22
Liquidity Index	(I_L)	0.8 - 1.5	1.2
Bulk Density	(γ)pcf	93 - 105	97
Undrained Shear Strength	(C_u)psf		Sensitivity
In-Situ Vane Tests		220 - 960	4 - 12
Laboratory Tests		270 - 920	3 - 9
Consolidation Tests (Two Tests)			
Initial Void Ratio	(e_o)	1.5 - 1.7	
Compression Index	(C_c)	0.6 - 1.1	

The Atterberg Limits indicate that the cohesive stratum is an inorganic clay of intermediate to high plasticity. The natural moisture content of the deposit is generally higher than the Liquid Limit, resulting in a Liquidity Index of slightly greater than 1 for the overall deposit, which indicates that the soil is sensitive to remoulding. This is confirmed by the fact that the sensitivity of the soil, as measured in the field was as high as 12. The undrained shear strength as measured by the situ vane tests increases with depth from 220 psf to up to 960 psf except for the upper 3 foot zone where the shear strength was measured to be about 450 psf. Based on field and laboratory test results the consistency of clay varies generally from very soft to firm, increasing with depth except for the upper 3 foot zone where the consistancy is soft.

Consolidation tests on two samples from this deposit indicate that the clay has been preconsolidated by a pressure of about 800 - 1000 psf in excess of the effective overburden pressure.

Heterogenous Mixture of Gravel and Sand, Trace of Silt and Clay

Underlying the clay stratum across the site is a glacial till deposit consisting of a heterogenous mixture of gravel and sand with a trace of silt and clay. The thickness of this deposit varied between 1 to 5 feet. Based on the Standard Penetration Test 'N' values ranging from 16 blows per foot to 50 blows for 2 inches the relative density is estimated to be compact to very dense.

Bedrock

Bedrock was not proven but according to available subsurface information in this area, the glacial till is underlain by limestine bedrock. It is further inferred that wherever the augers met refusal is considered to be the probable bedrock surface.

Groundwater Conditions

Groundwater observations were made 24 hours after the completion of the boreholes. The water level was found to be approximately at elevation 209, which is approximately 2.5 feet below ground surface.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to construct a vehicle inspection station along Highway 417 near Casselman. The proposed weigh scale arrangement consists of a 20 foot x 30 foot steel and masonary building, a 13 foot x 17 foot scale pit, a 5 foot x 7 foot connecting pit and two 12 foot x 70 foot long reinforced concrete approach slabs. Fill heights at the relocated site are about 6 feet above existing ground surface.

The subsurface investigation reveals a thin 1 foot cover of topsoil overlying a 34 to 40 feet thick stratum of very soft to firm sensitive clay. The clay stratum overlies a thin 1 to 5 foot thick layer of compact to very dense glacial till, a heterogenous mixture of gravel and sand with a trace of silt and clay.

According to design requirements for acceptable operation of the scale mechanism the weighing scale pit and slabs must remain almost dead level after construction. The allowable tolerance is limited to 3/8" for end to end rotation of the scale pit. The building and connecting pit will tolerate a maximum of one inch differential settlement. It is required to develop a scheme which will meet the above requirements without excessive continued maitenance problems.

The presence of the compressible very soft to firm clay deposit immediately below the ground surface requires that steps must be taken to ensure the overall stability of the approach embankments, and that settlements, differential as well as total, of the weigh scale arrangement are within tolerable limits.

Scale Building, Connecting Pit, Weighing Pit and Approach Slabs

As a result of several discussions about this project with the Ministry's Structural Office and other agencies, various foundation schemes have been proposed for the design of the foundations of the weigh scale mechanism. One of the schemes is to support the weigh scale arrangement on spread footings as outlined on page 5 of the previous report. Expected settlements of the weigh scale mechanism founded on spread footings were discussed in our previous report. Due to the sensitive nature of the weigh scale arrangement and to

ensure acceptable operation of the entire scale complex, the scale building, connecting pit, weighing pit and approach slabs should be supported on end bearing piles. Timber or steel 'H' piles founded on the bedrock surface or concrete caissons extended to the bedrock surface may be used. In consideration of the negative skin friction forces which will be induced because of the consolidation of the clay, it is recommended that the pile capacities should be reduced by 15%; i.e. 85% of their maximum allowable loads. For example a 12 BP 74 steel H pile may be designed for 80 tons per pile and a #14 timber pile for 20 tons per pile. Whereas, a 30 inch concrete caisson could be designed for 170 tons per caisson. Due to the sensitive nature of the clay, caissons would require a permanent or temporary liner to prevent caving in of the clay.

Because of the impervious nature of the clayey subsoil no major dewatering problems are anticipated. According to the proposed scheme, there will be no excavation below the water level. Any surface runoff into the excavations could be removed by pumping from sumps.

The pile caps should be provided with a minimum soil cover of 5 feet or equivalent insulation for frost protection purposes.

Earth Embankment Design Considerations

Stability Considerations

Analyses in terms of total stress have been carried out to determine the stability of fills immediately after construction. In this method of analysis, stability is governed by undrained shear strength properties of the foundation and fill materials. The following data and values were used in carrying out the stability analysis:

Fill Material

	γ (pcf)	ϕ^o	Cu(psf)
Locally Available Granular Material	130	30	0

Subsoil Foundation Material

Elevation (ft)	γ (pcf)	γ (pcf)	ϕ^o	Cu(psf)
206 - 212	110	48	0	400
199 - 206	95	33	0	230
194 - 199	95	33	0	370
189 - 194	95	33	0	500

The following are our recommendations based on the above analysis:

1) Fills up to 6 feet would be stable with side slopes of 2:1.
2) Fills up to 6 feet plus a 2 foot surcharge would also be stable with side slopes of 2:1.
3) Fills up to 6 feet plus a 4 foot surcharge with 10 foot long counter balancing berms at mid height on both sides of the embankment would be stable with side slopes of 2:1.

Settlement Considerations

The underlying compressible clay stratum will settle as a result of consolidation under the weight of the embankment. For the settlement computations the stresses induced within the subsoil by the embankment were computed by the Osterberg method. The soil parameters used in the settlement analyses were determined by laboratory consolidation tests, the results of which are shown on Figure 3.

Settlement analyses indicate that the maximum settlement due to consolidation of the clay deposit beneath a 6 foot fill height will be in the order of 6 inches. Since the clay deposit is slightly preconsolidated ($P_c - P_o \doteqdot 900$ psf) it is estimated that the settlement beneath the 6 foot fills will be about 2 inches due to the recompression of the subsoil and will occur during construction. Estimates of the time rate of settlement indicate that ninety percent of the remaining 4 inches of settlement would occur during the first 12 months after application of the embankment loading.

To minimize post construction settlement problems (total as well as differential settlements) between the earth fill approaches and the approach slabs, the following construction techniques could be adopted:

1) preload the site for a period of 12 months to the full height or alternatively
2) apply a 2 foot surcharge above the full fill height for a period of 6 months or alternatively

3) apply a 4 foot surcharge above the full fill height for a period of 4 months.

All of the above schemes will induce the same magnitude of settlements and the decision as to which method to employ should be based on construction scheduling and economic considerations.

At a meeting held in the Region January 6, 1977 between the Soil Mechanics Section and Regional Planning and Design Office it was decided that a 2 foot surcharge above the full fill height would be applied to the embankment for a period of six (6) months to reduce the anticipated post construction settlements. The Soil Mechanics Section provided recommendations for the extent of surcharge loading to be applied for the proposed scheme. A sketch showing the surcharge loading area together with a covering memorandum is appended to this report.

MISCELLANEOUS

The field work for the investigation was carried out from December 14 to December 16, 1976 under the supervision of Mr. M. MacLean, Project Engineer. The equipment used for subsoil sampling was owned and operated by Dominion Soil Investigation Ltd., Toronto, Ontario.

This report was written by Mr. M. MacLean and reviewed by Mr. M. Devata, Supervising Engineer.

M Maclean

M. Maclean, P. Eng.
Project Engineer

M. Devata

M. Devata, P. Eng.
Supervising Engineer

MD/MM/km
January, 1977

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. R. Molaro,
Planning and Design Office,
Eastern Region, Kingston

From: Soil Mechanics Section,
Engineering Materials Office,
West Building, Downsview

Attention:

Date: January 12th, 1977

Our File Ref.

In Reply to

Subject: VEHICLE INSPECTION STATION HWY. 417, 1.0 MI. WEST OF HWY. 138 W.P. 2505-71-01, DISTRICT 9, OTTAWA

Further to our meeting of Thursday January 6th, 1977 please find attached a sketch showing the extent and location of surcharge loading as recommended by this office.

As shown on the sketch the subgrade supporting some curb and gutter in the vicinity of the approach slabs will be subject to surcharge loading. This area will undergo relatively large settlements during the surcharge loading period and negligible post construction settlements. Areas not subjected to surcharge loading are expected to undergo substantial post construction settlements. Differential settlements are anticipated between those sections of curb and gutter located within the surcharge loaded area and those located outside of the areas.

The extent of surchage loading shown on the attached sketch will minimize post construction maintenance problems only for the weigh scale complex.

A complete foundation investigation report for the revised location of the vehicle inspection station including the results of the subsurface investigation together with recommendations will be issued by this office within two weeks.

Malcolm Maclean

M. Maclean,
Project Engineer

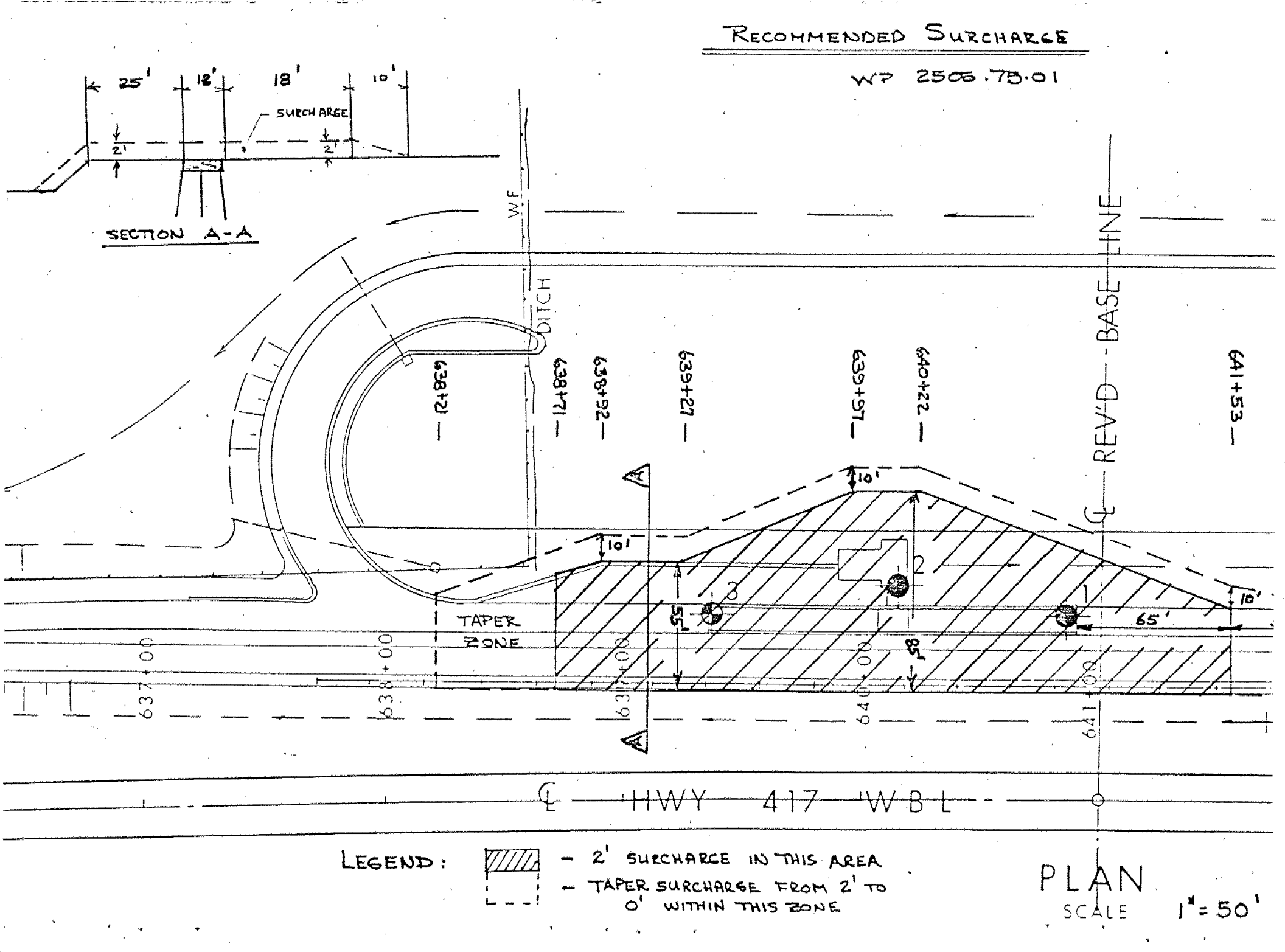
for M. Devata,
Supervising Engineer.

MM/km

c.c. D. McCune
K. Bassi
T. Kingsland
E.V. Saint
files
record services

RECOMMENDED SURCHARGE

WP 2506.75.01



LEGEND:

- 2' SURCHARGE IN THIS AREA
- TAPER SURCHARGE FROM 2' TO 0' WITHIN THIS ZONE

PLAN

SCALE 1" = 50'

APPENDIX

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 1

WP 2505 – 75-01 LOCATION W.B.L. STA 640+85 80' LT ORIGINATED BY MM

DIST 9 HWY 417 BORING DATE December 14 1976 COMPILED BY MM

DATUM GEODETIC BOREHOLE TYPE HOLLOW STEM AUGERS CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH PSF ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 400 800 1200 1600 2000	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W / WATER CONTENT % 25 50 75 100	UNIT WEIGHT γ pcf	REMARKS % GR SA SI CL
211.3						ELEV				
	Topsoil					210				
1.0	Mottled Reddish Brown and Grey		1	SS	5	209.2	+ s= 12			ORG. 4.4%
			2	TW	PH		+ s= 4			
	Clay Sensitive Grey		3	SS	1		+ s=2			
	Very SoftTo firm Occassional Seams or Pockets of Silt and Organics		3A	TW	PH	200				
			4	SS	1		+ s=12 ● × s= 4 + s=9			
			5	PS	PH				92.0	ORG. 1.1%
			6	SS	1/18"		+ s= 5			
			7	TW	PH	190	+ s=6			
			8	SS	1/18"		+ s= 7			
			9	TW	PH					
176.3						180				
35.0	Glacial Till – Wet. Mixture of Gravel & Sand, Trace of Silt & Clay. Compact		10	SS	16			○		63-26-8-3
171.6										
39.7	Auger Refusal Probable bedrock					170–				

20
15 ⊹ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 2

WP 2505 - 75 - 01 LOCATION W.B.L. STA 640 + 12 92' LT ORIGINATED BY M M

DIST 9 HWY 417 BORING DATE December 14 1976 COMPILED BY M M

DATUM GEODETIC BOREHOLE TYPE Hollow Stem Augers CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH PSF (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (400 800 1200 1600 2000)	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W (W_P W W_L) WATER CONTENT % (25 50 75 100)	UNIT WEIGHT γ PCF	REMARKS % GR SA SI CL
211.5										
0.0	Topsoil									
1.0	Mottled Reddish Brown and Grey		1	SS	8	210				
						209.0	+ S=5, ×S=3			
			2	TW	PH				97.0	
			3	SS	1/18"		+ S=2			
						200				
	Clay Sensitive Grey Very Soft to firm		4	TW	PM		× S=3, + S=5			e_o = 1.7, C_c = 1.1
			5	SS	1/18"		+ S=7			
	Occassional Seams or Pockets of Silt and Organics					190				
			6	TW	PH					e_o = 1.5, C_c = 0.6
			7	PS	PH		+ s=5, × s=6, + s=4		105	
						180				
173.5			8	SS	1/18"		+ s=5			
38.0	Glacial Till - Het. Mixture of Gravel & Sand, Trace of Silt & Clay. Compact		9	SS	30			○		42-46-10-2
169.5						170				
42.0	Auger Refusal Probable Bedrock									

20
15 ⊹ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 3

WP 2505 - 75 - 01 LOCATION W. B. L. STA. 639 + 37 80' LT ORIGINATED BY M M

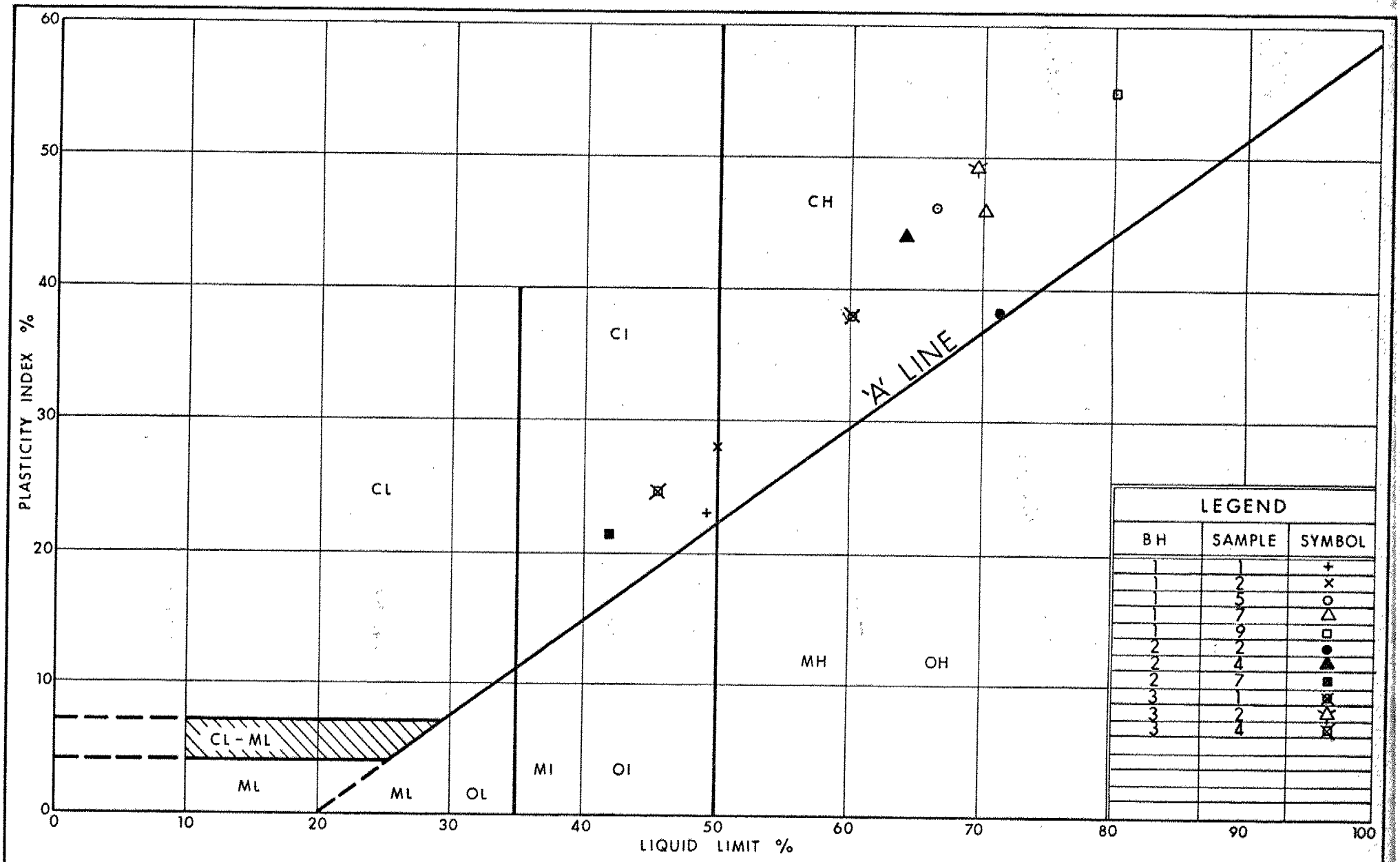
DIST 9 HWY 417 BORING DATE December 15 1976 COMPILED BY M M

DATUM GEODETIC BOREHOLE TYPE Hollow Stem Augers and Cone CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT PSF	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV	20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 400 800 1200 1600 2000	W_P W W_L WATER CONTENT % 25 50 75 100	γ PCF	% GR SA SI CL
211.2										
1.0	TOPSOIL					210				
	Mottled Reddish Brown and Grey					208.9				
	Clay Sensitive Grey Very Soft To Firm		1	SS	1		+ s=2			
	Occasional seams or pockets of silt and organics		2	TW	PH	200	× s= 4 + s= 5 + s= 8		92.5	
			3	TW	PM	190	+s= 9 + s=11			
			4	TW	PM	180	● × s=9 + s=8		100.0	
			5	SS	1					
169.2	Glacial Till V. Dense		6	SS	50/2"	170	100/ 0" Bouncing			9-11-60-20
42.0	Auger Refusal Probable Bedrock									

