

G.I.-30 SEPT. 1976

GEOCRES No. 40I13-45DIST. 2 REGION           W.P. No. 40-66-17 & 18CONT. No. 79-51W. O. No.           STR. SITE No.           HWY. No. 402LOCATION Sydenham River Bridges  
E.B.L / W.B.LNo. of PAGES -           

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.           

REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A.P. Watt (2)  
Regional Structural Planning Engineer  
Southwestern Region, London

FROM: Soil Mechanics Section  
Geotechnical Office  
West Bldg.

ATTENTION:

DATE: February 20, 1976

OUR FILE REF.

IN REPLY TO

FEB 26 1976

SUBJECT:

40 I 13-45  
GEOCRES No.

FOUNDATION INVESTIGATION REPORT

For

W.P. 40-66-17/18  
Hwy. 402 District 2, London  
Sydenham River Bridges  
E.B.L./W.B.L. 9.4 Miles West of Hwy. 2

Attached we are forwarding to you our detailed Foundation Investigation Report on the subsoil conditions existing at the above mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your requirements. Should additional information be required, please do not hesitate to contact our Office.

*K.G. Selby*

K.G. Selby  
Supervising Engineer

KGS/bp

cc: R.S. Pillar  
C.S. Grebski  
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Files

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# FOUNDATION INVESTIGATION REPORT

For

W.P. 40-66-17/18  
Hwy. 402 District 2, London  
Sydenham River Bridges  
E.B.L./W.B.L. 9.4 Miles West of Hwy. 2

## 1. INTRODUCTION

This report contains the results of a foundation investigation carried out at the above described location. The field work consisted of six boreholes.

The factual and interpreted soil data, together with recommendations for the design and construction of the proposed structures and approaches are presented in the report.

## 2. SITE DESCRIPTION

The site of the proposed twin structures is located at the crossing of the proposed Hwy. #402 and Sydenham River, Lot 20, Con. X, Twp. of Caradoc, Co. of Middlesex.

Sydenham River at this location flows in a general northeast to southwest direction. The river follows a somewhat meandering course through a self-eroded valley which is about 0.5 mi. wide. The existing river channel is about 25 ft. wide and 10 ft. deep.

The land surface rises sharply towards east. Physiographically the site is located in the region referred to as the Caradoc Sand Plains. Sands and other light textured waterlaid deposits are characteristics for this region.

## 3. SUBSURFACE CONDITIONS

### (3.1) General

Generally, a zone of silty sand to sandy silt, traces of clay occurs in the upper stratum of all boreholes. Below the granular there is a

very stiff to hard clayey silt with traces to some sand. The cohesive deposit is followed by a very dense deposit of sand and gravel with trace of silt and clay. The boundaries of the various deposits are shown on the accompanying Record of Borehole Sheets. The stratigraphical sections plotted on Drawing No. 406617 & 18-A have been inferred from this data. From ground level downward the various soil types encountered are described in some detail as follows:

### (3.2) Silty Sand to Sandy Silt, Traces of Clay

This deposit was intersected at every boring location immediately below ground surface but was not penetrated to its full extent in each borehole. The thickness was found to range from 52 to 81 ft. in Borehole #4 and 2 respectively.

The material in the stratum consists of sands and silts with varying proportions. The chief constituent is sand in the upper segment, while the lower part of the deposit contains a larger percentage of silt. Traces of clay were also found within this zone. Grain size distribution testing was carried out on selected samples from the deposit. The results are plotted in envelope form on Figure 1.

Standard penetration testing was carried out within this granular deposit and the results are plotted on the Record of Borehole Sheets. The obtained 'N' values ranged from 1 blow/18" to 196 blows/11 inches. Based on these results, it is estimated that the relative density of this deposit varies from very loose to very dense. The natural moisture content ranges from 5% to 23%.

### (3.3) Clayey Silt, Some to Trace of Sand

The granular deposit is underlain by a cohesive stratum in Boreholes #1,2,4 and 6 at approx. elev. 697. At the other borehole locations, the borings were terminated in the silty sand to sandy silt deposit. The stratum also contains some to traces of clay.

A limited number of laboratory tests carried out on selected samples indicate the following physical properties:

	<u>RANGE</u>
Liquid Limit (%)	17-32
Plastic Limit (%)	11-16
Natural Moisture Content (%)	16-22

The results of grain size distribution tests are plotted on Figure 2 of the Appendix.

The consistency of the stratum varies from very stiff to hard.