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

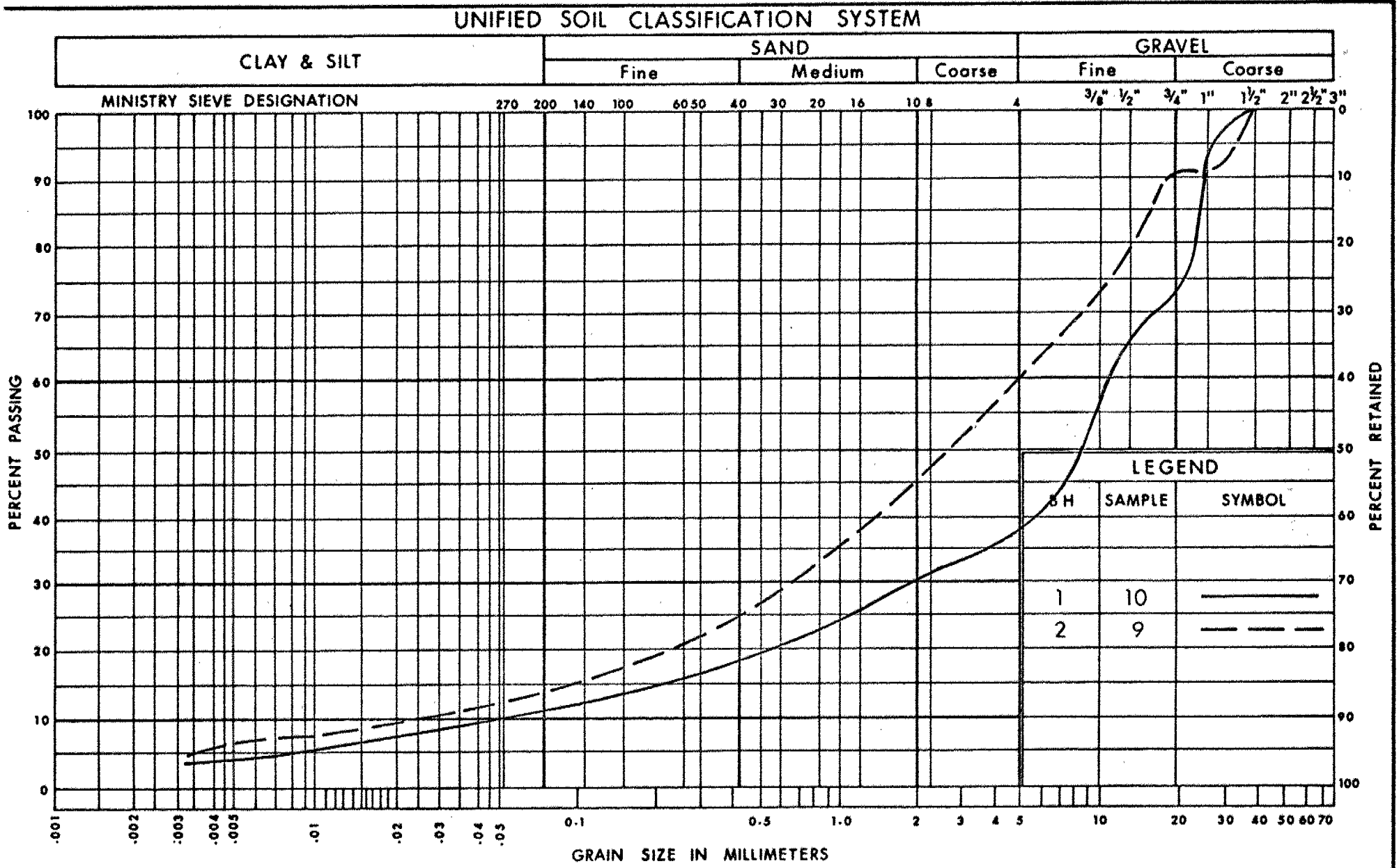


Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

PLASTICITY CHART
CLAY

FIG No 1
W P 2505-75-01

Oct 75, FF-S-22



Ministry of Transportation and Communications
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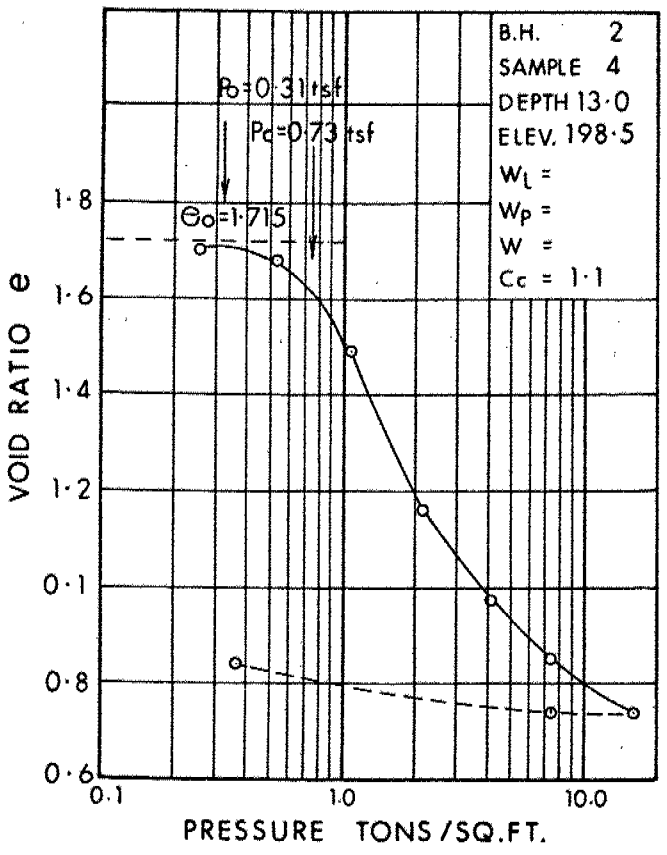
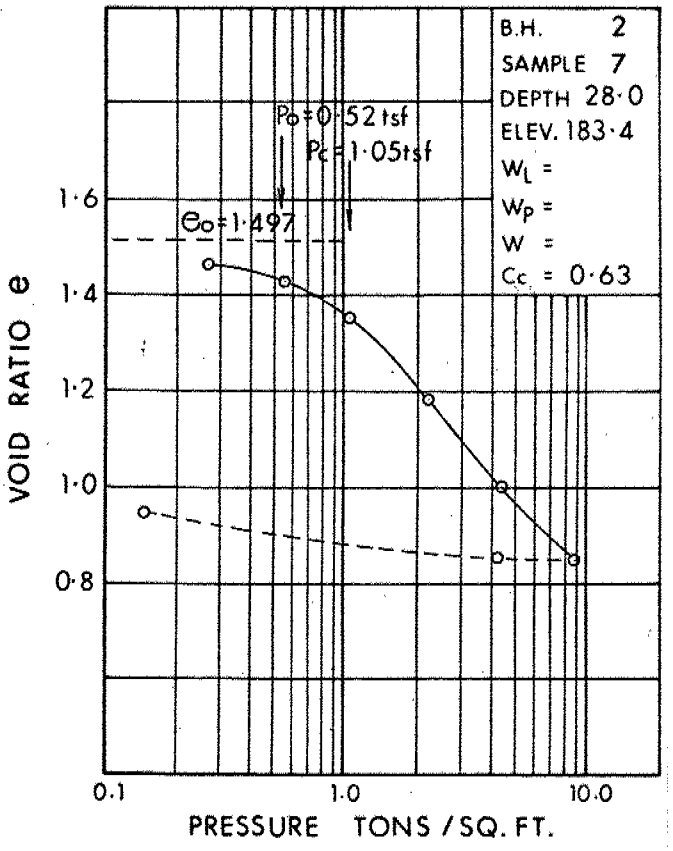
GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIX OF GRAVEL & SAND TRACE OF SILT & CLAY

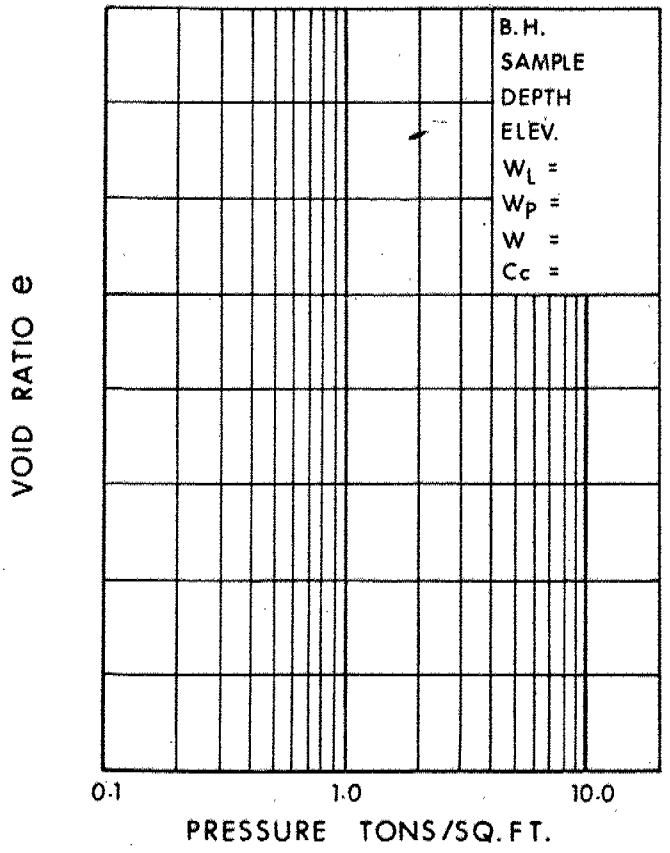
FIG No 2
W P 2505-75-01

VOID RATIO – PRESSURE CURVES

WP 2505-75-01







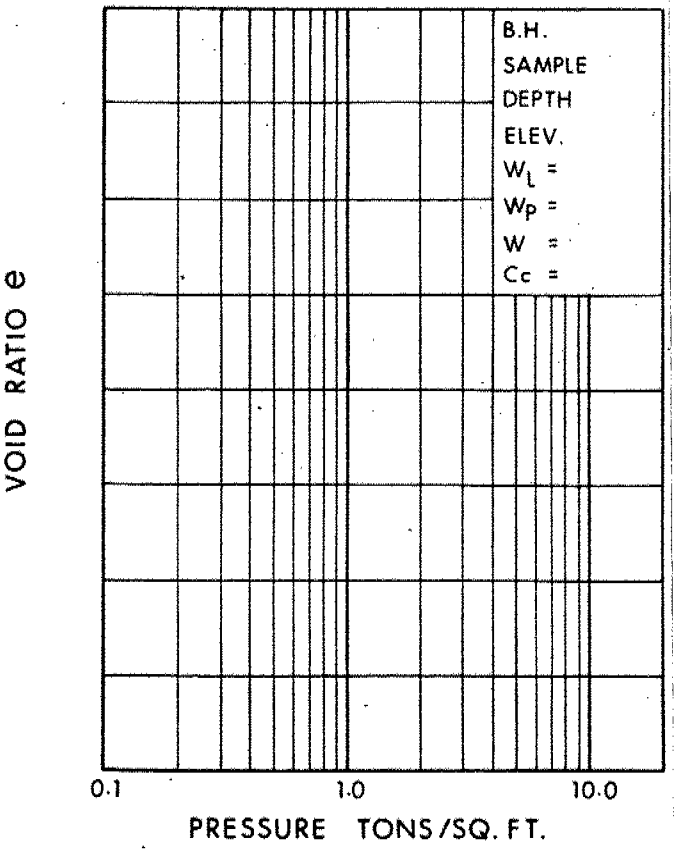


FIG. 3

FF-71

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

'N' = STANDARD PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

CONSISTENCY	c LB/SQ.FT.
VERY SOFT	0 - 250
SOFT	250 - 500
FIRM	500 - 1000
STIFF	1000 - 2000
VERY STIFF	2000 - 4000
HARD	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O S	OESTERBERG SAMPLE
A S.	AUGER SAMPLE	F S	FOIL SAMPLE
C S	CHUNK SAMPLE	R.C	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_P	PLASTIC LIMIT
I_P	PLASTICITY INDEX
w_S	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_P}{I_P}$
I_C	CONSISTENCY INDEX $= \frac{w_L - w}{I_P}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta \sigma'}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma'}$
T_v	TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

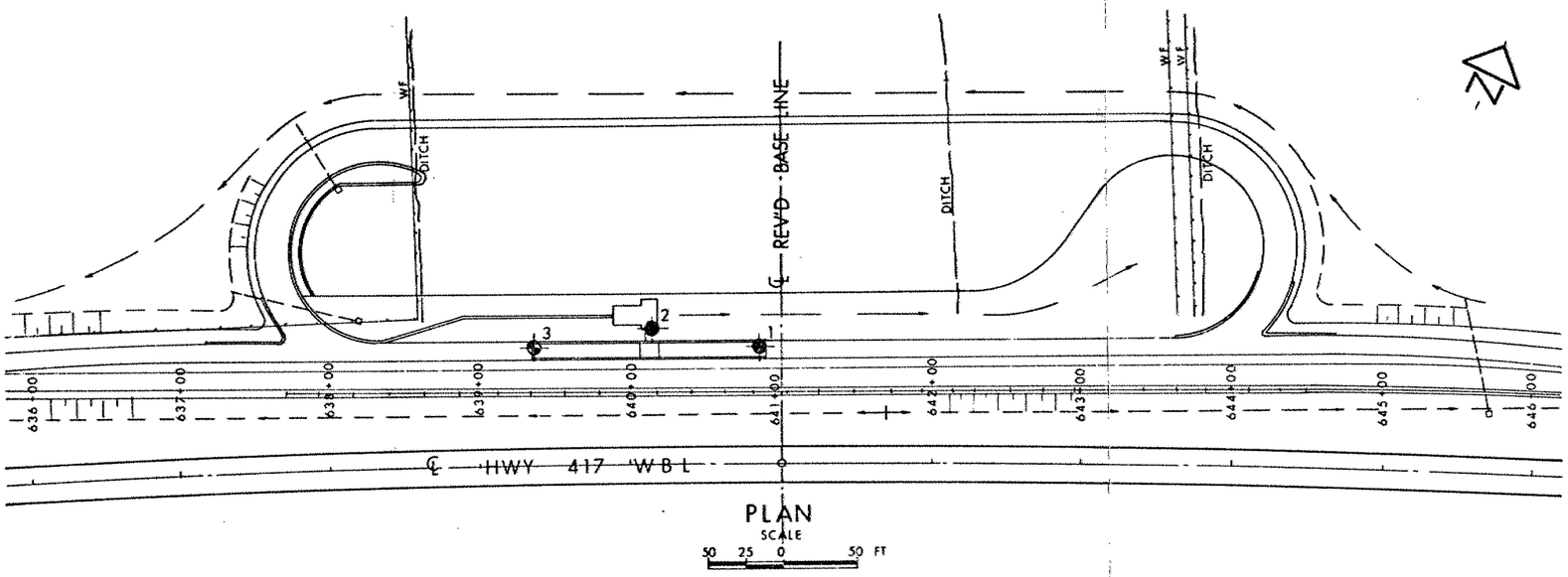
08-MT-308 10-75

CONT No
WP No 2505-75-01

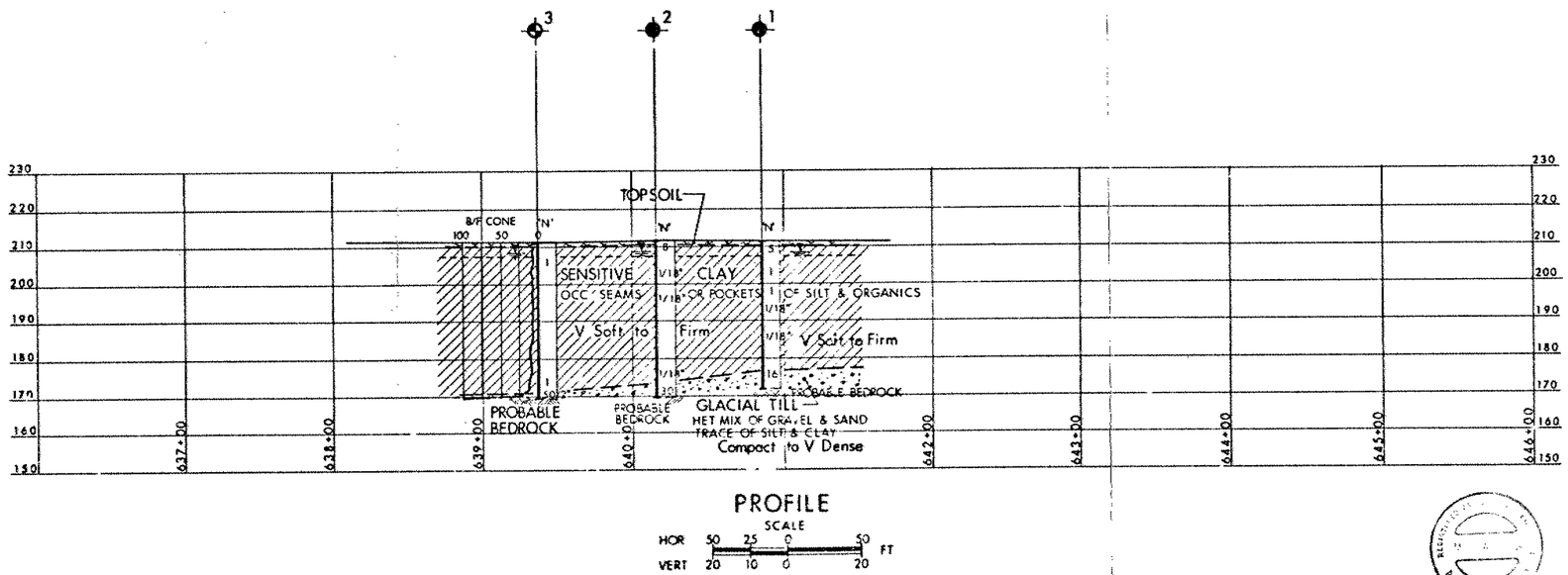
VEHICLE INSPECTION STATION RELOCATION

BORE HOLE LOCATIONS & SOIL STRATA

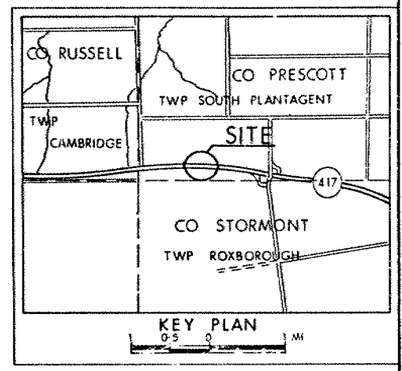
SHEET



PLAN
SCALE
50 25 0 50 FT



PROFILE
SCALE
HOR 50 25 0 50 FT
VERT 20 10 0 20



KEY PLAN
0·5 0 MI

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation DEC 1976

No	ELEVATION	STATION	OFFSET
1	211·3	640+85	80' LT
2	211·5	640+12	92' LT
3	211·2	639+37	80' LT

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

REVISIONS

DATE	BY	DESCRIPTION

REF. DWG No W-606-417-1

HWY No 417			DIST 9
SUBM'D M	CHECKED	DATE 05 01 77	SITE
DRAWN O J	CHECKED	APPROVED	DWG 25057501-A

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31G-177

DIST. 9 REGION Eastern

W.P. No. 2505-75-01

CONT. No. 77-408

W.O. No.

STR. SITE No.

HWY. No. 417

LOCATION Vehicle Inspection Station, 1.0 mi West of Hwy. 138

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 2

REMARKS (1) documents to be unfolded before microfilming

(2) TO BE ADDED TO EXISTING MICROFILM

G.I.-30 SEPT 1976

316-177

~~316-176~~

GEOCRES No.

FOUNDATION INVESTIGATION & DESIGN REPORT

W.P. 2505-75-01 DIST. 9

HWY. 417 STR. SITE N/A

Vehicle Inspection Station
1.0 Miles West of Hwy. 138

DISTRIBUTION

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GEOCRES 316-177 ~~316-176~~

DATE AUG 2 7 1976

INTRODUCTION

It is proposed to construct a service area on Hwy. 417 near Casselman. The proposed service area is to include a vehicle inspection station. The site is located on property which was previously acquired by the Ministry. Upon investigation by Regional Materials and Testing, the proposed site was found to be underlain by soft clay. The presence of soft clay would impose complex foundation problems on the proposed weigh scale system. As a result of this finding, this Section was requested to provide recommendations (memo dated April 26, 1976). A foundation investigation was carried out to determine the strength and compressibility characteristics and the extent of the clay deposit.

This report contains the results of this investigation and recommendations for the design and construction of the vehicle inspection station; scales, approaches, building and embankment.

SITE DESCRIPTION AND GEOLOGY

The site is located about 1 mile west of the intersection of Hwy. 138 and 417 to the north of Hwy. 417, WBL.

The site and surrounding area are flat and poorly drained. The area is used mainly for farmland and has been cleared of trees. At the time of the investigation the site was dry but available information indicates that the site is inundated with about 1 ft. of surface water in the spring season.

Geologically, the site lies in the Winchester Clay Plains Region. The predominant deposit is a sensitive marine clay locally know as Leda Clay. The clay was deposited by glacial Lake Champlain. The cohesive deposit is underlain by a thin layer of glacial till which is underlain by limestone bedrock of the Trenton Black River formation, Ordovician period.

FIELD AND LABORATORY WORK

The field work consisted of three sampled boreholes and one dynamic cone test. The investigation was carried out using a muskeg vehicle mounted drilling machine with hollow stem augers.

Disturbed samples were obtained using a 2" O.D. split spoon sampler. The split spoon was driven according to the specifications for the Standard Penetration Test with a driving energy of 350 ft-lb. per blow. Relatively undisturbed samples were recovered using 2" I.D. shelby tubes. The shelby tubes were pushed manually or hydraulically into the soil. Together with sampling, field vane tests were carried out to obtain in situ undrained shear strengths of the cohesive stratum.

The locations and elevations of all the boreholes were surveyed by personnel from Kingston Region, Engineering Surveys Section and are shown on Dwg. 25057501-A.

Samples were visually examined and identified in the field and again in the laboratory. Laboratory tests were conducted on representative samples to determine:

Atterberg Limits
Natural Moisture Contents
Bulk Densities
Undrained Shear Strengths Characteristics
Consolidation Characteristics

The results of the field and laboratory tests are summarized in the Record of Borehole Sheets and on the Plasticity Chart.

SUBSURFACE CONDITIONS

General

Immediately below a thin cover of topsoil (approx. 1 ft. thick) is the predominant stratum of soft sensitive clay. This clay stratum is about 32 ft. thick. The clay overlies a 1 ft. to 5 ft. thick deposit of glacial till. The glacial till overlies limestone bedrock.

The boundaries between the soil strata as determined by this investigation are shown in the Record of Borehole Sheets. A stratigraphical section shown on Dwg. 25057501-A is inferred from this data.

A summary of the subsoil conditions is presented in the following paragraphs.

Clay

Under the thin cover of topsoil is a clay deposit. The clay stratum is about 32 ft. thick across the site. The upper three ft. of the clay is brown and desiccated. Below this desiccated crust the clay is grey with

bands of brown clayey silt and silty clay. The upper 10 ft. of the clay also contains thin seams or pockets of silt and pockets of organics.

The physical properties of the clay stratum, as determined by field and laboratory testing, are summarized below:

		Range	Average
Natural Moisture Content (w)	%		
Liquid Limit (w_L)	%	39-77	58
Plastic Limit (w_p)	%	19-27	24
Liquidity Index (I_L)		0.9-1.8	1.4
Bulk Density (γ)		93-116	100

Undrained Shear Strength (C_u) psf		Sensitivity
Field Vanes	240-640	3-16
Laboratory Vanes	295-730	3-12
Quick Triaxial Tests	235-395	

Consolidation Tests

Initial Voids Ratio(e_0)	1.3-1.7
Compression Index (C_c)	1.1-1.6

The Atterberg limits which are shown on the Plasticity Chart indicate that the soil is of high plasticity. The liquidity indices of greater than 1 suggest that the soil is sensitive to disturbance and this is confirmed by field measurements of sensitivity as high as 16. Based on field and laboratory test results, the consistency of the clay is from very soft to firm increasing with depth except for the upper 3 ft. of dessicated crust which is firm in consistency. Consolidation tests on typical samples from this deposit indicate that the clay has been preconsolidated by a pressure of about 800 psf. in excess of the overburden pressure. Loads exceeding the preconsolidation pressure cause large settlements due to re-orientation of the flocculent clay structure. Available information from a previous nearby investigation suggest a similar preconsolidation pressure and slightly higher existing void ratios and co-efficient of consolidation.

Heterogeneous Mixture of Gravel and Sand Traces of Silt and Clay

Underlying the clay stratum is a thin layer of very dense glacial till. The material in this deposit is basically gravel and sand with traces of silt and clay. The layer is of variable thickness to a maximum of about 5 ft. at the site. From the Standard Penetration Test 'N' values of 110 blows per foot and together with the nature of the augering operation, it is estimated that the relative density of the glacial till is very dense.

Bedrock

Bedrock was not proven, but according to available subsurface information at this area, the glacial till is underlain by limestone bedrock. It is further inferred that wherever the augers met refusal is considered to be the probable bedrock surface.

Groundwater Conditions

Groundwater observations were made during the 24 hours after the completion of one borehole (B.H. 1). The water level was found to be at elev. 206.6 ft., approximately five ft. below the ground level. Stabilized water levels were not established in the remaining two boreholes due to time constraints.

In spring the surface of the site is reported to be inundated with one ft. of surface water. This water remains perched upon the clay stratum.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to construct a vehicle inspection station along Hwy. 417 near Casselman. The proposed weigh scale arrangement consists of a 20 ft. x 30 ft. steel and masonary building, a 13 ft. x 17 ft. scale pit, a 5 ft. x 7 ft. connecting pit and two 12 ft. x 70 ft. long reinforced concrete approach slabs. The grade at the scales and building is to be at elevation 217.6. This is approximately 6 ft. above the existing ground at elevation 211.5. The proposed service area grade is about 2 ft. above that of the existing Hwy. 417 WBL which is at elevation 215.6.

The subsurface investigation reveals a thin 1 ft. cover of topsoil overlying 32 ft. of soft to firm sensitive and compressible clay. The clay stratum overlies a thin 1 ft. to 5 ft. thick layer of dense glacial till composed of sand and gravel.

According to design requirements for acceptable operation of the scale mechanism the weighing scale pit and slabs must remain almost dead level after construction.

The allowable tolerance is limited to 3/8" for end to end rotation of the scale pit. The building and connecting pit will tolerate a maximum

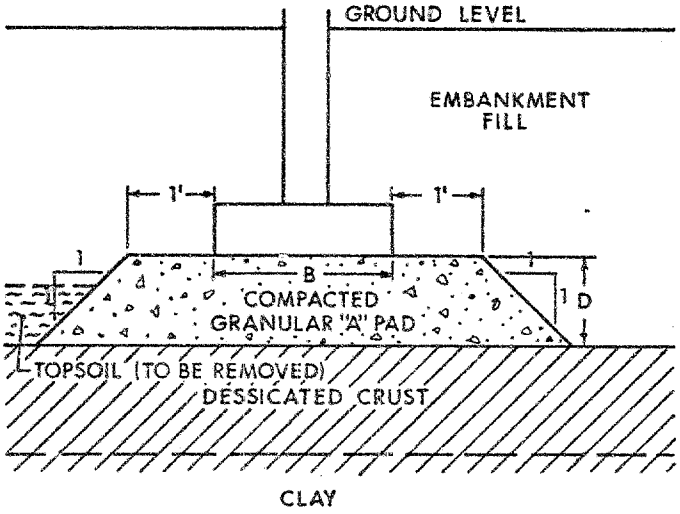
of one inch differential settlement. It is required to develop a scheme which will meet the above requirements without any continued maintenance problems.

As a result of several discussions about this project with the Ministry's Structural Office and other agencies, various foundation schemes have been proposed for the design of the vehicle inspection station, scales, approaches and building.

Foundation Considerations

Scale building: It is proposed to found the scale building on spread footings within the fill material. In this scheme it is necessary to provide a minimum of 1 ft. of granular pad beneath the footings. The scheme shown in Fig. #1 should be adopted.

FIG No 1



THE DEPTH (D) OF THE GRANULAR PAD SHOULD BE ONE THIRD THE FOOTING WIDTH (B) OR A MINIMUM OF 1'

$D = B/3 \geq 1'$

It is essential that the desiccated clay crust be preserved. If the crust is preserved and the suggested scheme used, an allowable bearing capacity of ½ tsf can be used. Settlement will take place as discussed under "Settlement".

Connecting Pit: According to information supplied by the Structural Office, a hollow box type connecting pit joins the scale building to the weighing pit. The connecting pit will impose less load on the soil than will the surrounding fill. To minimize differential settlement it is advantageous to increase the bearing pressure under the connecting pit to be similar to that under the surrounding fill and the scale building

footings. The connecting pit and linkages should be designed to accomodate differential settlements between the scale house and scale pit.

Weighing pit: The weighing pit is subject to significant dead loads and transient vertical and horizontal axle loading. The weighing pit is sensitive to differential settlements. End to end rotations must not exceed 3/8". Two foundation schemes have been provided to satisfy this settlement constraint.

(a) Mat foundation: If the weighing pit is placed on a mat foundation it is necessary to provide a minumum 2 ft. granular 'A' pad between the base of the scale pit and the top of the desiccated clay. The footing can be designed with an allowable pressure of ½ tsf.

(b) Piles or concrete caissons: To ensure acceptable operation of the scale mechanism it may be required to support the weighing pit on end bearing piles or caissons. Timber or steel 'H' piles or concrete caissons can be used. The tips of the piles or caissons should be founded within the very dense glacial till or on the bedrock surface. Pile capacities are discussed under 'Entire Complex'.

Approach slabs: The proposed approaches to the weighing pit consist of two 12 ft. by 70 ft. long by 9 in. thick reinforced concrete slabs. It is necessary that the approaches settle only nominally after construction to ensure accurate operation of the scales. For this reason it may be beneficial to support all or part of the approaches on piles. If only part of the slab is supported on piles there would be differential settlement between the pile supported section and the soil supported section. This differential settlement would require occasional maintenance. The slab must be designed to span between piles.

Dewatering: Because of the impervious nature of the soil no major dewatering problems are anticipated. According to the proposed scheme, there will be no excavation below the water level. Any surface runoff into the excavations could be removed by pumping from sumps.

Settlement Considerations

Embankment: The total settlement of the 6 ft. embankment is estimated to be approximately 6 in. Of the 6 inches, 2 inches would be due to recompression and would occur during construction of the embankment.

Ninety percent of the remaining 4 inches of settlement would occur during the first twelve months.

Weighing pit and scale building: If the weighing pit is supported by a mat foundation, an additional 2 inch settlement would take place. A similar 2 inch settlement would take place under the spread footings supporting the scale building.

Approach slabs: The approach slabs, if supported on soil, would settle approximately as the surrounding embankment. If all or part of the slabs were supported on piles or caissons, the remainder of the slab and/or the surrounding embankment will settle. In either case some differential settlement will occur and maintenance will be required.

Entire Complex

The expected settlements may exceed the allowable tolerances of the system. If such settlements are not acceptable the entire system including the building, connecting pit, weighing pit and approach slabs could be placed on wooden piles, steel 'H' piles or concrete caissons. To allow for negative skin friction forces the pile or caisson capacities should be reduced by 20%. Due to the sensitive nature of the clay, caissons would require a permanent or temporary liner to prevent caving of the clay. For a 30 inch diameter caisson an allowable capacity of 200 tons less the above reduction can be used.

It should be noted that differential settlements up to 4 inches can be anticipated if the approach slabs are supported on piles, whereas the rest of the weigh scale system is not.

To minimize post construction settlement problems the following construction techniques could be adopted:

1. Preload the site for 12 months to the full fill height, or alternatively,
2. Apply a 2 ft. surcharge above the full fill height for 6 months.

Either of these schemes will induce the same magnitude of settlement.

MISCELLANEOUS

The field work for this investigation was carried out on June 8 and June 9, 1976 under the supervision of Mr. E.C. Lane, Project Engineer. The equipment used for the investigation was owned and operated by Hawthorne Drilling Co. Ltd., Ottawa. This report was written by Mr. E.C. Lane and reviewed by Mr. M. Devata, Supervising Engineer.

H. Shah

For: E.C. Lane
Project Engineer

M. Devata, P. Eng.
Supervising Engineer

August/76
MD/gs

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 2505-75-01 LOCATION Sta. 631+48 ℄ WBL Hwy.#417 o/s 90' Left ORIGINATED BY T.L.

DIST 9 HWY 417 BORING DATE June 8 & 9 ,1976 COMPILED BY T.L.

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger and Cone Test CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV
211.4	Ground Level					
0.0	Topsoil		1A 1B	SS	6	210
1.5	Brown Desiccated		2	TW	PH	
	Clay- Sensitive Grey Very Soft to Firm (Occasional seams or pockets of silt and organics in the upper 10 feet.)		3	TW	PH	
			4	TW	PH	200
			5	TW	SANK	
			6	TW	SANK	190
			7	TW	SANK	
179.4			8	SS	1	180
32.0	Glacial Till-Het. mixture of gravel & sand, Trace of silt & clay-Very Dense					
173.5						
37.9	End of Borehole Refusal to augering Probable Bedrock					

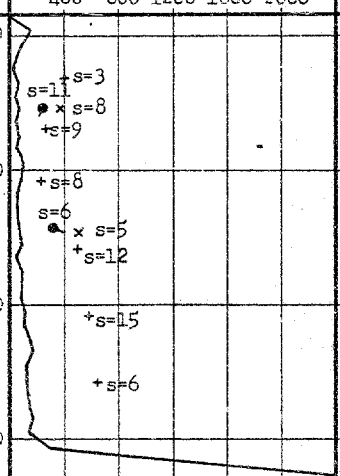
DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH PSF

○ UNCONFINED + FIELD VANE

● QUICK TRIAXIAL × LAB VANE

400 800 1200 1600 2000



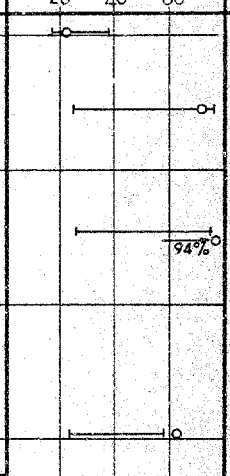
LIQUID LIMIT W_L

PLASTIC LIMIT W_P

WATER CONTENT W

W_P W W_L

WATER CONTENT % (20 40 60)



UNIT WEIGHT γ P.C.F	REMARKS	% GR	SA	SI	CL
95					
93					

20
15 ○ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

WP 2505-75-01 LOCATION Sta. 630+70 ℄ WBL Hwy.#417 o/s 95' Left. ORIGINATED BY T.L.

DIST 9 HWY 417 BORING DATE June 9,1976 COMPILED BY T.L.

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV
211.5	Ground Level					
0.0	Topsoil		1	SS	10	210
1.0	Brown Desiccated		2	SS	7	
			3	TW	PH	
	CLAY-sensitive Grey Very Soft to Soft (Occasional seams or pockets of silt and organics in the upper 10 feet.)		4	TW	PM	
			5	TW	PM	200
			6	TW	PM	
			7	SS	1/18"	190
188.5						
23.0	End of Borehole					

Note: W.L. not established.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH PSF

○ UNCONFINED + FIELD VANE

● QUICK TRIAXIAL × LAB VANE

400 800 1200 1600 2000

s=3 + s=5

● s=6 × s=16

+s=6

+s=7

+s=9

LIQUID LIMIT w_L

PLASTIC LIMIT w_P

WATER CONTENT w

w_P w w_L

WATER CONTENT %

20 40 60

UNIT WEIGHT γ P.C.F

94

REMARKS

e_o=1.7

C_c=1.1

P_c=0.75tsf

% GR SA SI CL

15 20 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

WP 2505-75-01 LOCATION Sta. 630+00 ℄ WBL Hwy.#417 o/s 80' Left. ORIGINATED BY T.L.

DIST 9 HWY 417 BORING DATE June 9, 1976 COMPILED BY T.L.

DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

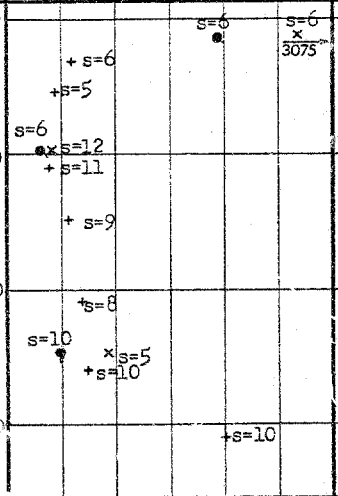
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
211.2	Ground Level					
0.0	Topsoil		1	SS	5	210
1.0	Brown Desiccated		2	TW	PH	
	CLAY - sensitive Grey Very Soft to Soft (Occasional seams or pockets of silt and organics in the upper 10 feet.)		3	SS	1	
			4	TW	PH	200
			5	SS	PM	
			6	SS	PM	190
			7	TW	PM	
179.2			8	SS	PM	180
32.0	Glacial Till-Het. mixture of gravel & sand, Trace of silt & clay. Very dense		9	SS	110	
174.7						
36.5	End of Borehole Refusal to Augering Probable Bedrock					

Note: W.L. not established.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH PSF (○ UNCONFINED ● QUICK TRIAXIAL ▷ FIELD VANE × LAB VANE)

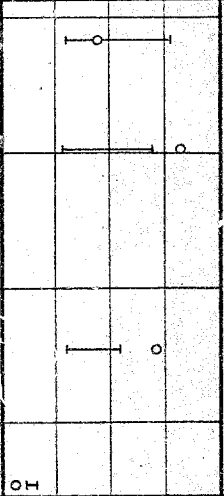
400 800 1200 1600 2000



LIQUID LIMIT ——W_L
PLASTIC LIMIT ——W_P
WATER CONTENT——W

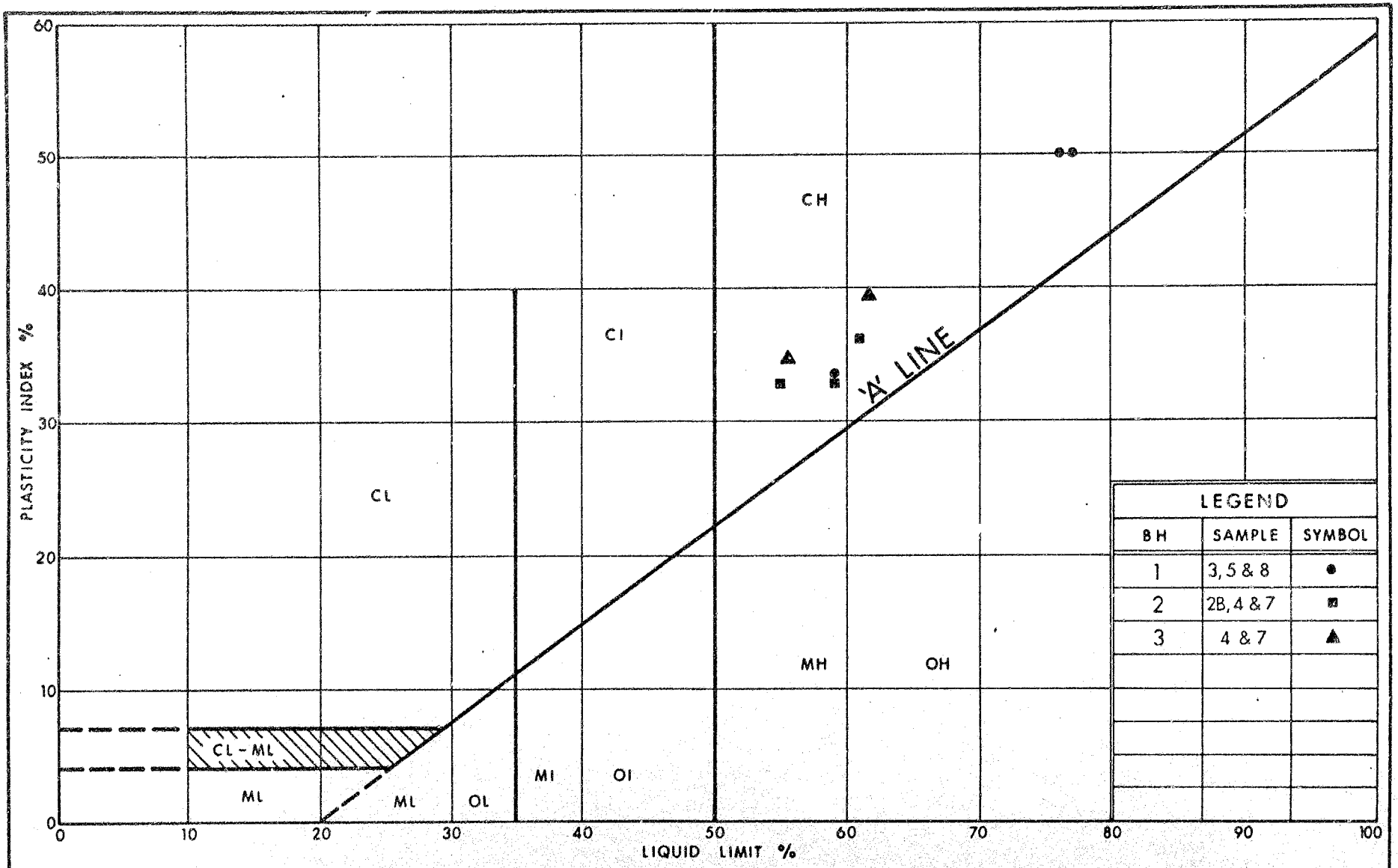
W_P W W_L

WATER CONTENT % 20 40 60



UNIT WEIGHT γ P.C.F	REMARKS	% GR SA SI CL
116		
97.5		
104		

20
15 ⊹ 5 % STRAIN AT FAILURE
10



Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

PLASTICITY CHART
CLAY

FIG No 2
W P 2505-75-01

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

'N' = STANDARD PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

CONSISTENCY	c LB/SQ FT
VERY SOFT	0 - 250
SOFT	250 - 500
FIRM	500 - 1000
STIFF	1000 - 2000
VERY STIFF	2000 - 4000
HARD	> 4000

DENSENESS	'N' BLOWS / FT
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

TERMS TO BE USED IN DESCRIBING SOILS -

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC

TYPE OF SAMPLE

S.S	SPLIT SPOON	T W	THINWALL OPEN
W.S	WASHED SAMPLE	T P	THINWALL PISTON
S.T	SLOTTED TUBE SAMPLE	O S	OESTERBERG SAMPLE
A S	AUGER SAMPLE	F S	FOIL SAMPLE
C S	CHUNK SAMPLE	R.C	ROCK CORE

P H SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L V	LABORATORY VANE
U U	UNCONSOLIDATED UNDRAINED TRIAXIAL	F V	FIELD VANE
C I U	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
C I D	" " DRAINED "	S	SENSITIVITY
C A U	" ANISOTROPIC UNDRAINED "		
C A D	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_P	PLASTIC LIMIT
I_P	PLASTICITY INDEX
w_S	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_P}{I_P}$
I_C	CONSISTENCY INDEX $= \frac{w_L - w}{I_P}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta\sigma'}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10}\sigma'}$
T_v	TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan\phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan\phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

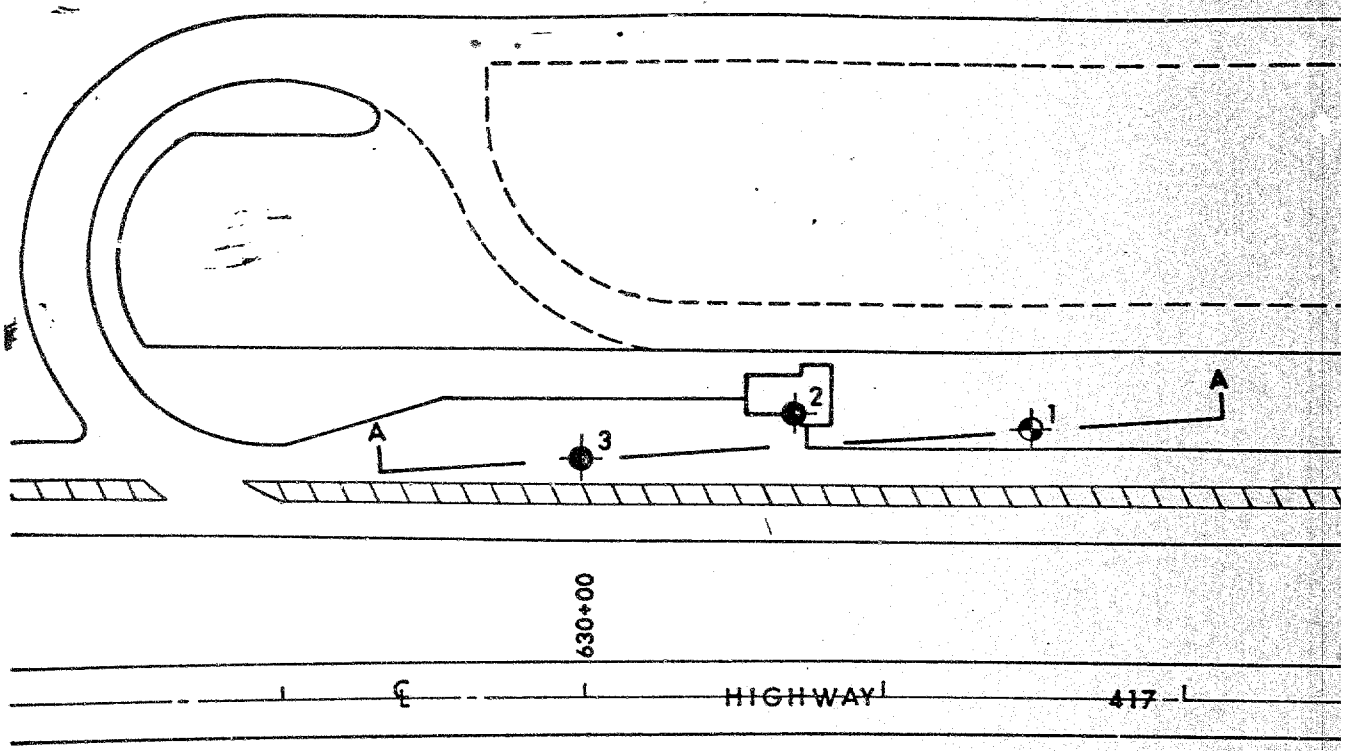
$\bar{d}$	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

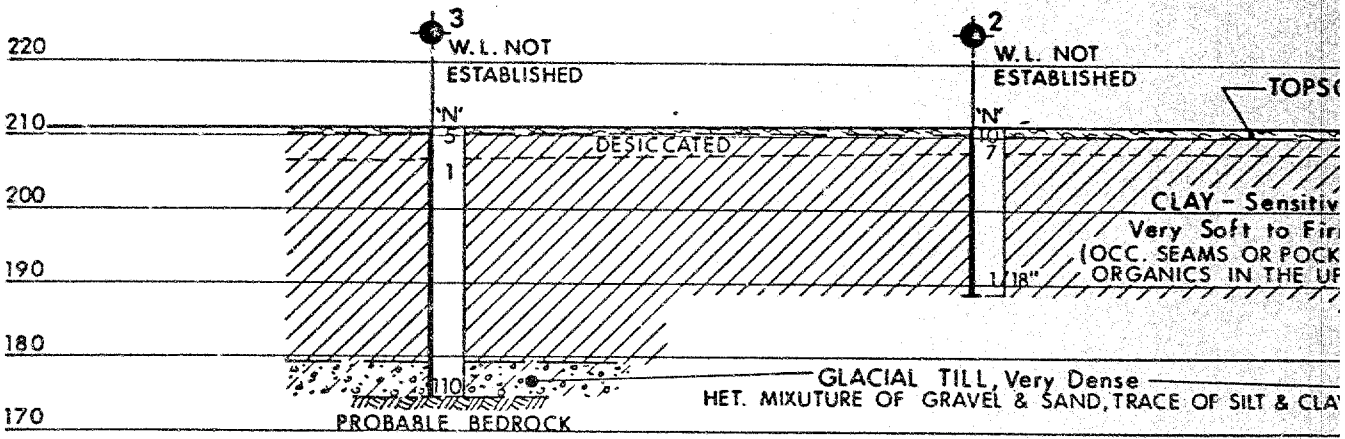
SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



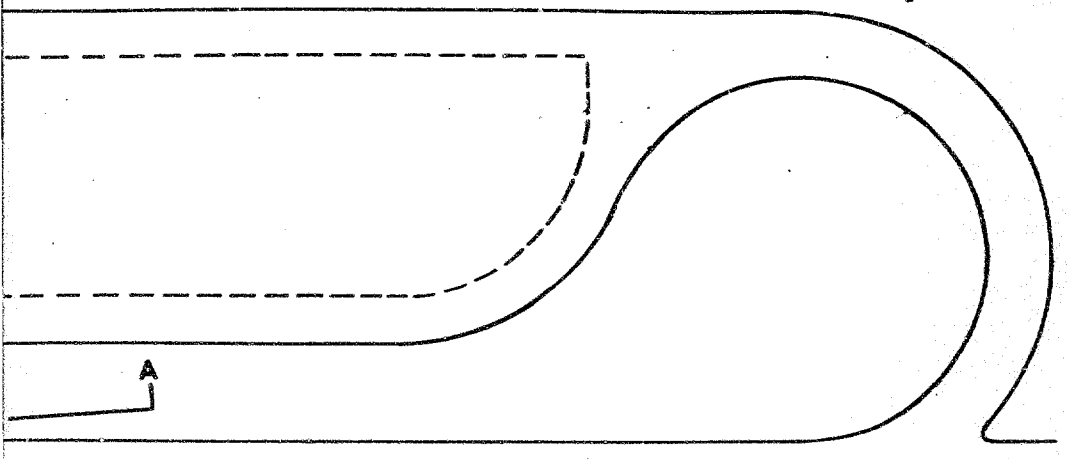
PLAN

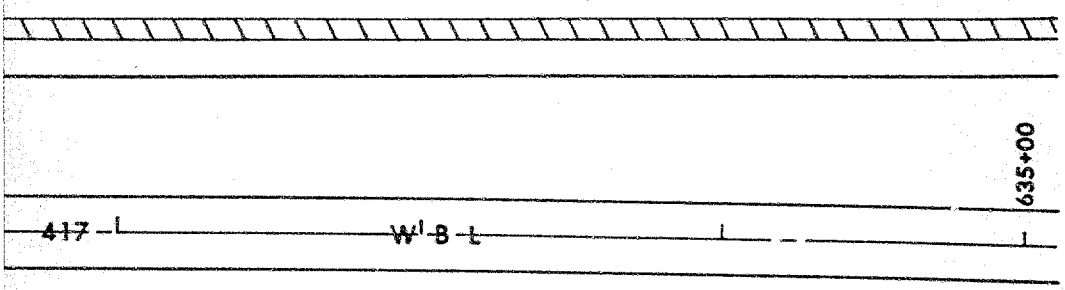
SCALE 50 25 0 50 100 FT



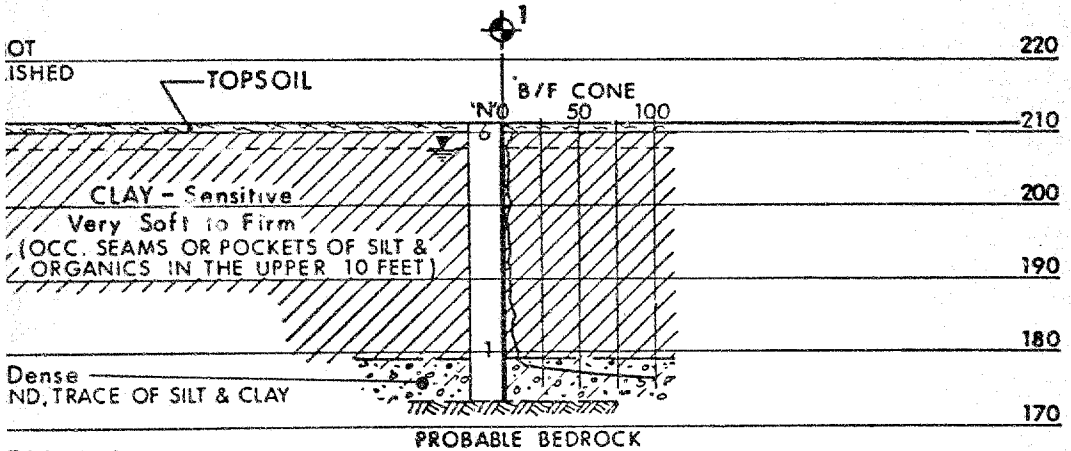
SECTION A-A

SCALE 20 10 0 20 40 FT





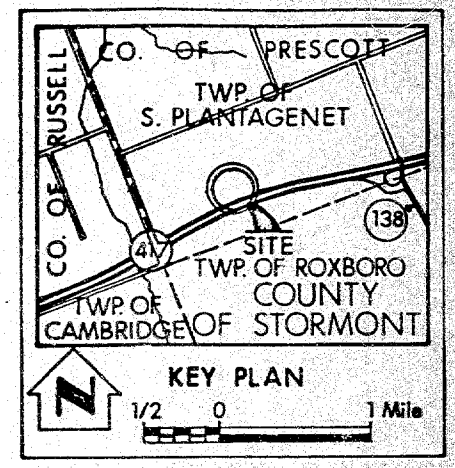
AN
ALE 50 100 FT

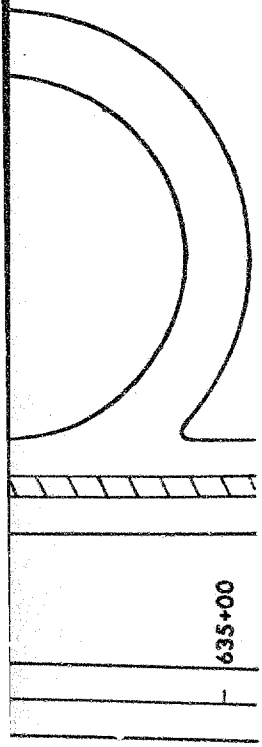


ON A-A
ALE 20 40 FT

REF Dwg No W-606-417-1; Jan 1976

Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH
DATE Aug 23, 1976





220
210
200
190
180
170

LEGEND

- Bore Hole
- Bore & Cone Penetration Hole
- Water Level established at time of field investigation, JUNE 1976

NO.	ELEVATION	STATION	OFFSET
1	211.4	631+48	90'LT
2	211.5	630+70	95'LT
3	211.2	630+00	80'LT

Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

VEHICLE INSPECTION STATION

HWY 417

V-606-417-1; Jan 1976

DATE Aug 23, 1976

WP 2505-75-01

Dwg No 25057501-A

FOUNDATION INVESTIGATION & DESIGN REPORT

W.P. 2505-75-01 DIST. 9

HWY. 417 STR. SITE N/A

Vehicle Inspection Station
1.0 Miles West of Hwy. 138

DISTRIBUTION

T.C. Kingsland (2)
R.S. Pillar
C.S. Grebski
B.J. Giroux
G.A. Wrong
S. Radbone
E.R. Saint
J.M. Childs

R. Hore

J. Anderson)
R. Forest) cover only
G. Sloan)

Files ✓

SAMPLE DISPOSITION NOTICE

TYPE	DISCARD AFTER	RECOMM. BY
JARS	Feb 15/77	D.S
TUBES	April 15/77	D.S
ROCK CORES		

GEOCRES 31G-177
GEOCRES No.