#### (3.4) Sand and Gravel, Traces of Silt and Clay

In Borehole #2 a very dense deposit of sand and gravel with traces of silt and clay was encountered below the cohesive deposit. The lower boundary was not determined.

#### 4. GROUNDWATER CONDITIONS

The following groundwater levels were observed during the field investigation:

Borehole #1	Elevation	758.5
#2		748.5
#3		746.0
#4		745.0
#5		745.0
#6		Not Established

#### 5. DISCUSSION AND RECOMMENDATIONS

##### (5.1) General

It is proposed to build three-span (61'-61'-61') twin structures at the crossing of the realigned Sydenham River and future Hwy. #402. The centre line of the proposed river diversion will be at Sta: 119 + 65+.

The proposed profile grade of Hwy. #402 will be approx. 30 ft. above the riverbed. In the vicinity of the E.B.L.'s east abutment up to 5 ft. of cut will be required.

(5.2) Foundations(5.2.1) Pile Support

All the footings (Abutments and Piers) for both structures may be supported on one of the following pile types:

(a) Franki Piles

Franki type displacement caissons may be used for footing support. The base of the pile, can be formed at the following elevations:

West Abutments (N & S Structures)	Elevation	740 ±
West Piers (N & S Structures)	Elevation	738 ±
East Piers (N & S Structures)	Elevation	740 ±
East Abutment (N Structure)	Elevation	740 ±
East Abutment (S Structure)	Elevation	755 ±

For different sizes of piles the following safe design loads are recommended:

14 in.	-	70 tons
18 in.	-	125 tons
22 in.	-	150 tons

(b) Steel Tube Piles

The footings may be supported on steel tube piles driven to approx. elev. 750 for the east abutment (E.B.L.) and elsewhere to elev. 724. In the case of 12 3/4" O.D. and 1/4" thick wall steel tube piles, a safe design load of 40 tons per pile may be used. Pile driving should be controlled by employing the Hiley Dynamic Pile Driving Formula (MTC Standards SS3-10 & 11).

#### (5.2.2) Spread Footings on Compacted Fill

The abutments with the exception of south structure's (E.B.L.) east abutment, may be supported on spread footings placed on well compacted suitable granular material within the approach fills. A safe design load of 2.0 t.s.f. may be assumed.

The granular material should consist of granular 'A' and should be fully compacted according to the current MTC standards. A construction scheme is outlined on Figure 3 of the Appendix.

The east abutment of the north structure (W.B.L.) will be situated on a sidehill. To avoid the condition, where part of the footing is located on original ground and partially on compacted fill, it is recommended that the subsoil be excavated for a minimum of 4 ft. below the base of footing and backfilled with Granular 'A'.

#### (5.2.3) Spread Footing in Original Ground

The east abutment of the south structure may be supported on spread footing placed within the dense to very dense zone of the subsoil, below elev. 766  $\pm$ . A safe net pressure of 3.0 t.s.f. may be assumed for design purposes.

#### (5.2.4) Hydrology Considerations

The suitability of spread footings at the proposed structure site depends on the magnitude of scour protection. This aspect will be investigated by the Hydrology Section and recommendations will be given.

#### (5.2.5) Frost Protection

The pile caps and the base of spread footings should be protected with a minimum of 4 ft. of earth cover.

#### (5.2.6) Dewatering

The observed groundwater level is located at or slightly above (Max. 12") the footing levels. (Elev. 746  $\pm$ ). Therefore, no major dewatering problems are anticipated. Any seepage into the excavations could be handled by pumping from sumps.



### (5.3) Approach Embankments

#### (5.3.1) Stability

The maximum height of the proposed approaches is in the order of 30 ft. (Measured from the existing river bottom). Cuts, up to 5 ft. deep will be required in the vicinity of the east abutment (E.B.L. only). The upper (Min 52 ft.) portion of the encountered subsoil is basically granular type material, followed by a deep deposit of very stiff to hard clayey silt. No stability problems are expected. The slopes of the approaches (cuts and fills) should be constructed with 2 horizontal and 1 vertical.

#### (5.3.2) Embankment Material

The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven and it is recommended that this portion of the fill contain grain sizes not larger than 3 in.

#### (5.3.3) Settlement

Settlements of the granular portion of the subsoil will be elastic in nature and should take place during or immediately after the completion of the embankment construction.

It is estimated that the settlement of the cohesive portion of the subsoil would not exceed 3 inches and would occur over a long term period.

#### (5.3.4) Topsoil Removal

The topsoil and any surficial organic material should be removed within the construction area in accordance with current MTC standards.