DATE FEB 0 3 1977

INTRODUCTION

This Section carried out a subsurface investigation at the original location for a vehicle inspection station approximately one mile west of Highway 138 on Highway 417. A detailed report for this original location, containing all the factual information, as well as recommendations pertaining to the design of the vehicle inspection station (scales, approaches, building and earth embankments) was submitted on August 27, 1976 (Report No. W.P. 2505-75-01). The location of the vehicle inspection station has recently been revised; the new location will be 938 feet east of the former approved location.

In a memorandum dated November 16, 1976 Mr. T. C. Kingsland, Regional Structural Planning Engineer, requested our office to carry out the investigation for the relocated site.

A subsurface investigation was carried out by the Soil Mechanics Section at the relocated site. This report presents the factual data obtained from the recent investigation together with our recommendations for the design and construction of the vehicle inspection station.

This report supercedes the foundation investigation report for the initial location of the vehicle inspection station submitted on August 27, 1976.

SITE DESCRIPTION AND GEOLOGY

The site is located about 1 mile west of the intersection of Highway 138 and 417 to the north of Highway 417, WBL.

The site and surrounding area are flat and poorly drained. The area is used mainly for farmland and has been cleared of trees. At the time of the investigation the site was dry but available information indicates that the site is inundated with about 1 foot of surface water in the spring season.

Geologically, the site lies in the Winchester Clay Plains Region. The predominant deposit is a sensitive marine clay locally known as Leda Clay.

The clay was deposited by the late Champlain Sea. The cohesive deposit is underlain by a thin layer of glacial till which is underlain by limestone bedrock of the Trenton-Black River Formation, Ordivician Period.

FIELD AND LABORATORY WORK

The field work consisted of three sampled boreholes and one dynamic cone test. The investigation was carried out using a muskeg vehicle mounted drilling machine with hollow stem augers.

Disturbed samples were obtained using a 2" O.D. split spoon sampler. The split spoon was driven according to the specifications for the Standard Penetration Test with a driving energy of 350 ft-lb. per blow. Relatively undisturbed samples were recovered using 2" I.D. Shelby tubes. The Shelby tubes were pushed manually or hydraulically into the soil. Together with sampling, field vane tests were carried out to obtain in-situ undrained shear strengths of the cohesive stratum.

The locations and elevations of all the boreholes were surveyed by personnel from Kingston Region, Engineering Surveys Section and are shown on Dwg. 25057501-A.

Samples were visually examined and identified in the field and again in the laboratory. Laboratory tests were conducted on representative samples to determine:

- Atterberg Limits
- Natural Moisture Contents
- Bulk Densities
- Undrained Shear Strengths
- Consolidation Characteristics

The results of the field and laboratory tests are summarized in Record of Borehole Sheets and on the Plasticity Chart, Figure 1; on the Grain Size Distribution Curves, Figure 2; and on the Consolidation e - log P Curves, Figure 3.

SUBSURFACE CONDITIONS

General

Immediately below a thin cover of topsoil (approx. 1 foot thick) is a deposit of very soft to firm sensitive clay. This clay stratum varies in thickness from 34 to 40 feet. The clay overlies a 1 foot to 5 foot thick deposit of glacial till. According to available local geological information the glacial till is underlain by limestone bedrock.

The boundaries between the soil strata as determined by this investigation are shown in the Record of Borehole Log Sheets. A stratigraphical profile shown on Dwg. 25057501 - A is inferred from the borehole data.

A summary of the subsoil conditions is presented in the following paragraphs.

Clay

Under a thin cover of topsoil is a clay deposit. The clay stratum varies in thickness from 34 to 40 feet below ground surface. Immediately below the topsoil for a depth of 3 feet the clay is slightly desicated and has a mottled reddish brown to grey colour. The remainder of the deposit is generally grey in colour. Within this stratum random thin seams or pockets of silt and organics were encountered.

The physical properties of the clay deposit as determined by the field and laboratory testing are summarized below:

		Range	Average
Natural Moisture Content	(W)%	62 - 86	78
Liquid Limit	(W_L)%	60 - 80	69
Plastic Limit	(W_p)%	20 - 25	22
Liquidity Index	(I_L)	0.8 - 1.5	1.2
Bulk Density	(γ)pcf	93 - 105	97
Undrained Shear Strength	(C_u)psf		Sensitivity
In-Situ Vane Tests		220 - 960	4 - 12
Laboratory Tests		270 - 920	3 - 9
Consolidation Tests (Two Tests)			
Initial Void Ratio	(e_o)	1.5 - 1.7	
Compression Index	(C_c)	0.6 - 1.1	

The Atterberg Limits indicate that the cohesive stratum is an inorganic clay of intermediate to high plasticity. The natural moisture content of the deposit is generally higher than the Liquid Limit, resulting in a Liquidity Index of slightly greater than 1 for the overall deposit, which indicates that the soil is sensitive to remoulding. This is confirmed by the fact that the sensitivity of the soil, as measured in the field was as high as 12. The undrained shear strength as measured by the situ vane tests increases with depth from 220 psf to up to 960 psf except for the upper 3 foot zone where the shear strength was measured to be about 450 psf. Based on field and laboratory test results the consistency of clay varies generally from very soft to firm, increasing with depth except for the upper 3 foot zone where the consistancy is soft.

Consolidation tests on two samples from this deposit indicate that the clay has been preconsolidated by a pressure of about 800 - 1000 psf in excess of the effective overburden pressure.

Heterogenous Mixture of Gravel and Sand, Trace of Silt and Clay

Underlying the clay stratum across the site is a glacial till deposit consisting of a heterogenous mixture of gravel and sand with a trace of silt and clay. The thickness of this deposit varied between 1 to 5 feet. Based on the Standard Penetration Test 'N' values ranging from 16 blows per foot to 50 blows for 2 inches the relative density is estimated to be compact to very dense.

Bedrock

Bedrock was not proven but according to available subsurface information in this area, the glacial till is underlain by limestine bedrock. It is further inferred that wherever the augers met refusal is considered to be the probable bedrock surface.

Groundwater Conditions

Groundwater observations were made 24 hours after the completion of the boreholes. The water level was found to be approximately at elevation 209, which is approximately 2.5 feet below ground surface.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to construct a vehicle inspection station along Highway 417 near Casselman. The proposed weigh scale arrangement consists of a 20 foot x 30 foot steel and masonary building, a 13 foot x 17 foot scale pit, a 5 foot x 7 foot connecting pit and two 12 foot x 70 foot long reinforced concrete approach slabs. Fill heights at the relocated site are about 6 feet above existing ground surface.

The subsurface investigation reveals a thin 1 foot cover of topsoil overlying a 34 to 40 feet thick stratum of very soft to firm sensitive clay. The clay stratum overlies a thin 1 to 5 foot thick layer of compact to very dense glacial till, a heterogenous mixture of gravel and sand with a trace of s and clay.

According to design requirements for acceptable operation of the scale mechanism the weighing scale pit and slabs must remain almost dead level after construction. The allowable tolerance is limited to 3/8" for end to end rotation of the scale pit. The building and connecting pit will tolerate a maximum of one inch differential settlement. It is required to develop a scheme which will meet the above requirements without excessive continued maitenance problems.

The presence of the compressible very soft to firm clay deposit immediately below the ground surface requires that steps must be taken to ensure the overall stability of the approach embankments, and that settlements, differential as well as total, of the weigh scale arrangement are within tolerable limits.

Scale Building, Connecting Pit, Weighing Pit and Approach Slabs

As a result of several discussions about this project with the Ministry's Structural Office and other agencies, various foundation schemes have been proposed for the design of the foundations of the weigh scale mechanism. One of the schemes is to support the weigh scale arrangement on spread footings as outlined on page 5 of the previous report. Expected settlements of the weigh scale mechanism founded on spread footings were discussed in our previous report. Due to the sensitive nature of the weigh scale arrangement and to

ensure acceptable operation of the entire scale complex, the scale building, connecting pit, weighing pit and approach slabs should be supported on end bearing piles. Timber or steel 'H' piles founded on the bedrock surface or concrete caissons extended to the bedrock surface may be used. In consideration of the negative skin friction forces which will be induced because of the consolidation of the clay, it is recommended that the pile capacities should be reduced by 15%; i.e. 85% of their maximum allowable loads. For example a 12 BP 74 steel H pile may be designed for 80 tons per pile and a #14 timber pile for 20 tons per pile. Whereas, a 30 inch concrete caisson could be designed for 170 tons per caisson. Due to the sensitive nature of the clay, caissons would require a permanent or temporary liner to prevent caving in of the clay.

Because of the impervious nature of the clayey subsoil no major dewatering problems are anticipated. According to the proposed scheme, there will be no excavation below the water level. Any surface runoff into the excavations could be removed by pumping from sumps.

The pile caps should be provided with a minimum soil cover of 5 feet or equivalent insulation for frost protection purposes.

Earth Embankment Design Considerations

Stability Considerations

Analyses in terms of total stress have been carried out to determine the stability of fills immediately after construction. In this method of analysis, stability is governed by undrained shear strength properties of the foundation and fill materials. The following data and values were used in carrying out the stability analysis:

Fill Material

	γ (pcf)	ϕ^{o}	Cu(psf)
Locally Available Granular Material	130	30	0

Subsoil Foundation Material

Elevation (ft)	γ (pcf)	γ (pcf)	ϕ^o	Cu(psf)
206 - 212	110	48	0	400
199 - 206	95	33	0	230
194 - 199	95	33	0	370
189 - 194	95	33	0	500

The following are our recommendations based on the above analysis:

1) Fills up to 6 feet would be stable with side slopes of 2:1.
2) Fills up to 6 feet plus a 2 foot surcharge would also be stable with side slopes of 2:1.
3) Fills up to 6 feet plus a 4 foot surcharge with 10 foot long counter balancing berms at mid height on both sides of the embankment would be stable with side slopes of 2:1.

Settlement Considerations

The underlying compressible clay stratum will settle as a result of consolidation under the weight of the embankment. For the settlement computations the stresses induced within the subsoil by the embankment were computed by the Osterberg method. The soil parameters used in the settlement analyses were determined by laboratory consolidation tests, the results of which are shown on Figure 3.

Settlement analyses indicate that the maximum settlement due to consolidation of the clay deposit beneath a 6 foot fill height will be in the order of 6 inches. Since the clay deposit is slightly preconsolidated (Pc - Po $\doteqdot$ 900 psf) it is estimated that the settlement beneath the 6 foot fills will be about 2 inches due to the recompression of the subsoil and will occur during construction. Estimates of the time rate of settlement indicate that ninety percent of the remaining 4 inches of settlement would occur during the first 12 months after application of the embankment loading.

To minimize post construction settlement problems (total as well as differential settlements) between the earth fill approaches and the approach slabs, the following construction techniques could be adopted:

1) preload the site for a period of 12 months to the full height or alternatively
2) apply a 2 foot surcharge above the full fill height for a period of 6 months or alternatively

3) apply a 4 foot surcharge above the full fill height for a period of 4 months.

All of the above schemes will induce the same magnitude of settlements and the decision as to which method to employ should be based on construction scheduling and economic considerations.

At a meeting held in the Region January 6, 1977 between the Soil Mechanics Section and Regional Planning and Design Office it was decided that a 2 foot surcharge above the full fill height would be applied to the embankment for a period of six (6) months to reduce the anticipated post construction settlements. The Soil Mechanics Section provided recommendations for the extent of surcharge loading to be applied for the proposed scheme. A sketch showing the surcharge loading area together with a covering memorandum is appended to this report.

MISCELLANEOUS

The field work for the investigation was carried out from December 14 to December 16, 1976 under the supervision of Mr. M. MacLean, Project Engineer. The equipment used for subsoil sampling was owned and operated by Dominion Soil Investigation Ltd., Toronto, Ontario.

This report was written by Mr. M. MacLean and reviewed by Mr. M. Devata, Supervising Engineer.

M Maclean

M. Maclean, P. Eng.
Project Engineer

M. Devata

M. Devata, P. Eng.
Supervising Engineer

MD/MM/km
January, 1977

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. R. Molaro,
Planning and Design Office,
Eastern Region, Kingston

From: Soil Mechanics Section,
Engineering Materials Office,
West Building, Downsview

Attention:

Date: January 12th, 1977

Our File Ref.

In Reply to

Subject: VEHICLE INSPECTION STATION HWY. 417, 1.0 MI. WEST OF HWY. 138 W.P. 2505-71-01, DISTRICT 9, OTTAWA

Further to our meeting of Thursday January 6th, 1977 please find attached a sketch showing the extent and location of surcharge loading as recommended by this office.

As shown on the sketch the subgrade supporting some curb and gutter in the vicinity of the approach slabs will be subject to surcharge loading. This area will undergo relatively large settlements during the surcharge loading period and negligible post construction settlements. Areas not subjected to surcharge loading are expected to undergo substantial post construction settlements. Differential settlements are anticipated between those sections of curb and gutter located within the surcharge loaded area and those located outside of the areas.

The extent of surchage loading shown on the attached sketch will minimize post construction maintenance problems only for the weigh scale complex.

A complete foundation investigation report for the revised location of the vehicle inspection station including the results of the subsurface investigation together with recommendations will be issued by this office within two weeks.

Malcolm Maclean

M. Maclean,
Project Engineer

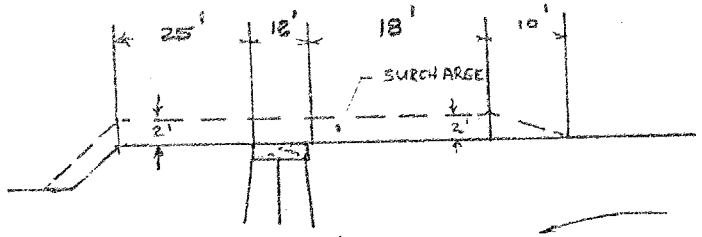
for M. Devata,
Supervising Engineer.

MM/km

c.c. D. McCune
K. Bassi
T. Kingsland
E.V. Saint
files
record services

RECOMMENDED SURCHARGE

WP 2506.78.01



SECTION A-A

LEGEND: ▨ – 2' SURCHARGE IN THIS AREA

– – – – TAPER SURCHARGE FROM 2' TO 0' WITHIN THIS ZONE

PLAN

SCALE 1" = 50'

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 1

WP 2505 – 75-01 LOCATION W.B.L. STA 640+85 80' LT ORIGINATED BY MM

DIST 9 HWY 417 BORING DATE December 14 1976 COMPILED BY MM

DATUM GEODETIC BOREHOLE TYPE HOLLOW STEM AUGERS CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH PSF ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 400 800 1200 1600 2000	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W / WATER CONTENT % 25 50 75 100	UNIT WEIGHT γ pcf	REMARKS % GR SA SI CL
211.3										
1.0	Topsoil					210				
	Mottled Reddish Brown and Grey		1	SS	5	209.2	+ s= 12			ORG. 4.4%
			2	TW	PH		+ s= 4			
	Clay Sensitive Grey		3	SS	1		+ s=2			
	Very Soft To firm Occassional Seams or Pockets of Silt and Organics		3A	TW	PH	200				
			4	SS	1		+ s=12 × s=4 ● s=9			
			5	PS	PH				92.0	ORG. 1.1%
			6	SS	1/18"		+ s= 5			
			7	TW	PH	190				
			8	SS	1/18"		s=6 + s= 7			
			9	TW	PH					
176.3						180				
35.0	Glacial Till – Het. Mixture of Gravel, Sand, Trace of Silt & Clay Compact		10	SS	16					63-26-8-3
171.6										
39.7	Auger Refusal Probable bedrock					170–				

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 2

WP 2505 - 75 - 01 LOCATION W.B.L. STA 640 + 12 92' LT ORIGINATED BY M M

DIST 9 HWY 417 BORING DATE December 14 1976 COMPILED BY M M

DATUM GEODETIC BOREHOLE TYPE Hollow Stem Augers CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH PSF (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w, WATER CONTENT %	UNIT WEIGHT γ PCF	REMARKS / % GR SA SI CL
211.5						ELEV	400 800 1200 1600 2000	25 50 75 100		
0.0	Topsoil					210				
1.0	Mottled Reddish Brown and Grey		1	SS	8	▼				
			2	TW	PH	209.0	+ S=5, × S=3		97.0	
			3	SS	1/18"					
						200	+ S=2			
	Clay Sensitive Grey Very Soft to firm		4	TW	PM		× S=3, + S=5			e_o = 1.7, C_c = 1.1
			5	SS	1/18"		+ S=7			
	Occassional Seams or Pockets of Silt and Organics					190				
			6	TW	PH		+ s=5, × s=6			e_o = 1.5, C_c = 0.6
			7	PS	PH		+ S=4		105	
						180				
173.5			8	SS	1/18"		+ s=5			
38.0	Glacial Till - het. Mixture of Gravel & Sand, Trace of Silt &		9	SS	30					42-46-10-2
169.5	Clay: Compact					170				
42.0	Auger Refusal Probable Bedrock									

20
15 ⊙ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

WP 2505 - 75 - 01 LOCATION W. B. L. STA. 639 + 37 80' LT ORIGINATED BY M M

DIST 9 HWY 417 BORING DATE December 15 1976 COMPILED BY M M

DATUM GEODETIC BOREHOLE TYPE Hollow Stem Augers and Cone CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV
211.2						210
1.0	TOPSOIL					
	Mottled Reddish Brown and Grey					208.9
	Clay Sensitive Grey Very Soft To Firm		1	SS	1	
	Occasional seams or pockets of silt and organics		2	TW	PH	200
			3	TW	PM	190
			4	TW	PM	180
			5	SS	1	
			6	SS	50/2"	
169.2	Glacial Till V. Dense					170
42.0	Auger Refusal Probable Bedrock					

DYNAMIC CONE PENETRATION RESISTANCE PLOT PSF
20 40 60 c 100
SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL AR E
400 800 1200 000

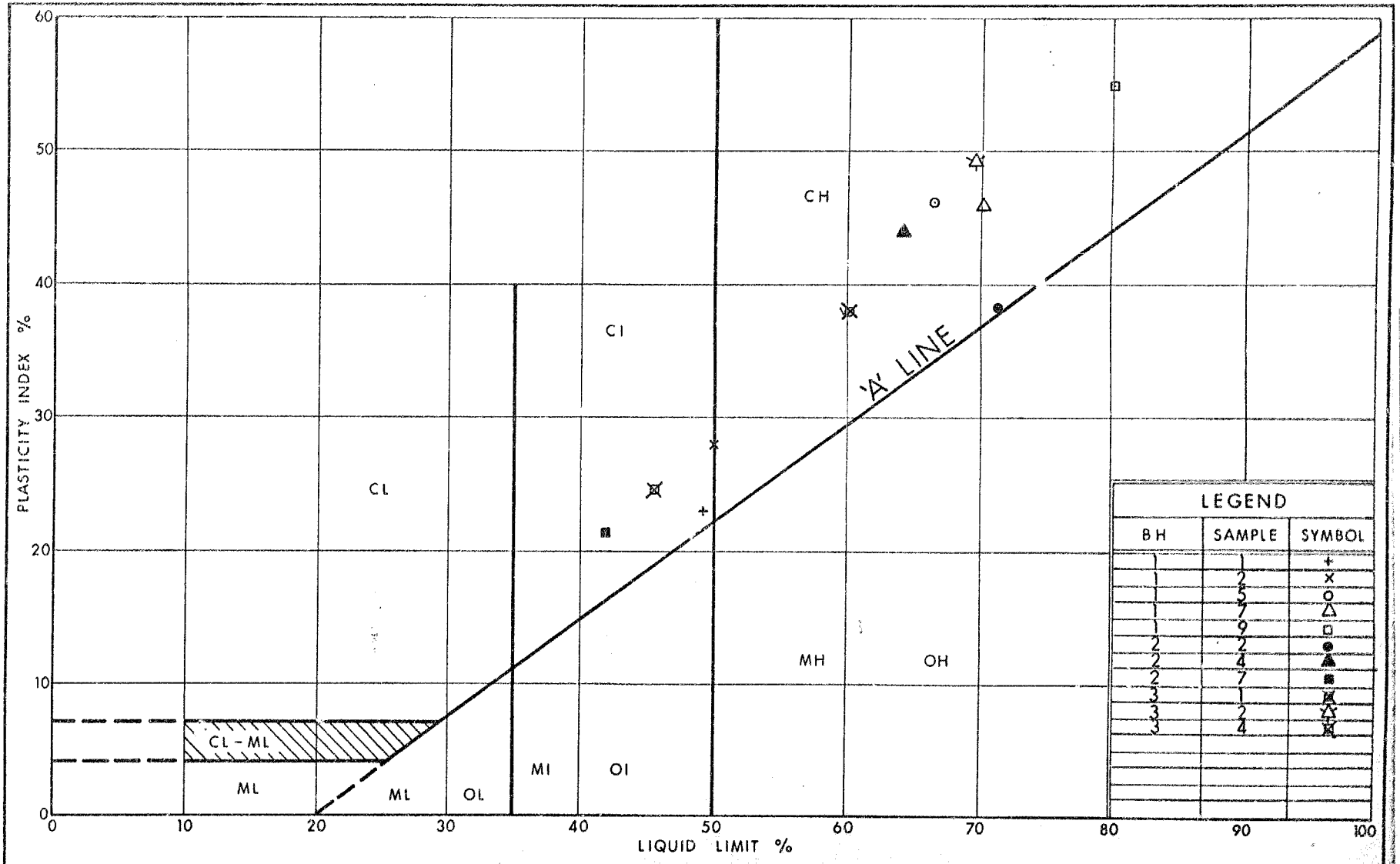
+ s=2
× s= 4
+ s= 5
+ s= 8
+s= 9
+ s=11
× s=9
+ s=8
100/ 0" Bouncing

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT %
25 50 75 100

UNIT WEIGHT γ PCF	REMARKS % GR SA SI CL
92.5	
100.0	
	9-11-60-20

20
15 ○ 5 % STRAIN AT FAILURE
10

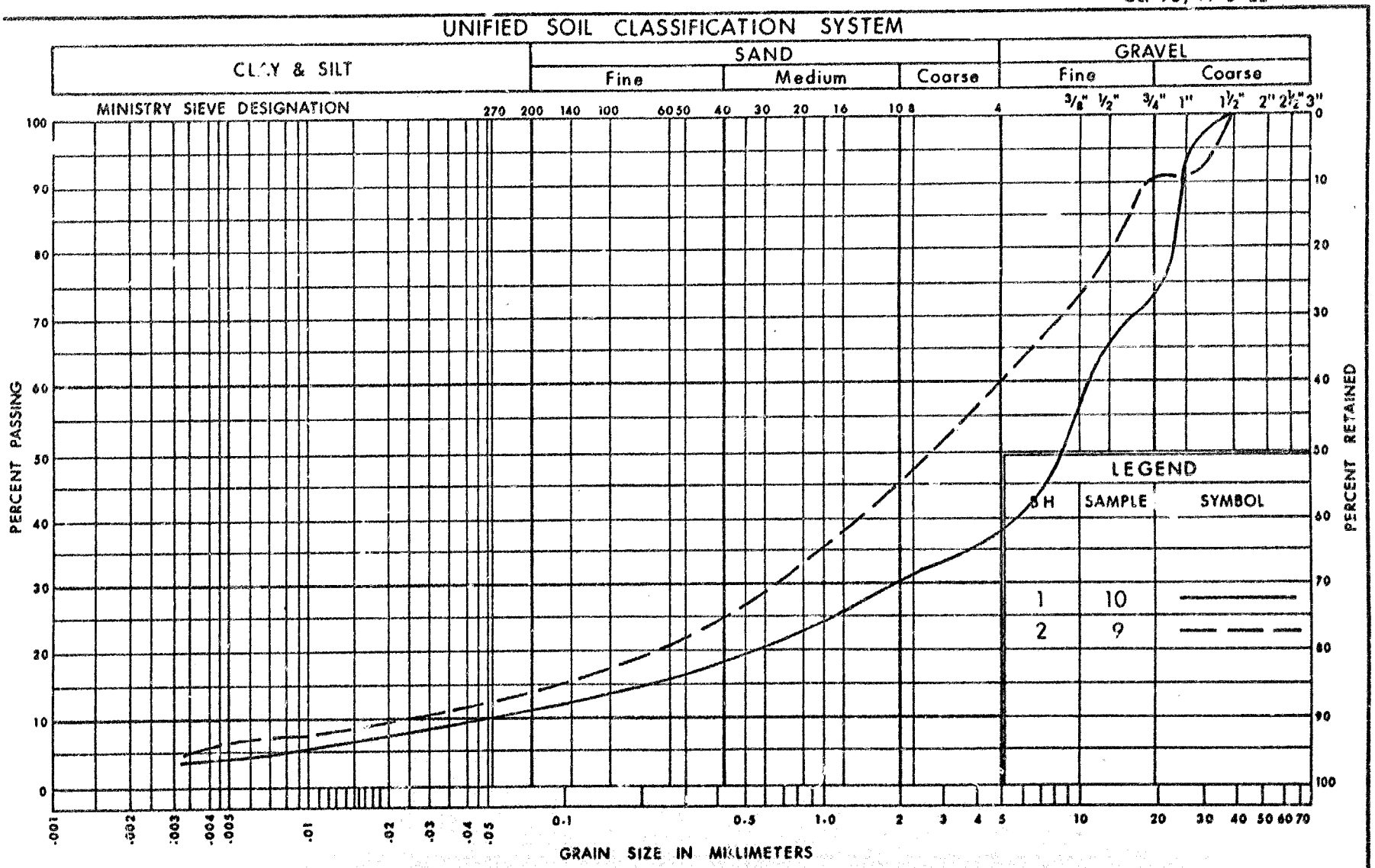
OFFICE REPORT ON SOIL EXPLORATION



Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

PLASTICITY CHART
CLAY

FIG No 1
W P 2505-75-01



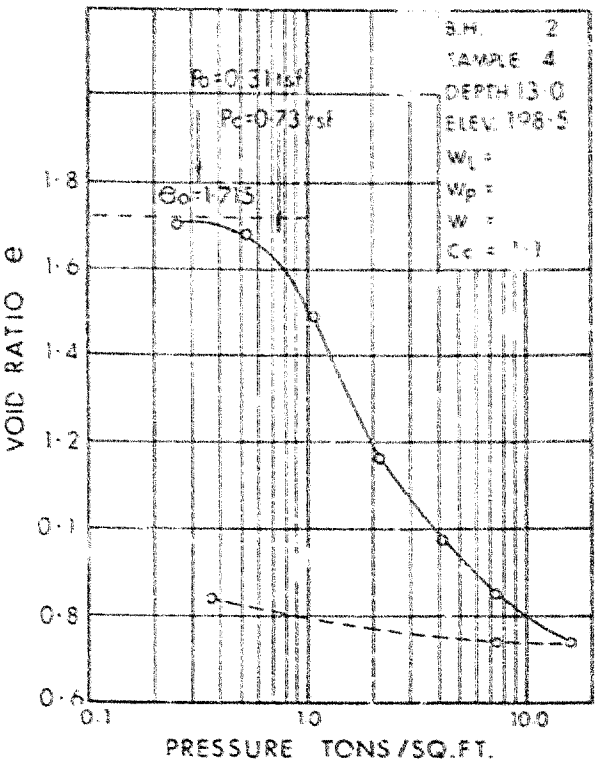
Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

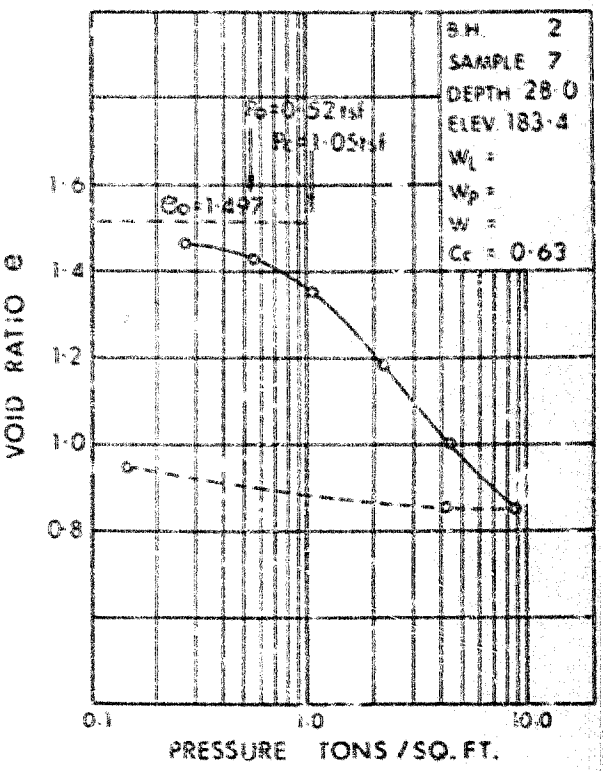
GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIX OF GRAVEL & SAND TRACE OF SILT & CLAY

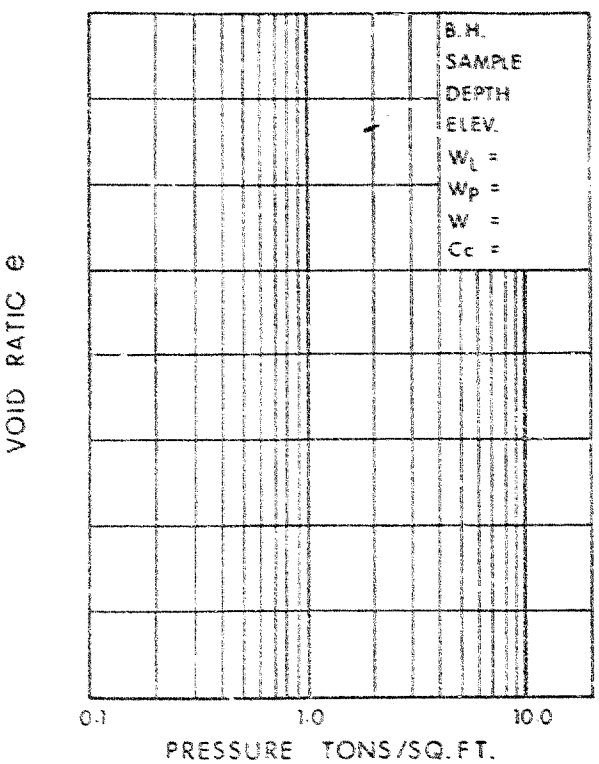
FIG No 2
WP 2505-75-01

VOID RATIO - PRESSURE CURVES

W P 2505-75-01







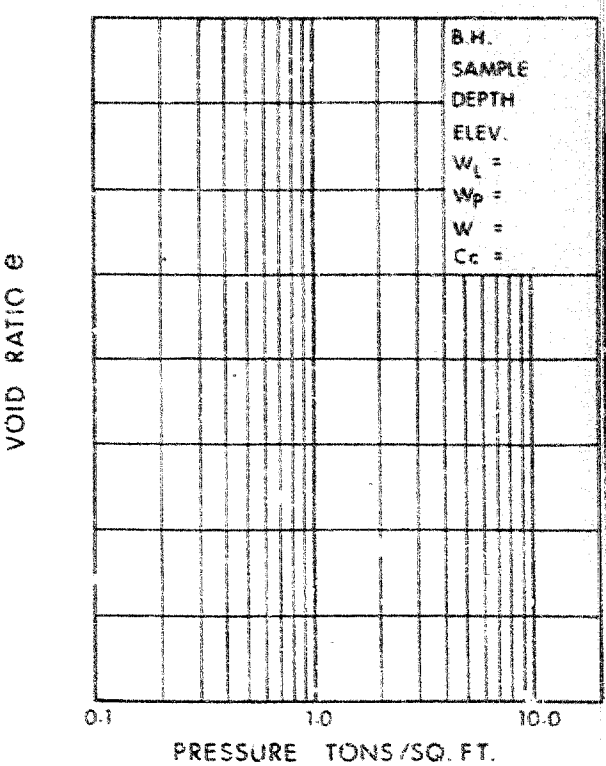
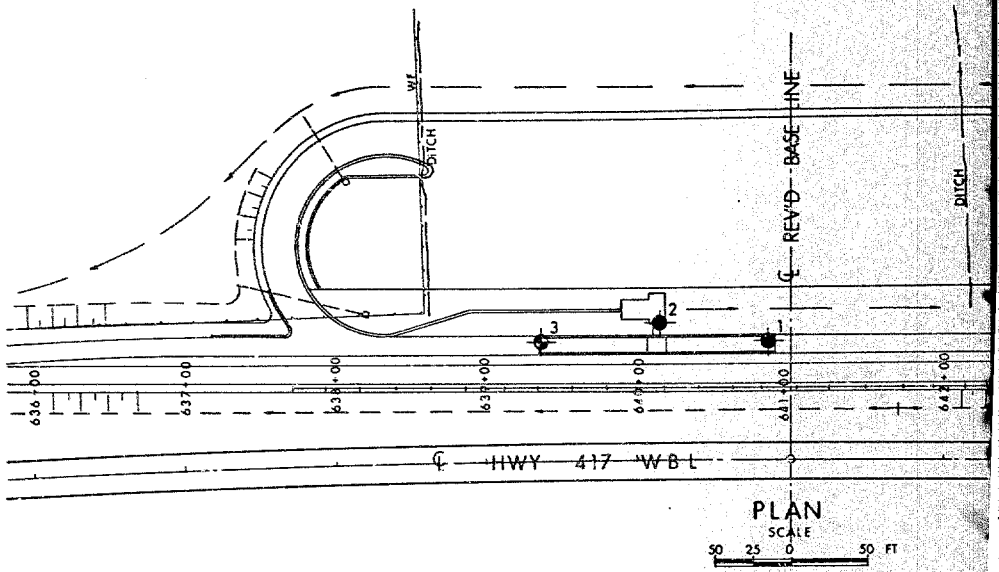


FIG. 3

FF - 71

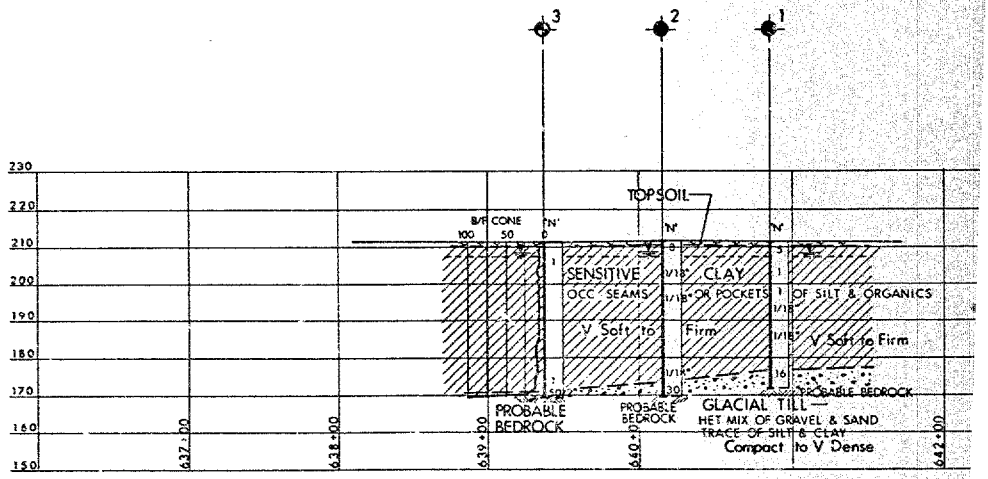
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO 08-W1-309 10-75



PLAN

SCALE

50 25 0 50 FT



PROFILE

SCALE

HOR 50 25 0 50 FT

VERT 20 10 0 20

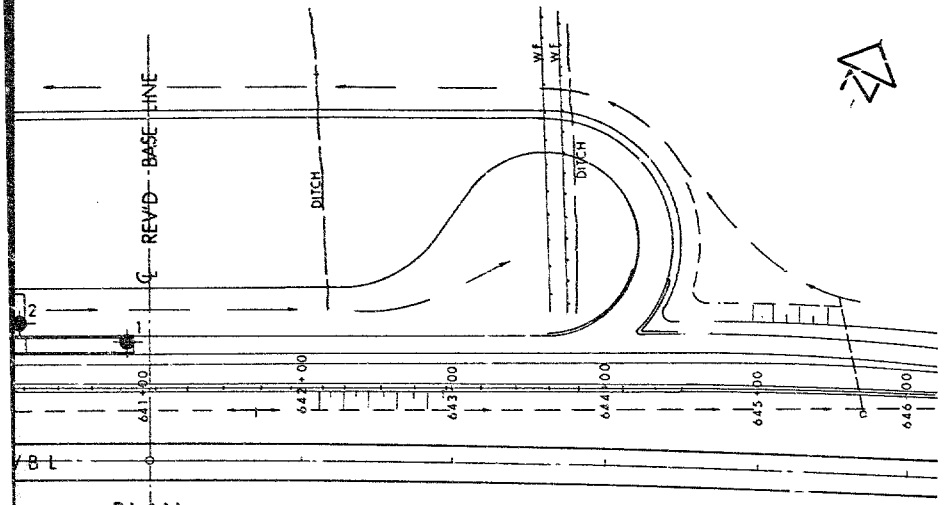
CONT No

WP No 2505-75-01

VEHICLE INSPECTION STATION RELOCATION

BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PLAN

SCALE

50 25 0 50 FT

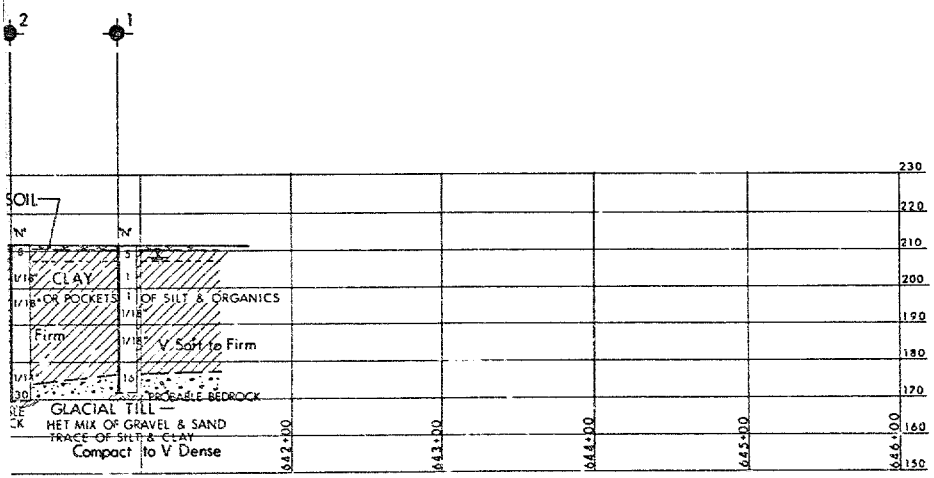
KEY PLAN

0·5 0 1 MI

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std. Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation DEC 1976

No	ELEVATION	STATION	OFFSET
1	211·3	640+85	80'LT
2	211·5	640+12	92'LT
3	211·2	639+37	80'LT



PROFILE

SCALE

HOR 50 25 0 50 FT

VERT 20 10 0 20

-NOTE-

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

REVISIONS

DATE	BY	DESCRIPTION

REF: DWG No W-606-417-1

HWY No 417			DIST 9
SUBM'D M	CHECKED	DATE 05 01 77	SITE
DRAWN OL	CHECKED	APPROVED	DWG 25057501-A

observation from the windows.

Sheet 41

Sidewalk Standard (DD-503) is to be revised to show 6" of concrete (for Reference only)

Building Drawings (Sheets 20-39 inclusive) were given to Bill Martin for updating by the Structural Office.

The District indicated that the Contractor should be informed of existing cross-overs so that haulage costs could be reduced. (i.e. 1½ miles west of site). Planning & Design to review this with the Construction Office and insert the necessary Special Provision.

SUMMARY QUANTITY SHEETS

Break-down of Main Items - The location for the stockpile of the topsoil is to be indicated.

DOCUMENTS

D-4 A. Silbiger informed the committee that a revised Sundry cost for the Two Traffic Control Signs would be forwarded to the Planning & Design Office.

There was some discussion concerning the cost for the Settlement Plates. District felt that the cost indicated was too low, after discussion, the indicated cost of $150.00 was accepted.

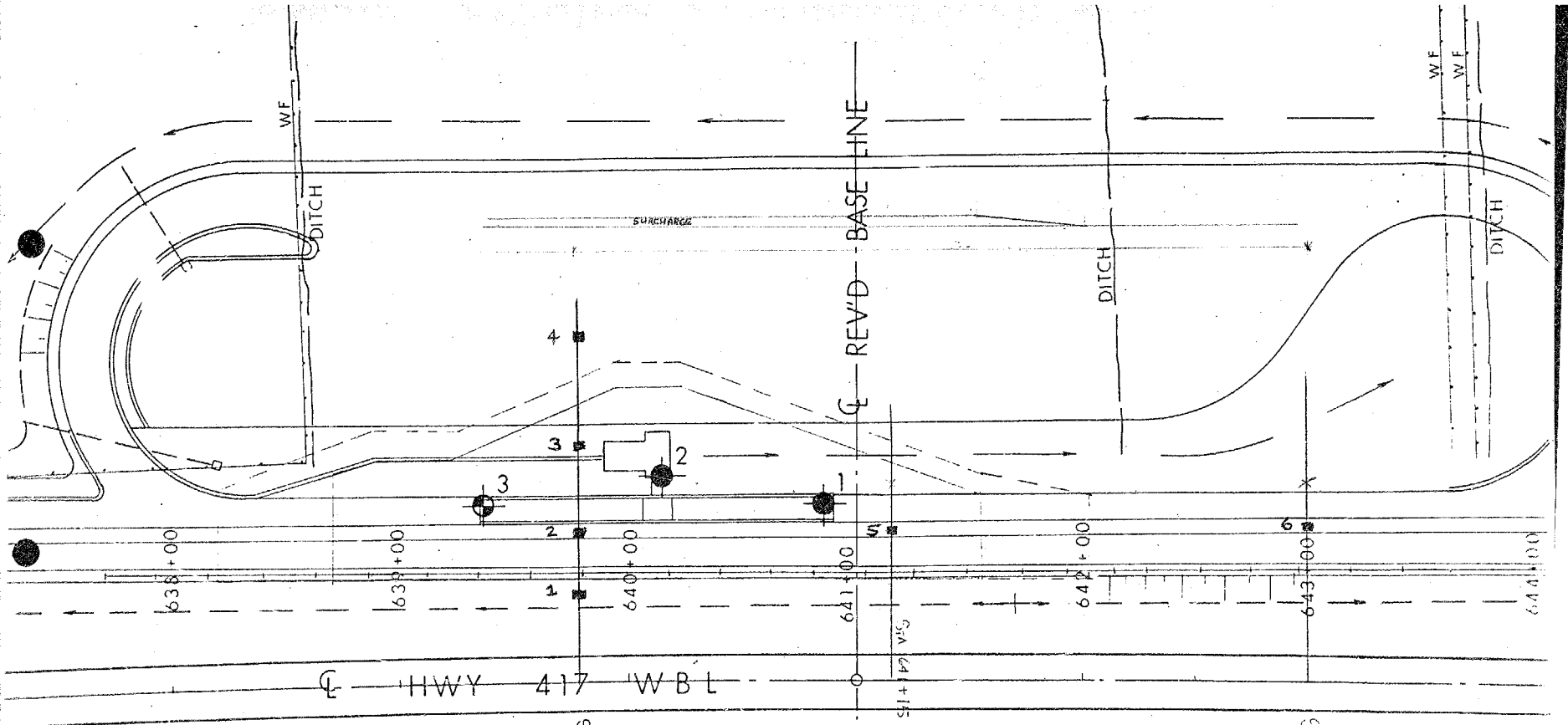
S. P. 114 - Engineering Audit felt that this special provision should be included - it was pointed out that S. P. 114 had recently been cancelled by the Detail Design Section.

PROPOSED SPECIAL PROVISIONS

Building of Stockpiles - The Geotechnical Branch questioned this special provision. They indicated that the slope should be changed to 2½:1 and the height changed to 10 feet. The placing of stockpiles within the contract site was questioned, and the S. P. is to be revised to indicate "within the contract site".
Planning & Design is to contact the Foundation Section for the proper wording.

SETTLEMENT PLATES - The District requested that the length of notification be changed from four weeks to two weeks.

Cont'd...../4



LEGEND:

Settlement Plates ■

Plate Number 2

PLAN

SCALE

50 25 0 50 FT

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. H.R.B. McIntyre
Planning and Design Office
Eastern Region, Kingston

From: Soil Mechanics Section
Engineering Materials Office
West Building, Downsview

Attention: Mr. R.T. Molaro

Date: February 22, 1977

Our File Ref.

In Reply to

Subject: Re: W.P. 2505-75-01. Site N/A
Vehicle Inspection Station
1.0 Miles West of Hwy. 138
Hwy. 417, District 9, Ottawa

Further to our Foundation Investigation Report the Soil Mechanics Section will instrument and monitor settlements of the embankment at the proposed Vehicle Inspection Station. It is, therefore, requested that the Soil Mechanics Section be notified four weeks prior to the placement of the embankment.

The instrumentation will consist of six settlement plates installed at the following locations.

Station	Offset
636+80 WBL	40' lt.
636+80 WBL	66' lt.
636+80 WBL	105'lt.
636+80 WBL	155'lt.
641+15 WBL	66' lt.
643+00 WBL	70' lt.

The settlement instruments are steel plates (2' x 2' x ½") placed flush with the existing ground surface on a 1 foot thick compacted granular pad. The plates are placed prior to construction of the embankment and the elevations recorded. A special provision will be required to ensure that the contractor's equipment does not disturb the settlement plates. Mr. T.C. Kingsland, Regional Structural Planning Engineer, has agreed to insert the appropriate special provisions into the contract.