### (5.4) Stream Diversion

It is intended to realign the meandering Sydenham River at this location. As indicated on Plan E-5386-1 the centre line of the diversion will intersect the proposed Hwy. #402, Line 'A' at Sta: 119 + 65+.

At the time of the report writing details concerning the depth and

width of the new riverbed are not available.

Indications are, that the silty sand deposit encountered immediately below the ground surface may be subjected to scour and erosion. Several local slumping of the existing banks are visible.

In order to ensure the stability of the new river banks it is recommended that 2:1 slopes be constructed and protected with rip-rap cover to a level at least 2 ft. above the recorded high water level in the vicinity of the structure.

*P. Payer*  
P. Payer, P. Eng.  
Senior Engineer



*K. G. Selby*  
K.G. Selby, P. Eng.  
Supervising Engineer

## APPENDIX

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 40-66-17/18 LOCATION Co-ords. 15,618,163 N; 1,247,288 E. ORIGINATED BY PP  
DIST 2 HWY 402 BORING DATE November 7, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Washbore-NX & BX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W			UNIT WEIGHT Y	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		25	50	75	100	125	WP	W	WL		
774.7	Ground Level															
0.0	Silty sand to sandy silt, traces of clay  Compact to  Very Dense		1	SS	12	770										0 47 (53)
			2	SS	18											0 5 92
			3	SS	37											
			4	SS	43											
			5	SS	64											
			6	SS	100	4"										0 87 (13)
			7	SS	100	5"										
			8	SS	100	5"	750									0 90 (10)
			9	SS	61											
			10	SS	39											
			11	SS	44	740										
			12	SS	53											0 87 (13)
			13	SS	56	730										
			14	SS	137	720										
			15	SS	85	710										
			16	SS	70	700										
696.7	Clayey silt Hard		17	SS	52											
78.0																
693.2																
81.5	End of Borehole															

WP 40-66-17/18

LOCATION Co-ords. 15.618,265 N; 1,247,352 E.

ORIGINATED BY PP

DIST 2 HWY 402

BORING DATE November 12-17, 1975

COMPILED BY OJ

DATUM            Geodetic

BOREHOLE TYPE Washbore - NX & BX Casing

CHECKED BY \_\_\_\_\_

15 <sup>20</sup> 5 % STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 2 cont.

WP 40-66-17/18 LOCATION Co-ords. 15,618,256 N; 1,247,352 E. ORIGINATED BY PP  
 DIST 2 HWY 402 BORING DATE November 12-17, 1975 COMPILED BY OJ  
 DATUM Geodetic BOREHOLE TYPE Washbore-NX & BX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		25	50	75	100	125	$W_P$	$W$	$W_L$		
	continued															
634.8			20	SS	35	640										
117.0	Sand & gravel, traces of silt & clay		21	SS	59											40 48 (12)
631.3																
120.5	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 40-66-17/18 LOCATION Co-ords. 15,618,298 N; 1,247,316 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE Nov. 18, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Washbore-NX Casing CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		25	50	75	100	125	$w_p$	$w$	$w_L$		
749.8	Ground Level															
0.0	Silty sand to sandy silt, traces of clay  Loose to Very Dense		1	SS	9											0 92 ( 8 )
			2	SS	8											
			3	SS	24	740										
			4	SS	57											
			5	SS	21											
			6	SS	34	730										
			7	SS	27											
			8	SS	134											
			9	SS	36											
			10	SS	52	720										
			11	SS	57											
			12	SS	33	710										
			13	SS	44											
698.3			14	SS	38	700										0 6 87
51.5	End of Borehole															

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

RECORD OF BOREHOLE NO 4

WP 40-66-17/18 LOCATION Co-ords. 15,618,390 N; 1,247,223 E. ORIGINATED BY MK  
 DIST 2 HWY 402 BORING DATE November 17-18, 1975 COMPILED BY OJ  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		25	50	75	100	125	$w_p$	$w$	$w_L$		
748.2	Ground Level															GR SA SI CL
0.0	Silty sand to sandy  silt.       Very Loose to   Very Dense		1	SS	4											0 7 91
			2	SS	1/18											
			3	SS	3											
			4	SS	1/6											
			5	SS	38											
			6	SS	36											
			7	SS	9											
			8	SS	8											
			9	SS	18											
			10	SS	56											
			11	SS	13											
			12	SS	17											
			13	SS	22											
			14	SS	11											
			15	SS	17											
697.2			16	SS	40											0 5 80 1
51.0	Clayey silt, trace of sand.		17	SS	52											
691.7	Very Stiff to Hard		18	SS	18											
56.5	End of Borehole															