M MacLean

M. MacLean
Project Engineer

For: M. Devata
Supervising Engineer

MM/gs

cc: T.C. Kingsland
E.V. Saint
D. McCune
Files
Record Services

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. R. McIntyre,
Project Manager,
Reg. Planning and Design Office,
Eastern Region, Kingston.

Attention:

From: Structural Office,
West Building,
Downsview, Ontario.

Date: July 12, 1976.

Our File Ref.

In Reply to

Subject: Hwy. 417 Truck Inspection Station

Although we have not yet received the soils report for the above site, we have discussed the situation in some detail with Mr. M. Devata, Soil Mechanics Office.

Due to the very sensitive clay at the proposed site the allowable bearing pressure will be very low and even at that low value substantial settlement can be expected.

We have reached the following conclusions:

1. The scale pit, building, and approach slabs will have to be supported on piles or caissons to bedrock to ensure the tolerances in level required for the weighing operation.

2. The additional cost of the installation, due to the poor soil conditions at the site, will be approximately $100,000 to $150,000 (including $15,000 additional cost for pole footings).

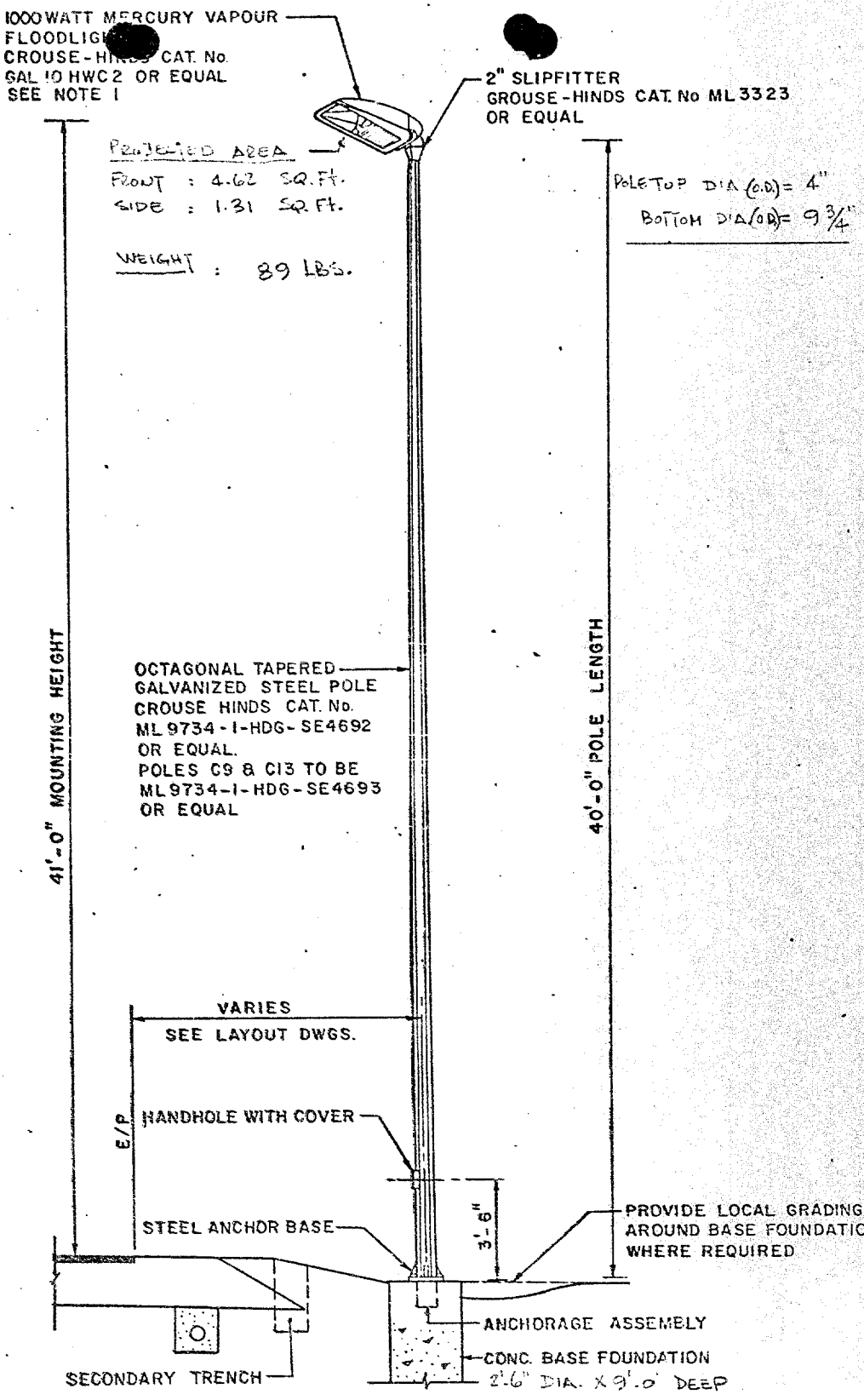
We trust that this information will assist you in your assessment of the site.

D. S. Meder

D. Meder,
for:
D. McCune,
Contract Standards Engineer.

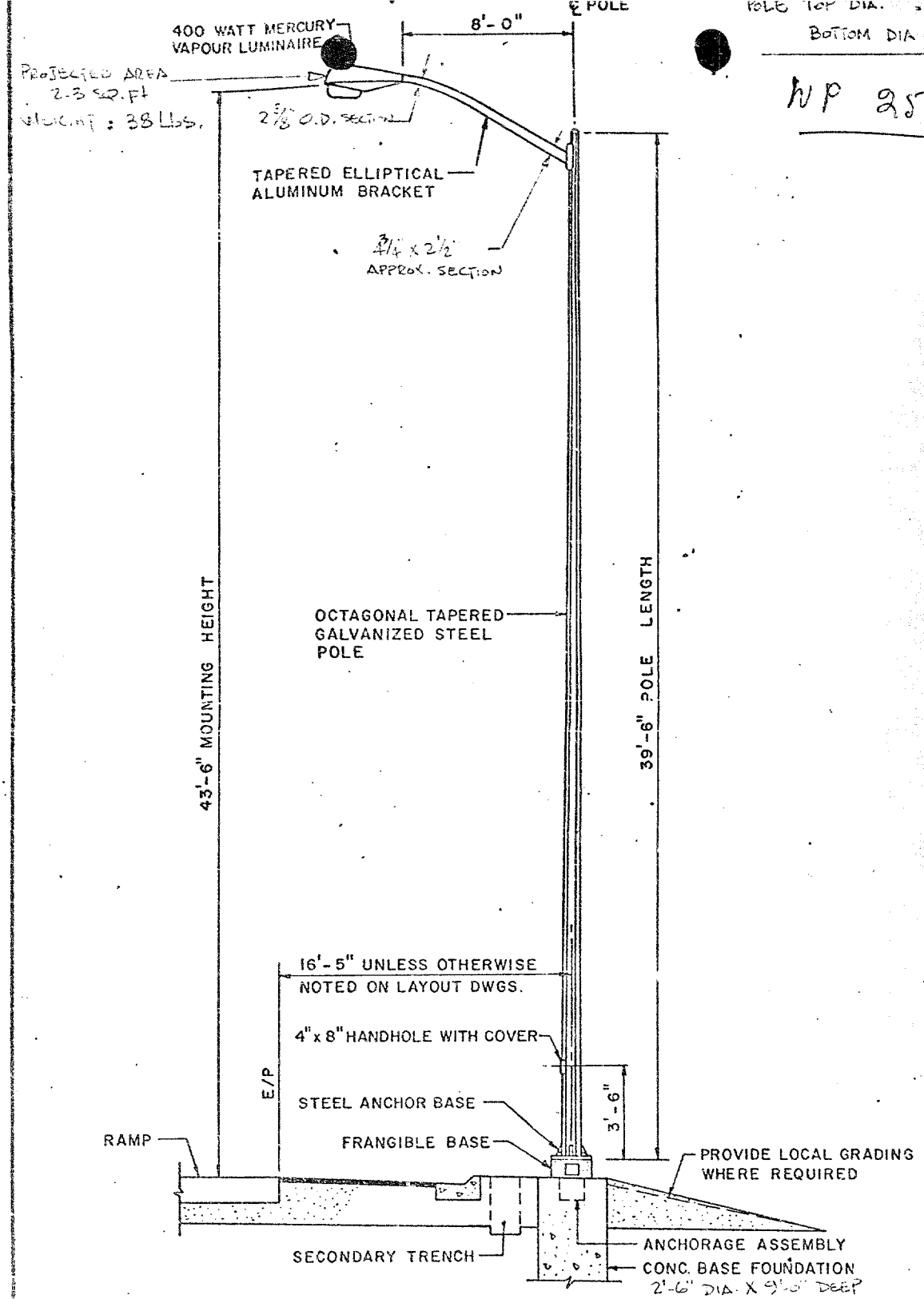
DM/ac

c.c. M. Devata



BASE MOUNTED STEEL POLE AT PARKING LOT AND IMPOUNDED TRUCK STORAGE AREA

N.T.S.

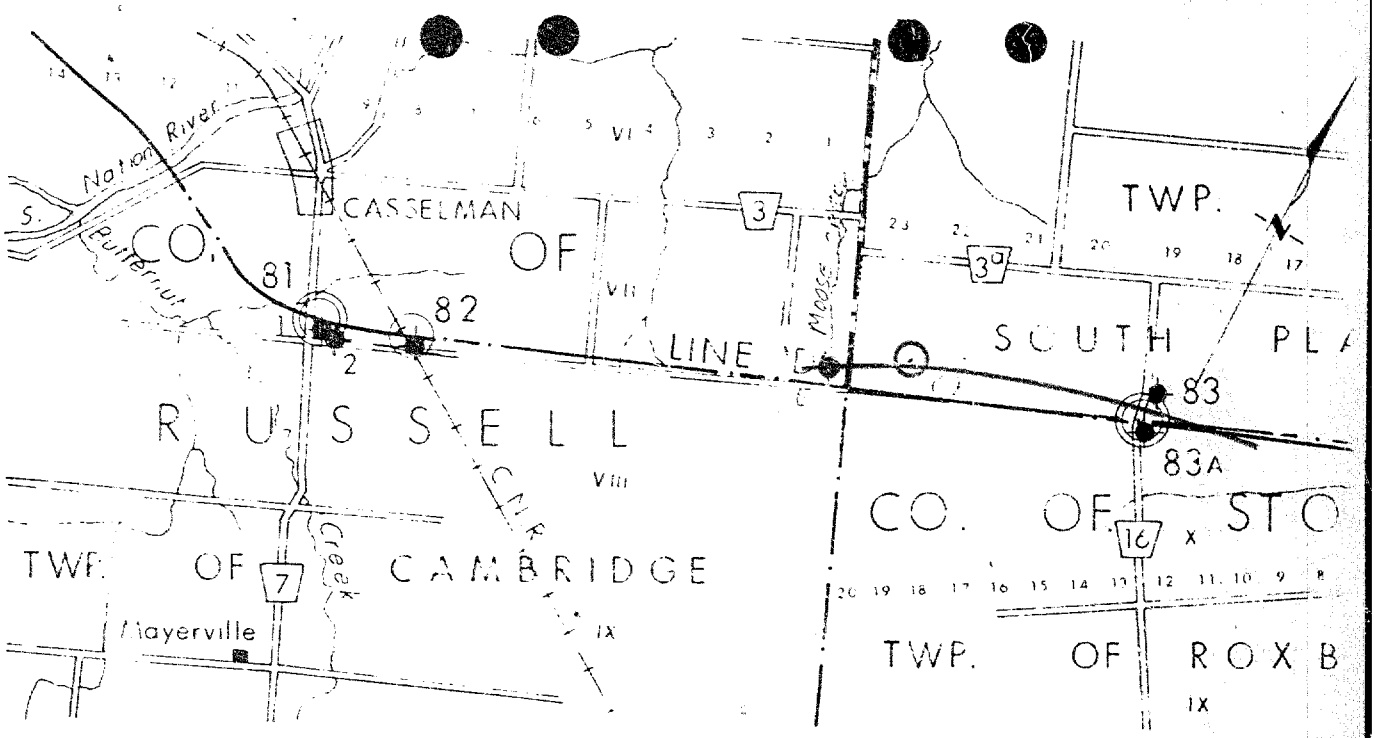


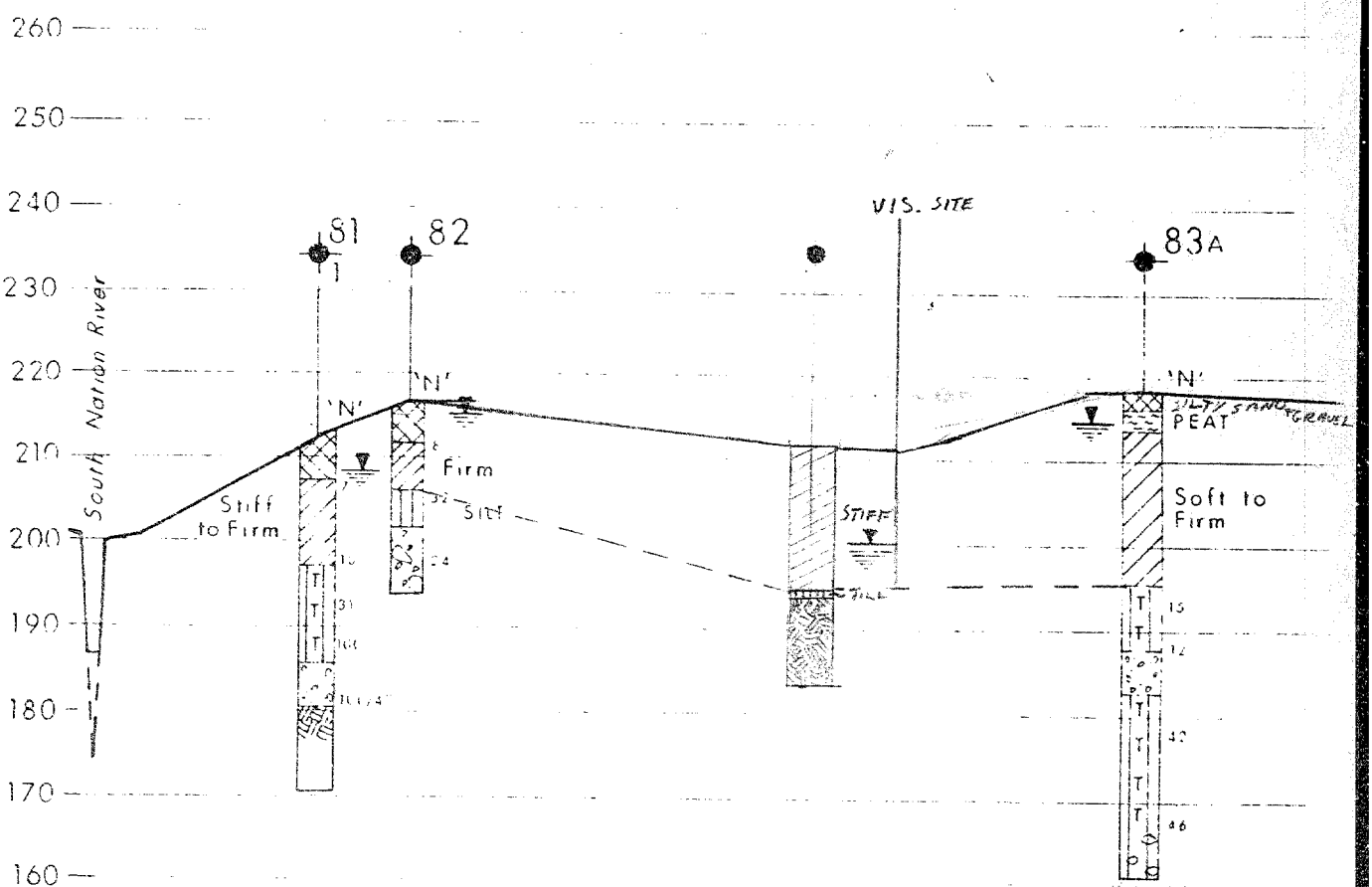
POLE TOP DIA. = 4"
BOTTOM DIA = 8.5"

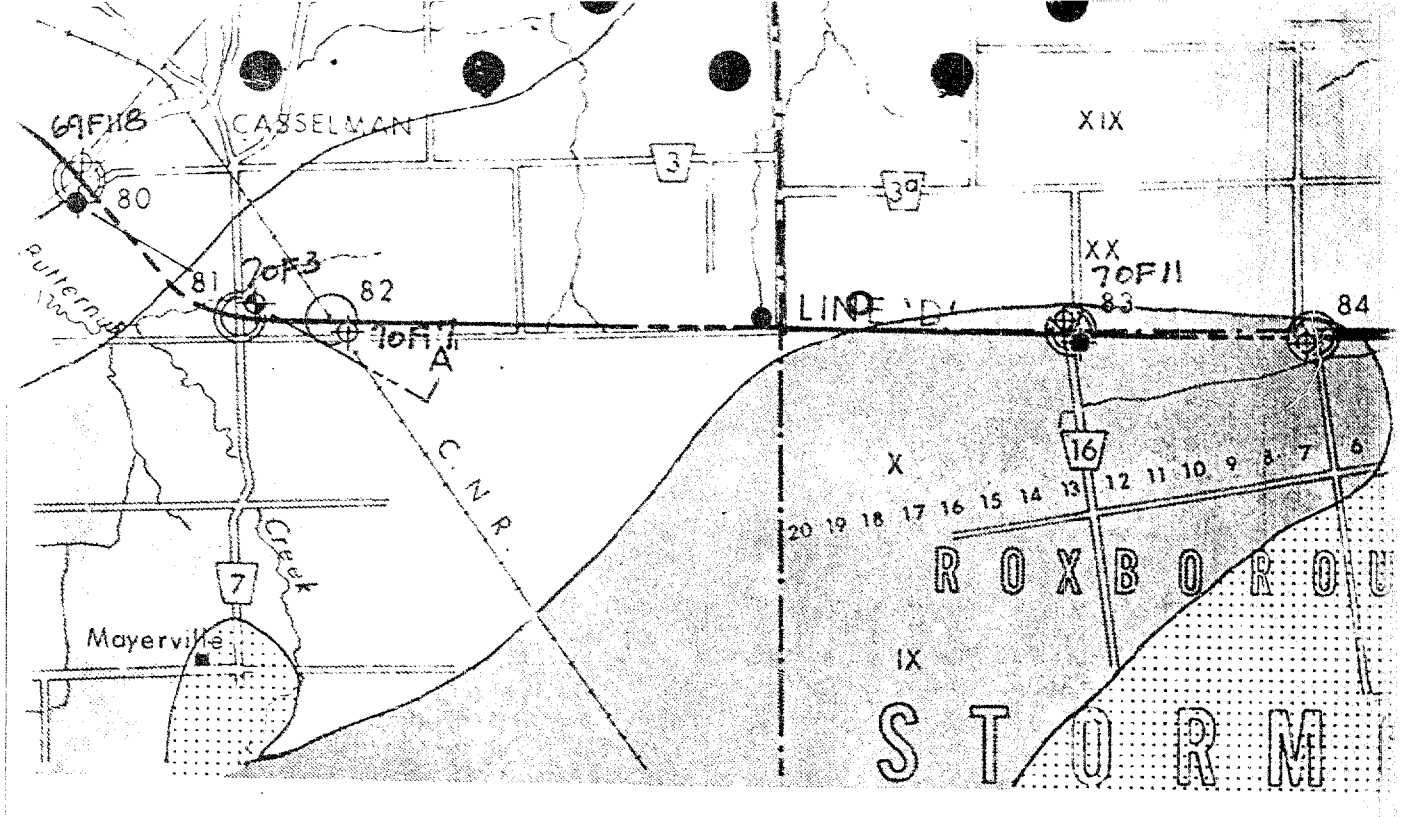
WP 2505-75-01

BASE MOUNTED FRANGIBLE BASE STEEL POLE ON ENTRANCE OR EXIT RAMP

N. T. S.


South Nation River
CASSELMAN
CO. OF
RUSSELL
TWP. OF CAMBRIDGE
Mayerville
Creek
Moose Creek
TWP.
SOUTH
CO. OF STO
TWP. OF ROXB
81
82
83
83A
Structure
Structure and Interchang


260
250
240
230
220
210
200
190
180
170
160
81
82
83A
VIS. SITE
South Nation River
'N'
Stiff to Firm
Firm
SILT
STIFF
SILTY SAND TO GRAVEL
PEAT
Soft to Firm



PLAN

SCALE

1 .5 0 1 2 3 4 Miles

PHYSIOGRAPHIC REGIONS

RUSSELL & PRESCOTT SAND PLAINS 10' - 30' OF SAND OVERLYING EXTENSIVE DEPOSIT OF MARINE CLAY (40-180')

WINCHESTER CLAY PLAINS 10' - 25' OF MARINE CLAY (QUITE VARIABLE IN THICKNESS) OVERLYING GLACIAL TILL - SOUTH OF RUSSELL & PRESCOTT SAND PLAINS

SWAMP VARIABLE THICKNESS OF ORGANIC MATTER DUE TO POOR DRAINAGE

GLENGARRY TILL PLAINS 10' - 25' OF GLACIAL TILL OVERLYING BEDROCK

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. M. Devuta,
Soils Mechanics Office,
DOWNSVIEW, Ont.

From: Structural Planning Office,
Kingston, Ont.

Attention:

Date: April 26th, 1976 .

Our File Ref.

In Reply to

Subject:

W.P. 2505-75-01, Vehicle Inspection Station ,
Sta. 630 + 83.49 W.B.L., Hwy # 417 ,
Township South Plantagenet,
DISTRICT #9 - OTTAWA

Further to our recent telephone discussion concerning the above mentioned V.I.S.

Please find enclosed a copy of Drawing #W 606-417-1, Site Plan for the proposed V.I.S.

We shall be glad if you will investigate this location and carry out a foundation investigation, if you deem this necessary.

Please liaise in this matter directly with Mr. N.McQueen, Special Services Office, Downsview, to whom your recommendations should be forwarded with a copy to this office.

Reference can be made to the detailed building and scale footing drawings in Special Services Office .

T.C. Kingsland .

TCK/pab
Encl.

T.C. Kingsland ,
Regional Structural Planning Engineer,

c.c. Mr. S.C.J. Radbone Att: Mr. H.R. McIntyre
E.R. Saint Att: Mr. M. Batten ,
J.M. Childs , Dist. Engineer-Ottawa
Mr. C.S. Grebski - Att: Mr. K. Bassi .

MATERIALS & TESTING OFFICE

EASTERN REGION

SOILS DESIGN REPORT

Truck Inspection Station
Hwy. 417
1.1 Mi. W. of Highway #138
W.P. 2505-75-01
Proposed G,D,GB & Pav.Project
District 9 - Ottawa

DISTRIBUTION:

C.	Mirza	
J.M.	Childs	(2)
S.C.J.	Radbone	(2)
A.E.	Argue	
W.R.	Bennett	
G.A.	Wrong	
Z.L.	Katona	
N.J.	M'Queen	(2)
R.J.	Forrest	
H.B.	McKay	
P.D.	Billings	
B.J.	Giroux	

A.M. Batten
Senior Soils Supervisor

E.R. Saint
Regional Materials Engineer

22nd December 1975
Date

T.Ronald Graham
Project Soils Supervisor

/jeb

SOILS DESIGN REPORT

Truck Inspection Station

Hwy. 417

1.1 Mi. W. of Hwy #138

W.P. 2505-75-01

Proposed G, D, GB and P., Project

District 9 - Ottawa

GENERAL DATA

This project includes the grading, drainage and paving for a Regional Truck Inspection Station located beside the westbound lane of Hwy #417, 1.1 Mi. West of Hwy #138 interchange. The pavement geometrics are appended to this report.

The project also includes installation of the sub structure for the scale installation. The existing Hwy #417 westbound lanes will be widened to provide for entrance and exit ramps to the Inspection Station. The pavement structure of Hwy #417 consists of 9 inches of hot mix asphalt over 6 inches of cement treated base. The shoulders are full depth granular. The pavement surface is new and in good condition.

INVESTIGATION

A soils investigation was carried out on this project in November, 1975. A truck mounted auger was used to place borings and recover samples of the sub-soil. Hand auger borings were placed in areas inaccessible to the power auger.

The soils data obtained from the borings is appended to this report.

PHYSIOGRAPHY AND SOILS DATA

This project is within the Winchester Clay Plain. It is an area of low relief and lies within the drainage basin of the South Nation River. The topography of the area is generally flat.

.....2

The silty clay within the clay plain consists of the typical sensitive Leda Clay that characterizes the Champlain Sea deposits in the low lands adjacent to the Ottawa and St. Lawrence Rivers. Although the in situ material in the 4' boreholes was found to be of firm consistency, it's moisture content is approximately 6 percent above optimum.