RECORD OF BOREHOLE NO 5

WP 40-66-17/18 LOCATION Co-ords. 15,618,271 N; 1,247,184 E. ORIGINATED BY MK  
 DIST 2 HWY 402 BORING DATE November 18 - 19, 1975 COMPILED BY OJ  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 25 50 75 100 125 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
749.6	Ground Level									
0.0	Silty sand to sandy silt, traces of clay  Very Loose to  Very Dense		1	SS	5					
			2	SS	1/12"					
			3	SS	1/18"					
			4	SS	1/12"					
			5	SS	1/18"					
			6	SS	46					0 91 ( 9
			7	SS	22					
			8	SS	16					
			9	SS	11					
			10	SS	76					
			11	SS	107					
			12	SS	10					
			13	SS	21					
			14	SS	15					0 9 90 1
698.1				15	SS	24				
			16	SS	19					
51.5	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6

WP 40-66-17/18 LOCATION Co-ords. 15,618,315 N; 1,247,143 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE November 19-20, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p \rightarrow w \rightarrow w_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		25	50	75	100	125			
748.0	Ground Level													
0.0	Silty sand to sandy silt, traces of clay  Very Loose to Very Dense		1	SS	4									
			2	SS	1/12"									
			3	SS	3									
			4	SS	62									
			5	SS	15									
			6	SS	15									
			7	SS	14									
			8	SS	33									
			9	SS	10									
			10	SS	66									
			11	SS	17									
			12	SS	25									
			13	SS	22									
			14	SS	18									
			15	SS	25									
697.0	Clayey silt, traces of sand.  Very Stiff to Hard		16	SS	61									0 7 92 1
51.0														
			17	SS	22									0 1 92 7
			18	SS	20									0 16 78 6 0 1 77 22
			19	SS	20									0 0 71 29
			20	SS	64									0 5 69 26
			21	SS	26									0 0 79 21

cont.

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

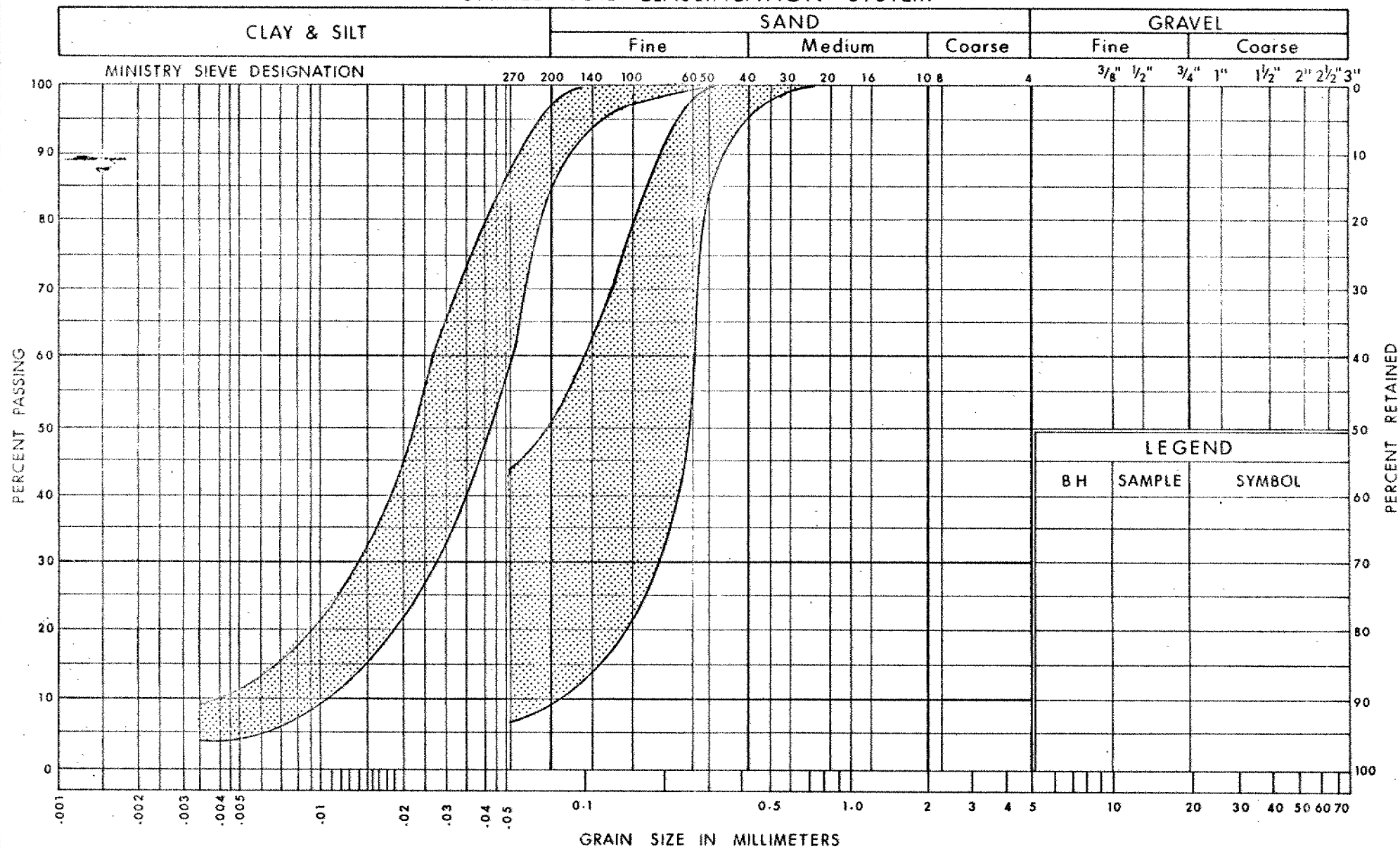
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6 cont.

WP 40-66-17/18 LOCATION Co-ords. 15,618,315 N; 1,247,143 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE November 19-20, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		25	50	75	100	125	$w_p$	$w$	$w_L$		
	continued						SHEAR STRENGTH					WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					10 20 30				
627.5			22	SS	90	640										
						630										
121.5	End of Borehole		23	SS	116											0 8 53 39

## UNIFIED SOIL CLASSIFICATION SYSTEM

Ministry of  
Transportation and  
Communications

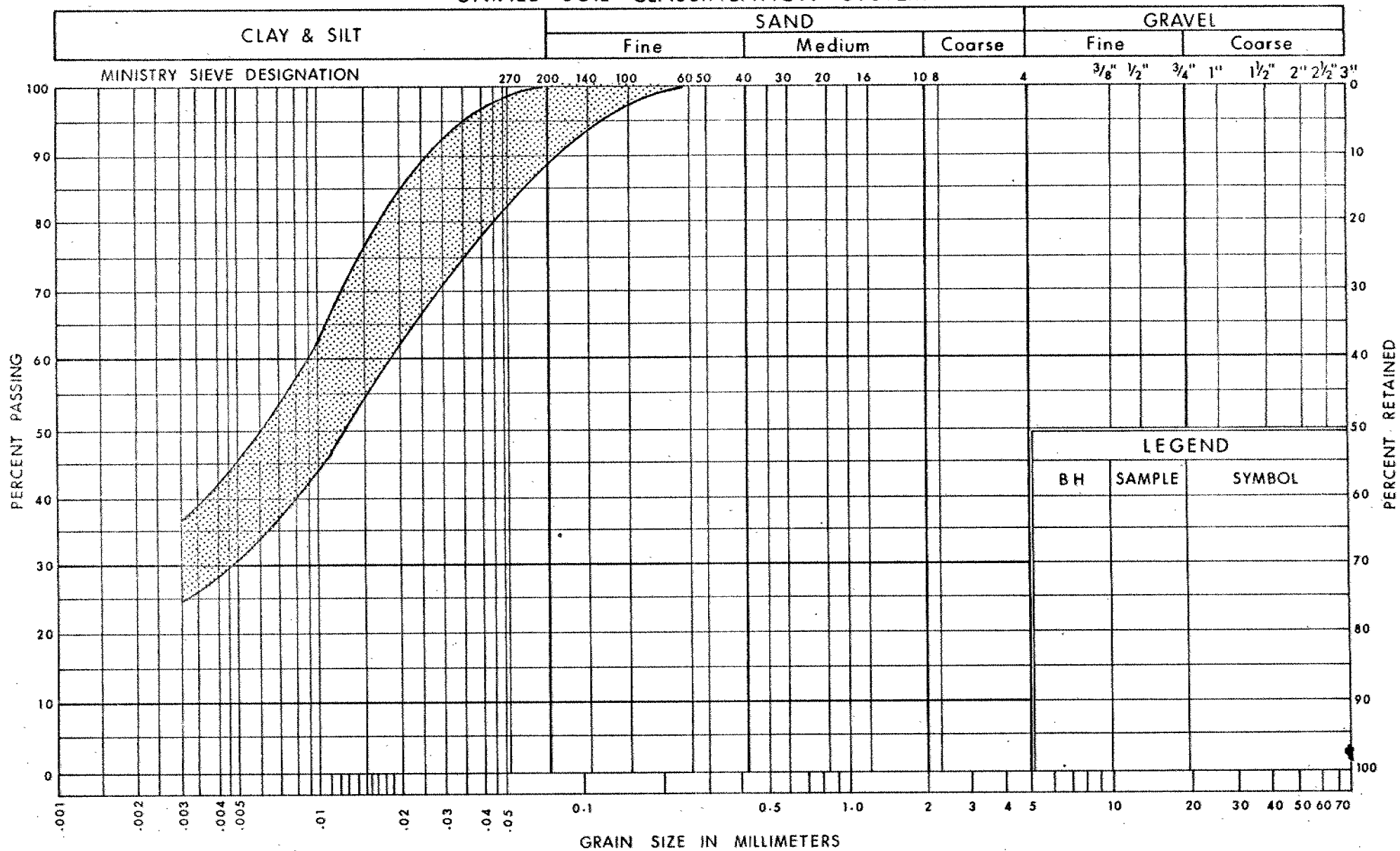
ENGINEERING SERVICES BRANCH

## GRAIN SIZE DISTRIBUTION SILTY SAND TO SANDY SILT

FIG No 1

W P 40-66-17 & 18

# UNIFIED SOIL CLASSIFICATION SYSTEM

Ministry of  
Transportation and  
Communications

Ontario

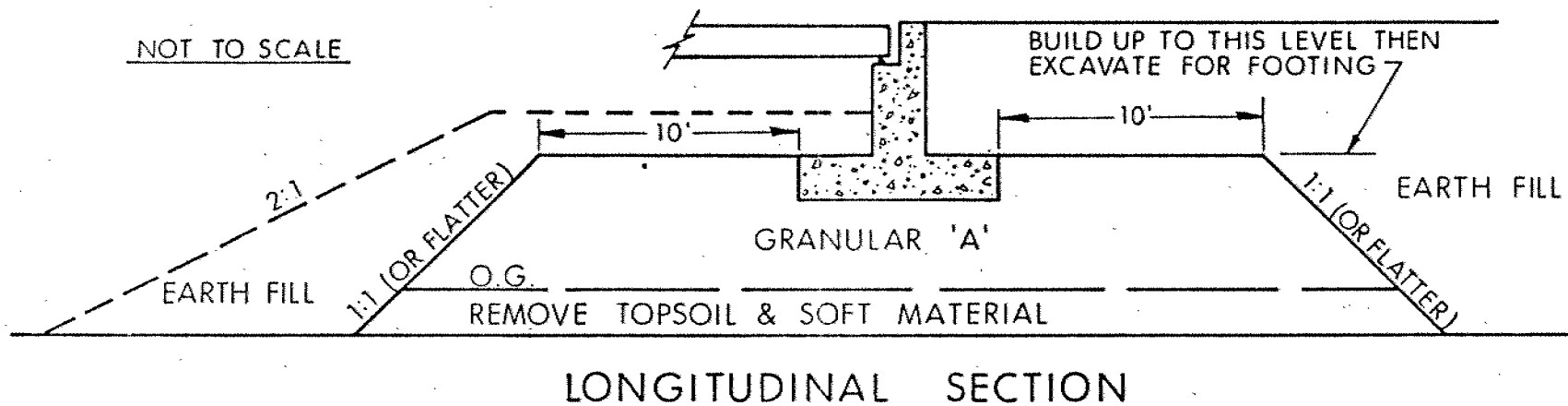
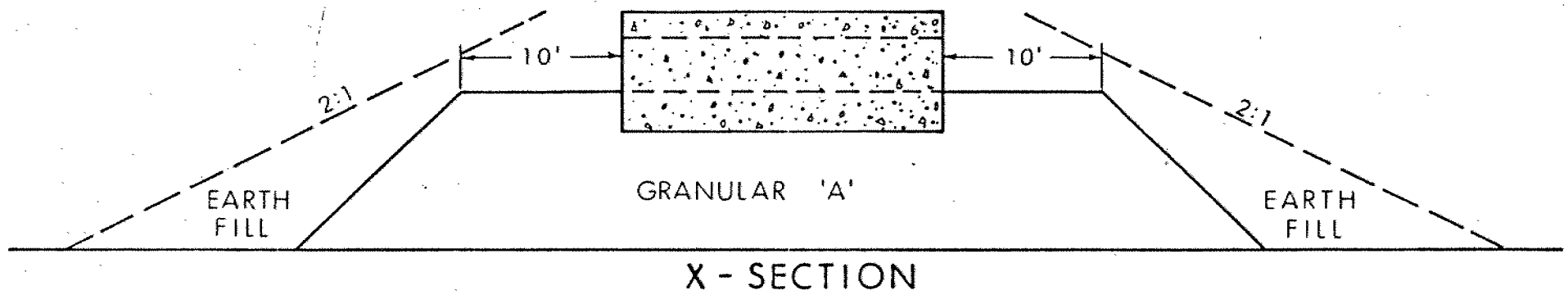
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION  
CLAYEY SILT  
SOME SAND