Limit tests on the sample obtained from borings are as follows:-

WI - 55%

Wp - 25%

Ip - 30%

Field moisture content 31%

The high moisture content makes the material unsuitable for embankment construction.

EARTH BORROW

The project is located along the westbound lane of the existing Hwy #417, 1.1 miles west of Hwy #138 interchange. The materials in the immediate area consist of a wet silty clay and are not suitable for fill purposes due to these moisture contents.

In view of the restricted access to the project, because of Hwy #417 and the small quantities involved, it is likely that borrow materials will be obtained from sources south of Hwy #417 along Hwy #138. The average haul distance is expected to be 6 miles. The earth borrow material will likely be a silty sand or a sandy clay till from the Drumlin Ridges in this area. Further south, on Hwy #138, there are deltaic fine sand and beachline sandy granular deposits that are suitable for borrow at an average 10 mile haul to the project.

GRANULAR MATERIALS

Materials suitable for production of Granular 'A' and crushed rock sub-base can be acquired from quarries south of the Hwy #138 interchange at an average haul distance of .....

approximately 4 miles.

In addition to the above sources, material suitable for Granular 'C' can be obtained in sources to the south, along Hwy #138 at an average haul distance of approximately 10 miles.

RECOMMENDATIONS

1.1 Granular Materials

It is recommended that the granular materials for this project consist of Granular 'A' and Granular 'C'.

1.2 Depths and Widths of Granular Materials

(a) New Construction Truck Inspection Station

It is recommended that the granular materials be placed full width and to the following depths:-

Granular 'A'	6 inches	(full width)
Granular 'C'	12 inches	(full width)

(b) Widenings for Entrance and Exit Ramps

Granular 'A'	9 inches	(full width)

1.3 Manufactured Granular 'C' Alternative

In view of the availability of Granular 'C' granular deposits, it is recommended that a special provision be included to allow the use of crushed material from quarries as an alternative. Such special provision should stipulate that the material shall be produced from a crusher and meet the following gradation requirements:-

.....

Sieve Designation	Percent Passing
3"	100
1"	50 - 100
½"	35 - 100
No. 4	20 - 90
No. 16	10 - 55
No. 50	5 - 30
No. 200	0 - 12

All other requirements for Granular 'A' as specified in MTC Specification # 314 apply.

2.1 Asphalt Pavement

(a) Widenings Adjacent to Hwy #417

Surface Course	1 @ 1½"	1½"	HL 4
Upper Binder Course	1 @ 1½"	1½"	HL 4
Lower Binder Course	2 @ 2"	4"	HL 4
	Total:	7"	HL 4

(b) Driving Lanes and Parking Area for Truck Inspection Station

Surface Course	1 @ 1½"	1½"	HL 4
Binder Course	2 @ 1½"	3"	HL 4
Binder Course	1 @ 1"	1"	HL 2
	Total:	5½"	

2.2 Transition Points and Pavement Joints

The pavement depths for the widenings adjacent to Hwy #417 should extend from the start of tapers to the concrete bullnose. The transition detail from 9 inch to 5½ inch pavement depth is appended to this report.

The pavement joints should be constructed as outlined in form 310.05.13. Designation of an item for saw cutting is involved.

3.1 Culvert Types and Foundation Conditions

It is recommended that culverts placed where the foundation soil is silty clay material should be C.S. pipes and bedded with a minimum of 12" of G.B.C. 'A'.

3.2 Gasket Joints for Corrugated Steel Pipe

It is not recommended that the special provision for placing polyethylene gaskets on C.S.P. be included at the design stage. The borrow material is expected to be relatively coarse. However, in the event that the backfill is fine sand, the gaskets should be added during construction.

4.1 Topsoil Depths for Stripping

An average depth of 12 inches of topsoil can be assumed for estimating purposes. Topsoil stripping should be carried out within 70' from each end of the weigh scales over the full subgrade width.

5.1 Stripping of Side Slopes and Existing Ditches

Where fill widenings and embankments cross side slopes and ditches, it is recommended that stripping be carried out regardless of height of fill, in order to avoid differential settlement.

6.1 Weigh Scale Styrofoam Frost Heave Treatment

It is recommended that styrofoam installation be provided in the vicinity of the weigh scale and scale house per Std. SD 4-89. Application of this standard should be reviewed with Regional Soils staff during the detail design stage.

.....6

7.1 Stockpiling of Materials

It is recommended that a special provision be included in the contract to limit the height of stockpiled material to 12' , due to the underlying soft clays.

8.1 Scale Foundation and Soils Structure

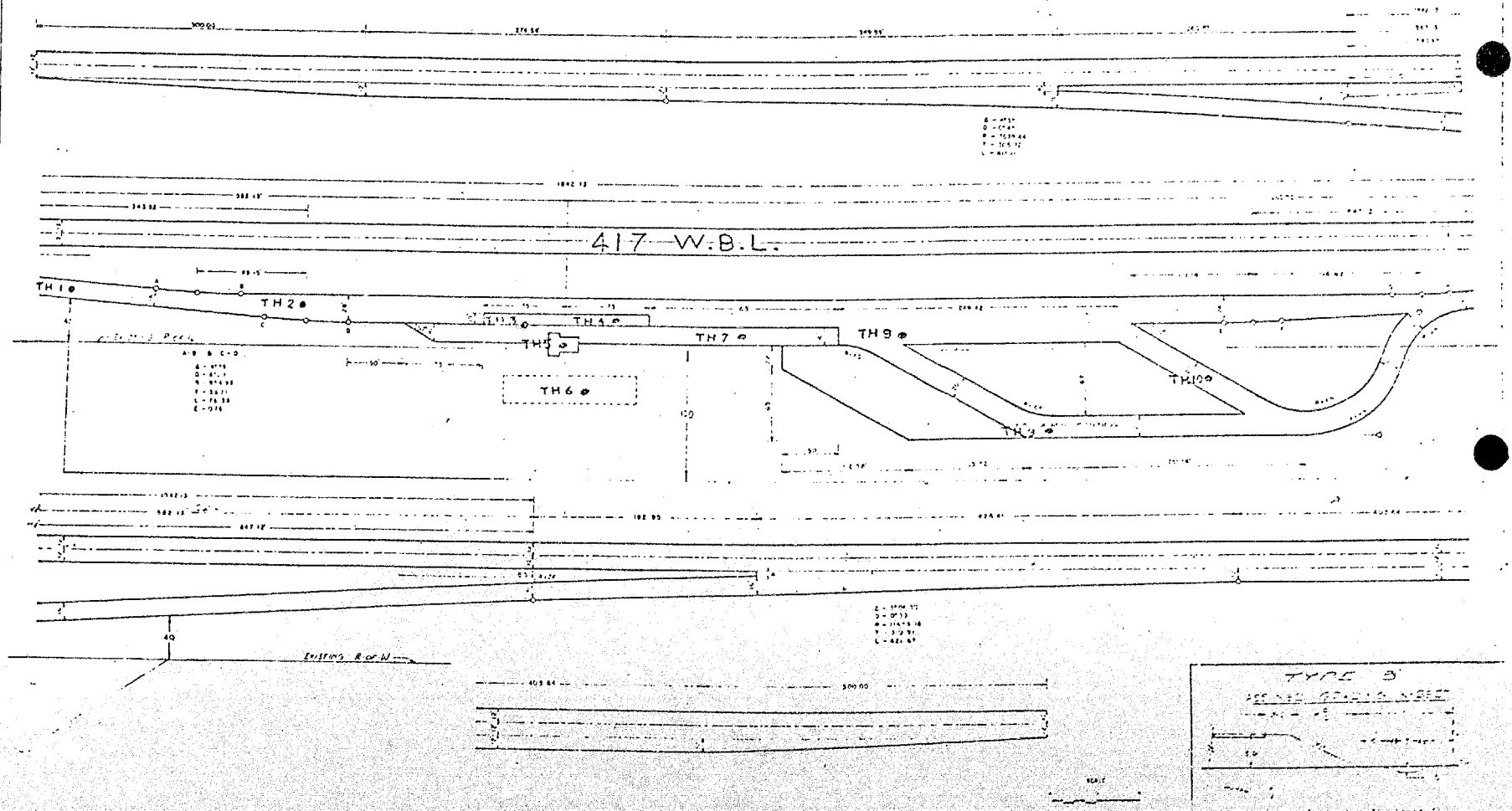
In view of the anticipated sensitivity of the scale mechanisms, it is recommended that the detail sub-structure and adjacent yard and paving lane designs be reviewed with the Soils Mechanics Office, Head Office, Downsview. Such review should determine if deep foundation borings are required and the type of bedding that is required for sub-structure footings. Requirements for any stage construction may also be considered.

****

Hwy #417 W.P. 2505-75-01 Twp. S.Plantagenet

T.H. #1	0-4"	Br Cl Lo Tps
	4-48"	Br H Cl Wet Firm
T.H. #2	0-10"	Br Cl Lo Tps
	10-48"	Br H Cl Wet Firm
T.H. #3	0-12"	Br Cl Lo Tps
	12-48"	Br H Cl Wet Firm
T.H. #4	0-12"	Br Cl Lo Tps
	12-48"	Br H Cl Wet Firm
T.H. #5	0-12"	Br Cl Lo Tps
	12-48"	Br H Cl Wet Firm 75-LL-442
		Sa - 8% W_L - 55.1%
		Si - 17% Wp - 24.6%
		Cl - 75% Ip - 30.5%
		VF Sa & Si - 18% FMC @ 36" - 31.1%
T.H. #6	0-10"	Br Cl Lo Tps
	10-48"	Br H Cl Wet Firm
T.H. #7	0-12"	Br Cl Lo Tps
	12-43"	Br H Cl Wet Firm
T.H. #8	0-12"	Br Cl Lo Tps
	12-48"	Br H Cl Wet Firm
T.H. #9	0-12"	Br Cl Lo Tps
	12-48"	Br F Cl Wet Firm
T.H. #10	0-12"	Br Cl Lo Tps
	12-48"	Br H Cl Wet Firm

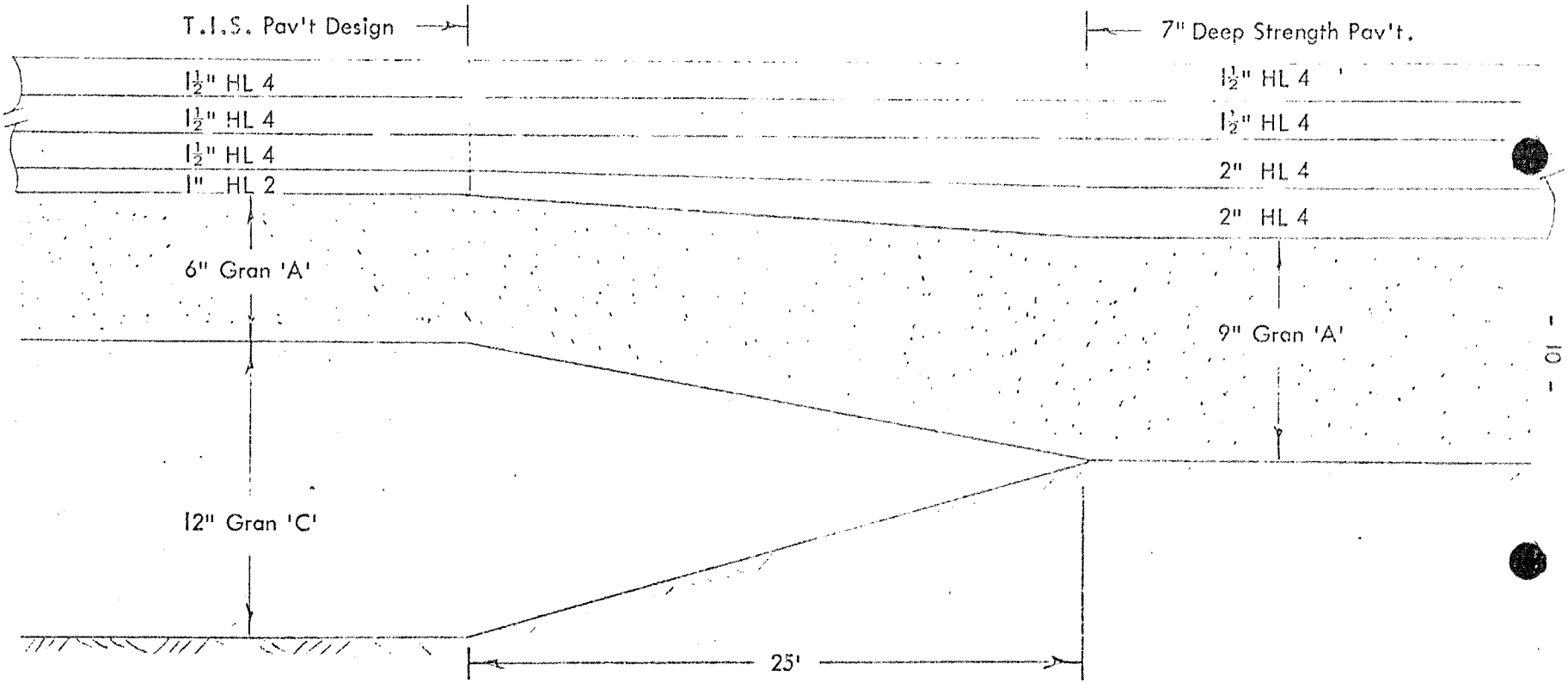
W P 2505 – 75 – 01
TRUCK INSPECTION STATION
HWY. 417



HWY. 417

W.P. 2505 - 75 - 01

TRUCK INSPECTION STATION



PAVEMENT TRANSITION TREATMENT

DOCUMENT [illegible] IDENTIFICATION

GEOCRES No. 31G-177

DIST 9 REGION EASTERN

W.P. No. 2505-75-01

CONT. No. 77-408

W. O. No.

STR. SITE No.

HWY. No. 417

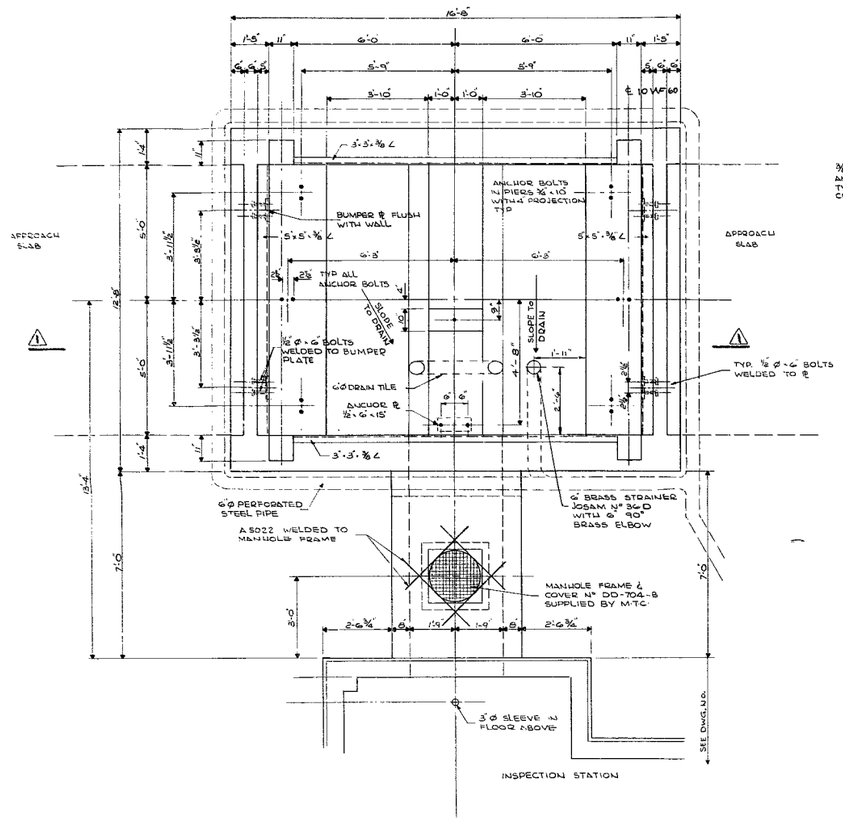
LOCATION VEHICLE INSPECTION STATION, 1.0 MI WEST OF HWY 138

OVERSIZE DRAWINGS [illegible] 2

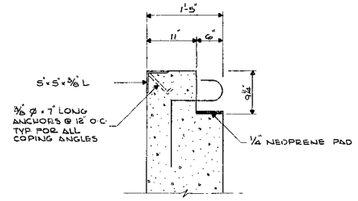
REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO DB-BR-15 4-76

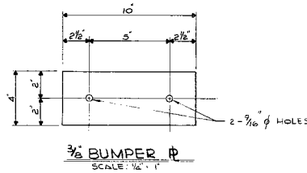
CONT No WP No 2505-75-020	
SCALE PIT DIMENSIONS	SHEET 1



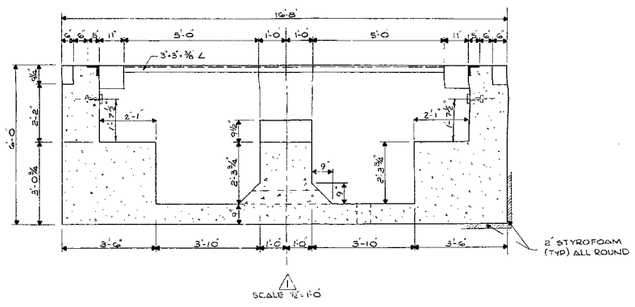
SCALE PLAN & ANCHOR BOLT LAYOUT
SCALE ½" : 1'-0



DETAIL FOR CONNECTING APPROACH SLAB
SCALE: 1"-1'-0"



⅜" BUMPER ℄
SCALE: ½" = 1"



SCALE ½"-1'-0

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

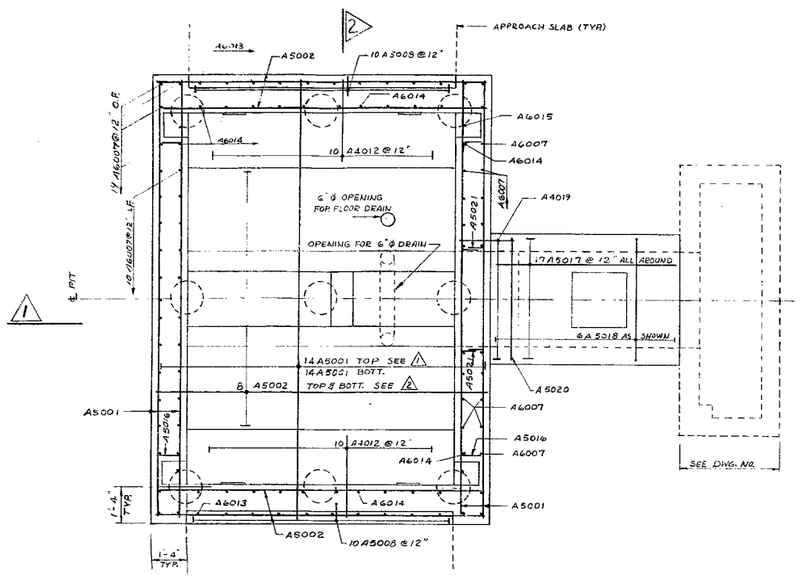
REVISIONS			
NO.	DATE	BY	DESCRIPTION

DESIGN [illegible]	CHECK	LOADING HS 20 44	DATE OCT. '76
DRAWING [illegible]	CHECK [illegible]	SITE No	DWG

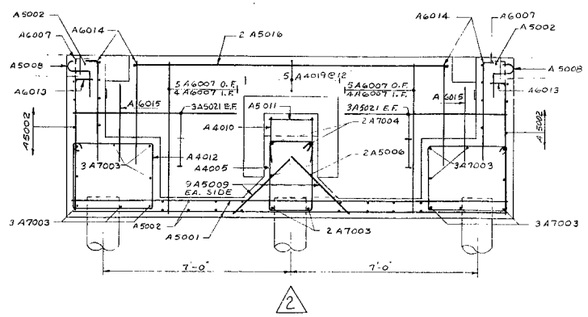
TRANSLAR 116-615

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO 08-BP-15 4-75

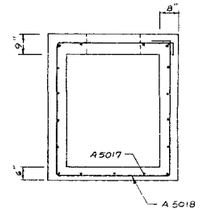
CONT No WP No 2505-75-020	
SCALE PIT REINFORCING	SHEET 2



PLAN



2

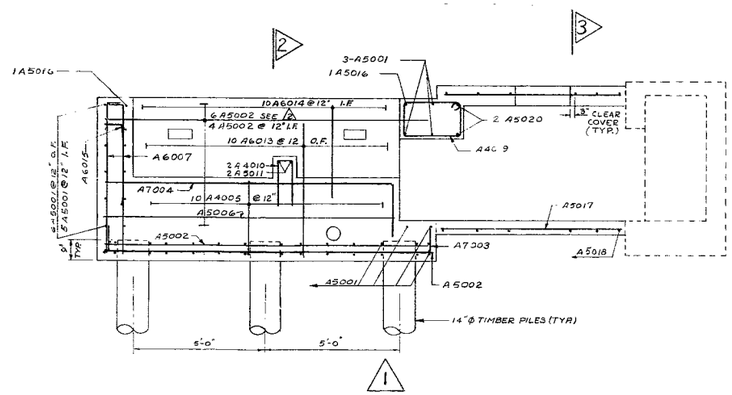


3

O.F. = OUTSIDE FACE
I.F. = INSIDE FACE
E.F. = EACH FACE

FOR A5022 SEE DWG. NO.

NOTES:
SEE DWG. NO.



SCALE: 1/2" = 1'-0"

FOR REDUCED PLAN
USE SCALE BELOW
10 11 12 13
3 INCHES ON ORIGINAL PLAN

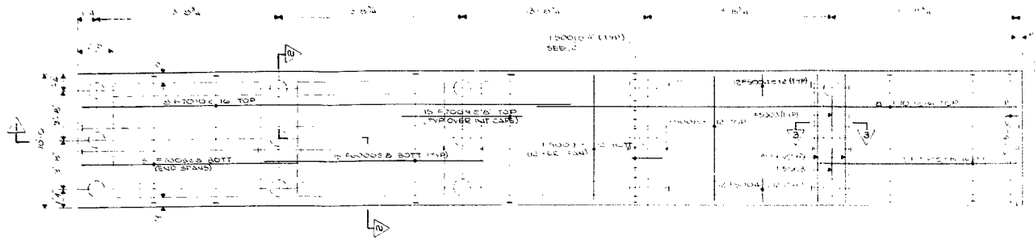
REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	CHECK	LOADING MS 20-44	DATE	
DRAWING	CHECK	SITE No	DWG	

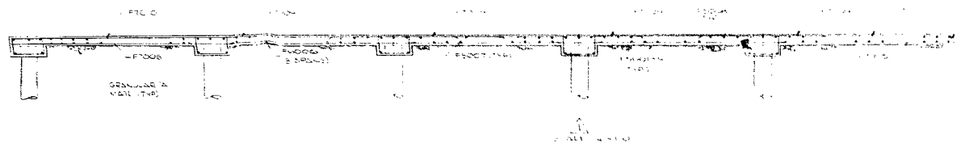
TRANSLAN 1M-8-75

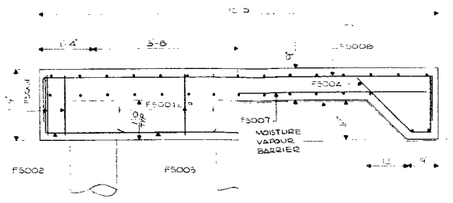
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO 03-RW-10 4-75

CONT No WP No 2505-75-010	
70 FT APPROACH SLAB FOR TRUCK INSPECTION STATION	SHEET

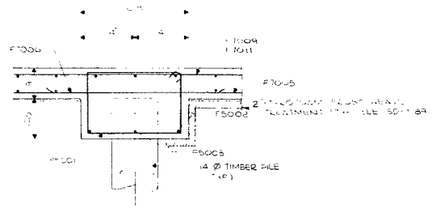


APPROACH SLAB





SCALE ½"=1'-0



SCALE ½"=1'-0

NOTES

CLASS 'A' CONCRETE 4000 P.S.I.
CLEAR COVER TO REINFORCING STEEL 2"

FOR REDUCED PLAN
USE SCALE BELOW
10 11 12 13
3 INCHES ON ORIGINAL PLAN

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN	CHECK	LOADING MS 20 44	DATE OCT 76
DRAWING	CHECK	SITE No	DWG

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO — 8.74

CON 20
LOT 22

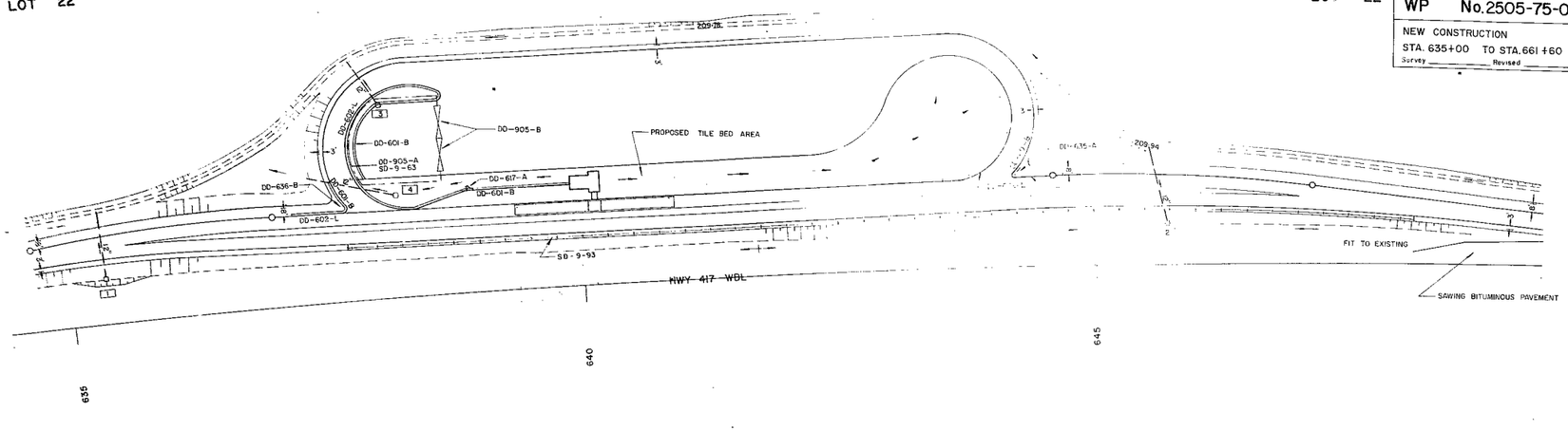
FOR FURTHER DETAILS SEE SHEET Nos 8 A .

CON 20
LOT 22

PLATE No
CONT No
WP No. 2505-75-01

NEW CONSTRUCTION
STA. 635+00 TO STA. 661+60
Survey _____ Revised _____

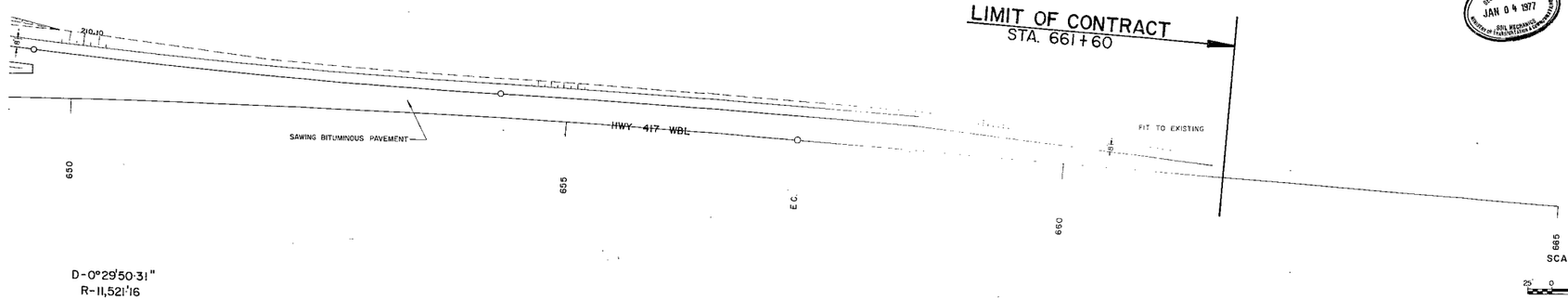
SHEET 7



FOR ALIGNMENT OF VEHICLE INSPECTION STATION SEE SHEET Nos 9 B 9

CON 20
LOT 21

CON 20
LOT 21



D-0°29'50.31"
R-11,521'.16

RECEIVED
GEOTECHNICAL OFFICE
JAN 04 1977
SOIL ENGINEERS
MINISTRY OF TRANSPORTATION & COMMUNICATIONS

SCALE
25' 0 50'

MINISTRY OF TRANSPORTATION, ONTARIO PH-D-707 88-08

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No

CONT No .

WP No 2511-91-00

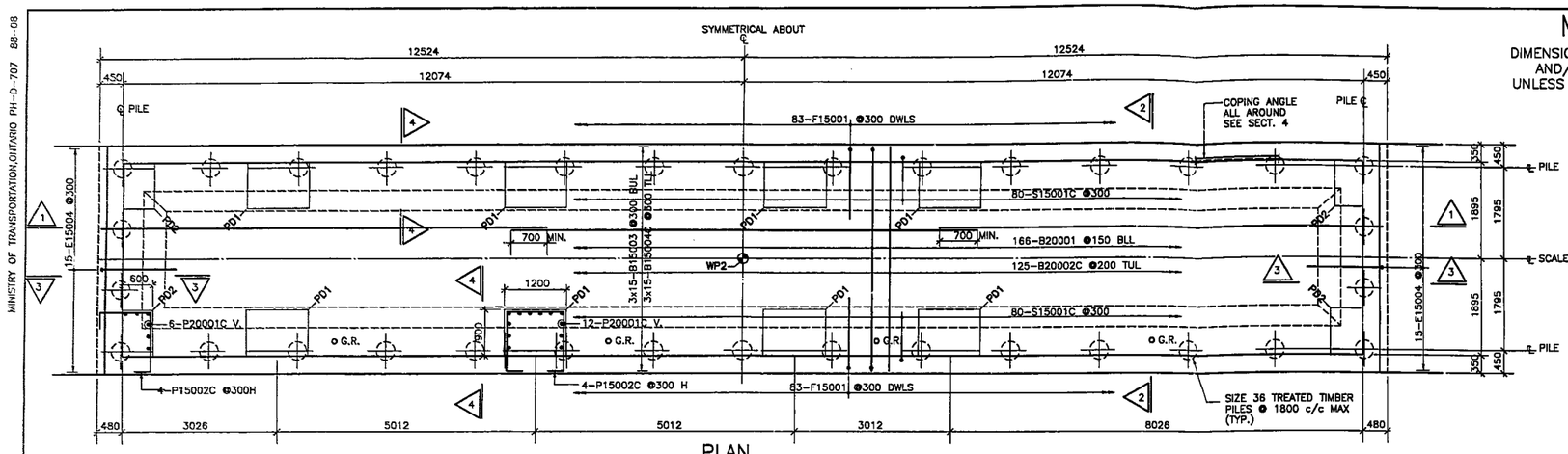
CURRY HILL TIS
STATIC SCALE FOUNDATION
STRUCTURAL DETAILS

SHEET 3

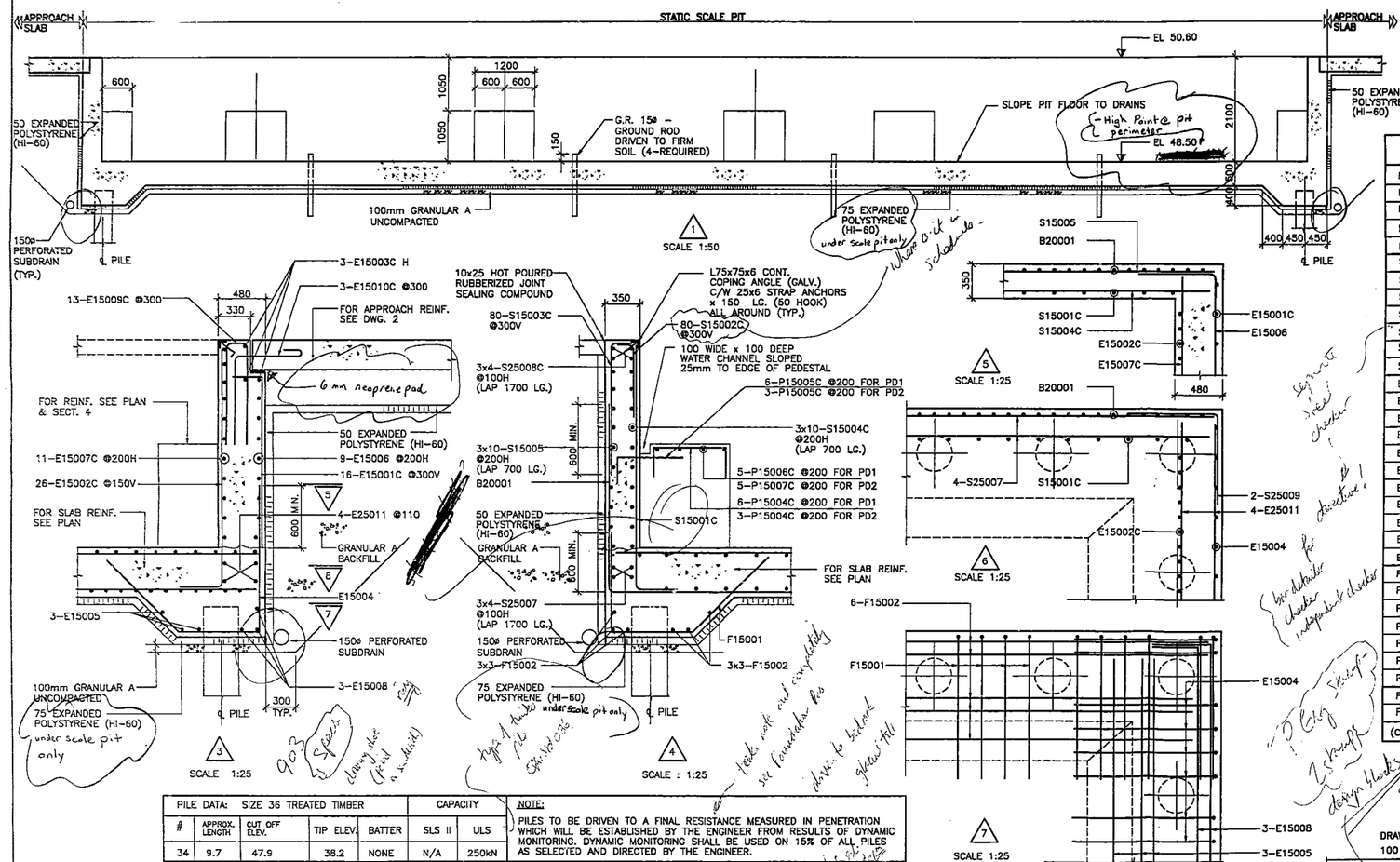
Marshall Macklin Monaghan Limited
Consulting Engineers . Surveyors . Planners

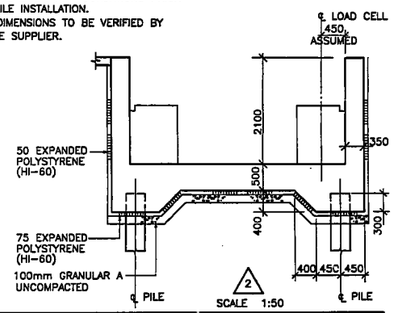
NOTES:

1) FOR GENERAL NOTES SEE DWG. 2
2) LOAD CELL NOT TO BE FARTHER FROM WALL THAN SHOWN IN SECTION 2 UNLESS APPROVED BY THE ENGINEER.
3) REMOVE EXIST. PIT FOUNDATIONS PRIOR TO PILE INSTALLATION.
4) ALL DIMENSIONS TO BE VERIFIED BY SCALE SUPPLIER.



PLAN
SCALE 1:50





REINFORCING BAR LIST

MARK	No.ø	LENGTH	TYPE	A	B	C	D	H	K	MASS (kg)	MASS (kg)
B20001	166	8050	17		1850	4350	1850			-	3147
B20002C	125	4350	STR							1281	
B15003	45	8770	STR								620
B15004C	45	8770	STR							620	
S15001C	160	2850	20		210	2430	210			716	
S15003C	160	1410	2	210	1200					354	
S15004C	60	8770	STR							826	
S15005	60	8770	STR								826
S25007	24	9440	STR								889
S25008C	24	9440	STR							889	
S25009	8	1800	2	900	900						57
E15001C	32	2000	2	300	1700					101	
E15002C	52	2680	2	250	2430					219	
E15003C	6	5250	17		450	4350	450			50	
E15004	30	3300	16		1500	800	1000	720	720		156
E15005	6	4300	STR								41
E15006	18	5250	17		450	4350	450				148
E15007C	22	4300	STR							149	
E15008	6	5250	17		450	4350	450				50
E15009C	26	1430	17		600	230	600			58	
E15010C	30	1400	18	200	600	600		J=100		66	
E25011	8	4300	STR								135
P20001C	120	1650	2	250	1400					466	
P15002C	32	3800	36	300	1050	1100	1050	C=300		191	
P15003C	16	2500	36	300	1050	850	300			63	
P15004C	60	1300	17		300	700	300			122	
P15005C	60	1000	17		300	700				94	
P15006C	40	1700	17		300	1100	300			107	
P15007C	20	1450	17		300	850	300			46	
F15001	166	2810	16		1000	800	1000	720	720		733
F15002	36	8750	STR								495
(C) DENOTES EPOXY COATED BARS								TOTAL (C) BARS		6418	
								TOTAL OTHER BARS			7297

PILE DATA: SIZE 36 TREATED TIMBER					CAPACITY	
#	APPROX. LENGTH	CUT OFF ELEV.	TIP ELEV.	BATTER	SLS II	ULS
34	9.7	47.9	38.2	NONE	N/A	250kN

NOTE:
PILES TO BE DRIVEN TO A FINAL RESISTANCE MEASURED IN PENETRATION WHICH WILL BE ESTABLISHED BY THE ENGINEER FROM RESULTS OF DYNAMIC MONITORING. DYNAMIC MONITORING SHALL BE USED ON 15% OF ALL PILES AS SELECTED AND DIRECTED BY THE ENGINEER.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN A.S.	CHECK (A.S.)	LOADING OHBD CLASS A	DATE
DRAWN K.G.H.	CHECK (A.S.)	SITE No	DWG

DIR 16-82004 SCALE 1:50
DATE PLOTTED: 10:12 MAR 27 1992

ACAD FILE NAME: 92004S01

MINISTRY OF TRANSPORTATION, ONTARIO PII-D-707 88-08

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No

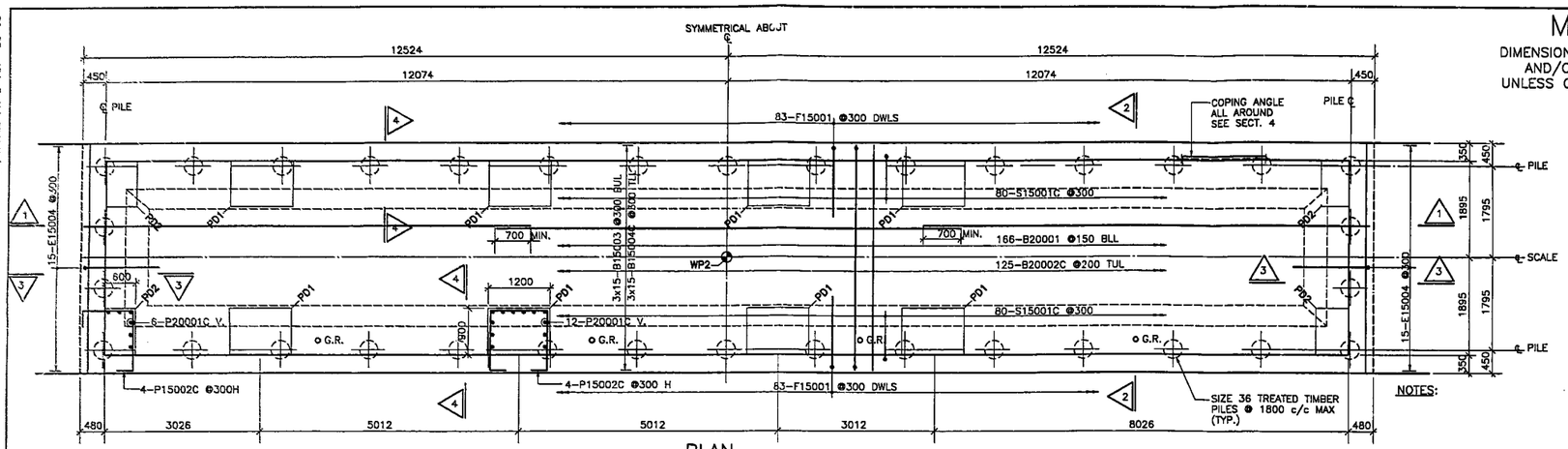
CONT No .

WP No 2511-91-00

SHEET 12

CASSELMAN TIS
STATIC SCALE FOUNDATION STRUCTURAL DETAILS

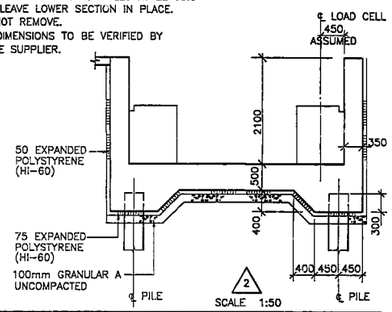
Marshall Macklin Monaghan Limited
Thornhill
Consulting Engineers . Surveyors . Planners



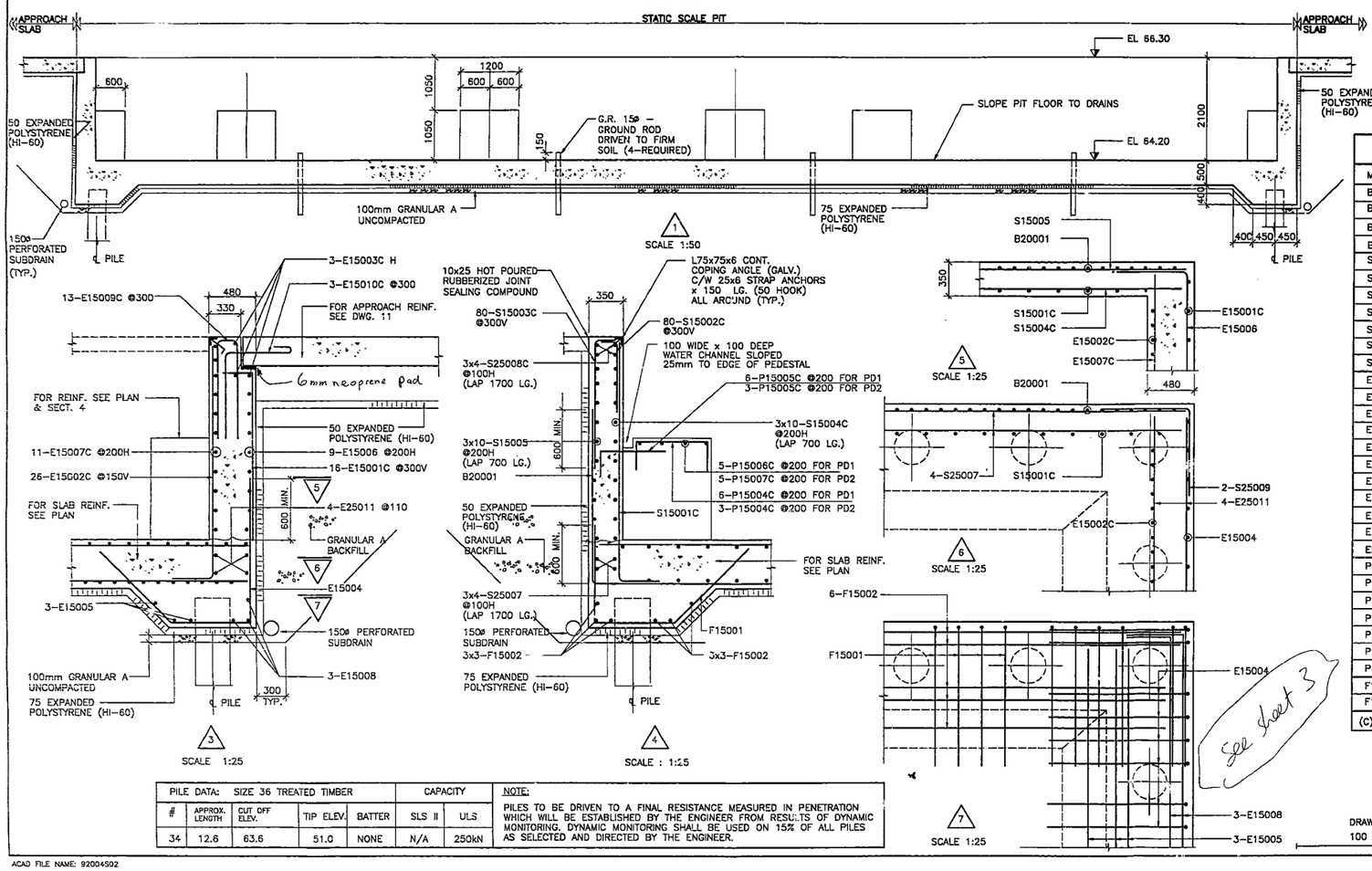
PLAN
SCALE 1:50

NOTES:

1) FOR GENERAL NOTES SEE DWG. 11
2) LOAD CELL NOT TO BE FARTHER FROM WALL THAN SHOWN IN SECTION TWO UNLESS APPROVED BY THE ENGINEER.
3) CUT–OFF EXIST. TIMBER PILES AT EL 63.0 AND LEAVE LOWER SECTION IN PLACE. DO NOT REMOVE.
4) ALL DIMENSIONS TO BE VERIFIED BY SCALE SUPPLIER.



2 SCALE 1:50



PILE DATA: SIZE 36 TREATED TIMBER					CAPACITY	
#	APPROX. LENGTH	CUT OFF ELEV.	TIP ELEV.	BATTER	SLS II	ULS
34	12.6	63.6	51.0	NONE	N/A	250kN

NOTE:
PILES TO BE DRIVEN TO A FINAL RESISTANCE MEASURED IN PENETRATION WHICH WILL BE ESTABLISHED BY THE ENGINEER FROM RESULTS OF DYNAMIC MONITORING. DYNAMIC MONITORING SHALL BE USED ON 15% OF ALL PILES AS SELECTED AND DIRECTED BY THE ENGINEER.

REINFORCING BAR LIST

MARK	No.*	LENGTH	TYPE	A	B	C	D	H	K	MASS (kg)	MASS (kg)
B20001	166	8050	17		1850	4350	1850				3147
B20002C	125	4350	STR							1281	
B15003	45	8770	STR								620
B15004C	45	8770	STR							620	
S15001C	160	2850	20		210	2430	210			716	
S15003C	160	1410	2	210	1200					354	
S15004C	60	8770	STR							826	
S15005	60	8770	STR								826
S25007	24	9440	STR								889
S25008C	24	9440	STR							889	
S25009	8	1800	2	900	900						57
E15001C	32	2000	2	300	1700					101	
E15002C	52	2680	2	250	2430					219	
E15003C	6	5250	17		450	4350	450			50	
E15004	30	3300	16		1500	800	1000	720	720		156
E15005	6	4300	STR								41
E15006	18	5250	17		450	4350	450				148
E15007C	22	4300	STR							149	
E15008	6	5250	17		450	4350	450				50
E15009C	26	1430	17		600	230	600			58	
E15010C	30	1400	18	200	600	600		J=100		66	
E25011	8	4300	STR								135
P20001C	120	1650	2	250	1400					466	
P15002C	32	3800	S6	300	1050	1100	1050	G=300		191	
P15003C	16	2500	S6	300	1050	850	300			63	
P15004C	60	1300	17		300	700	300			122	
P15005C	60	1000	17		300	700				94	
P15006C	40	1700	17		300	1100	300			107	
P15007C	20	1450	17		300	850	300			46	
F15001	166	2810	16		1000	800	1000	720	720		733
F15002	36	8750	STR								495
(C) DENOTES EPOXY COATED BARS									TOTAL (C) BARS	8418	
									TOTAL OTHER BARS		7297

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
	DATE	BY	DESCRIPTION

DESIGN	A.S.	CHECK	A.S.	LOADING	OHBD CLASS A	DATE
DRAWN	K.G.H.	CHECK	A.S.	SITE No		DWG

DIR 16–92004 SCALE 1:50
DATE PLOTTED: 10:24 MAR 27 1992

ACAD FILE NAME: 92004S02