FIG No. 2

W P 40-66-17 & 18

# ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



## NOTES

- 1 - REMOVE TOPSOIL & /OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.
- 2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION 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 :-

<u>CONSISTENCY</u>	<u>c LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

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

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

## GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

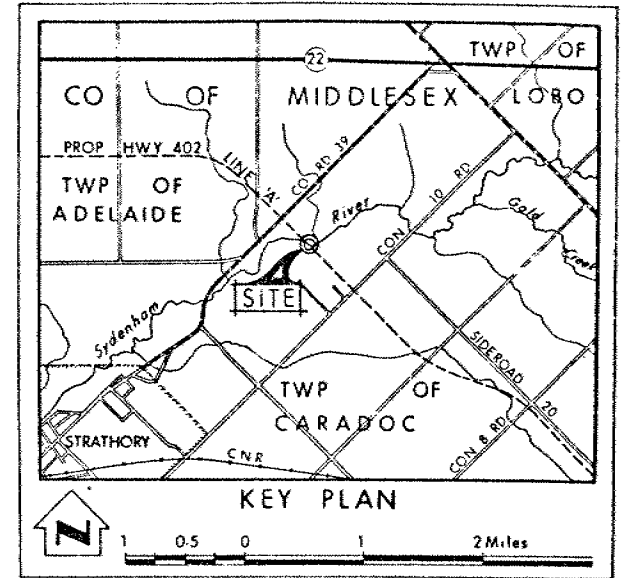
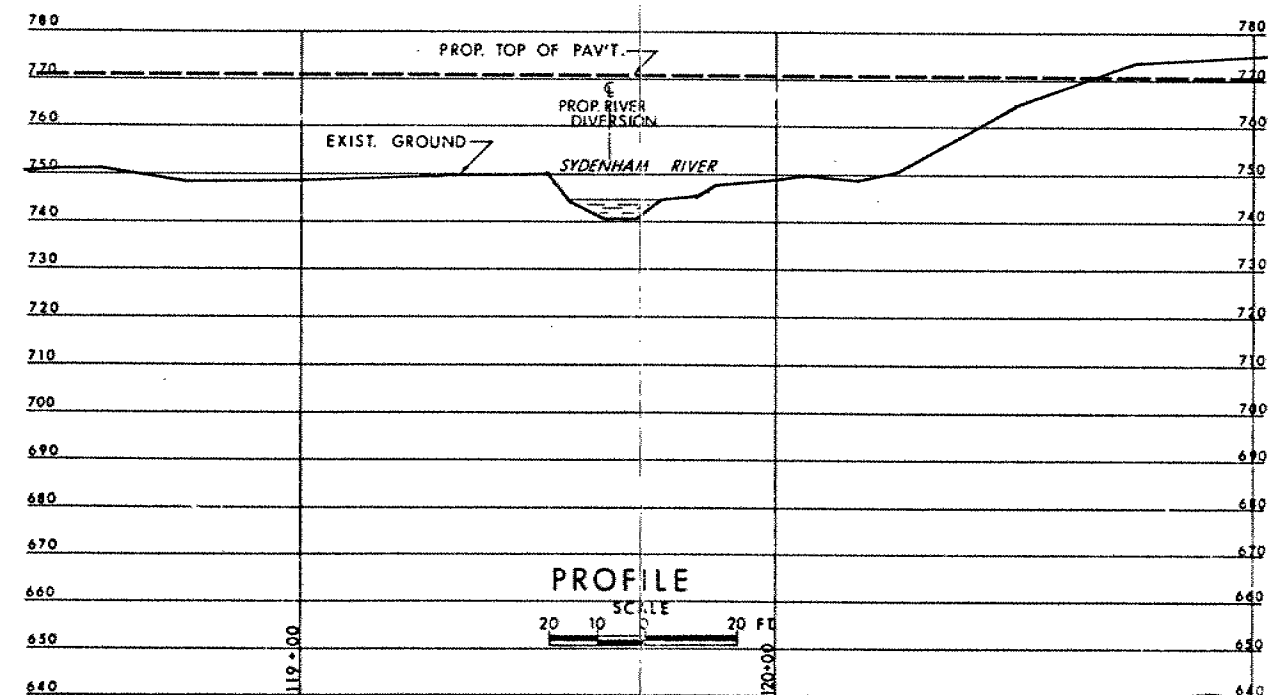
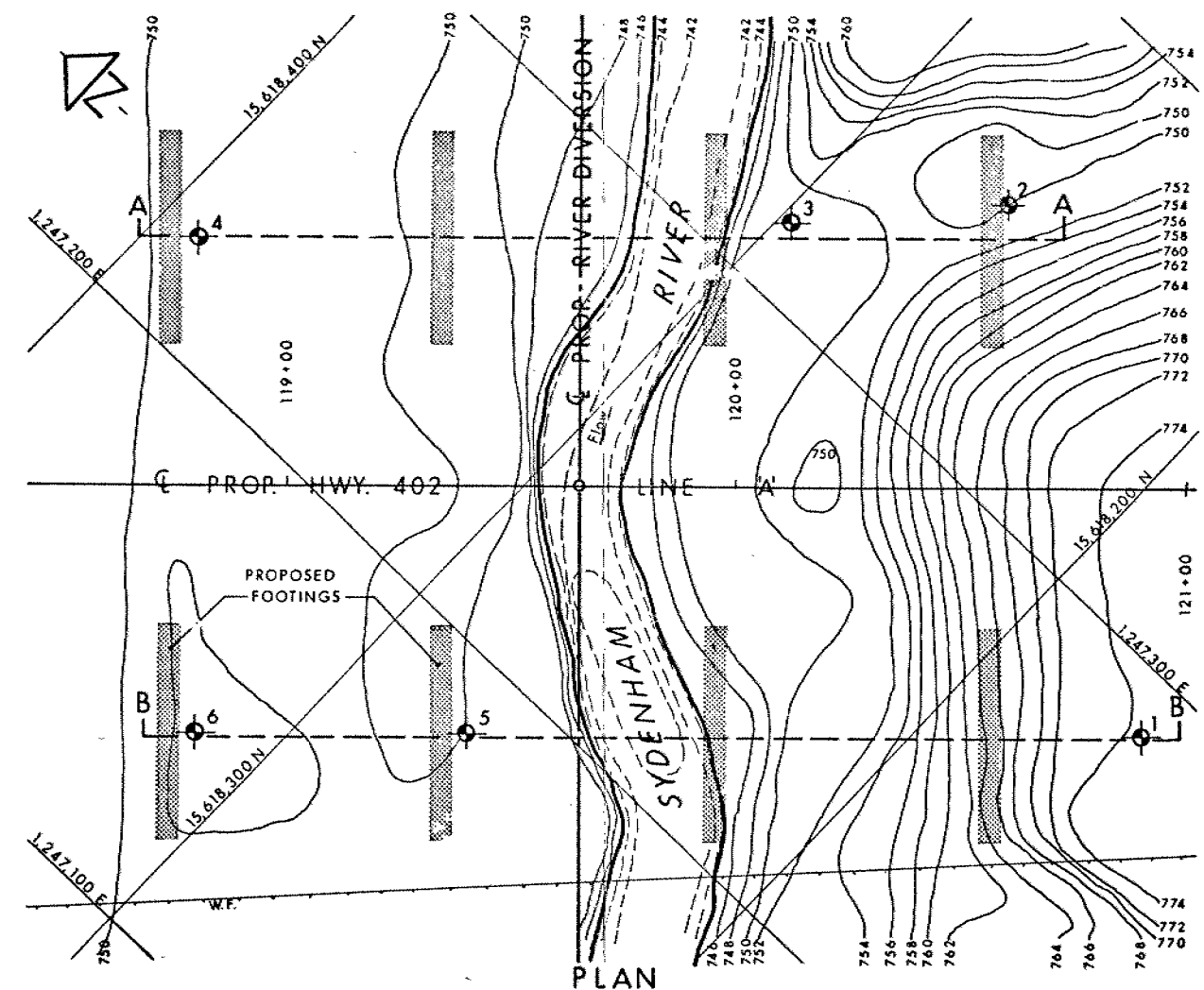
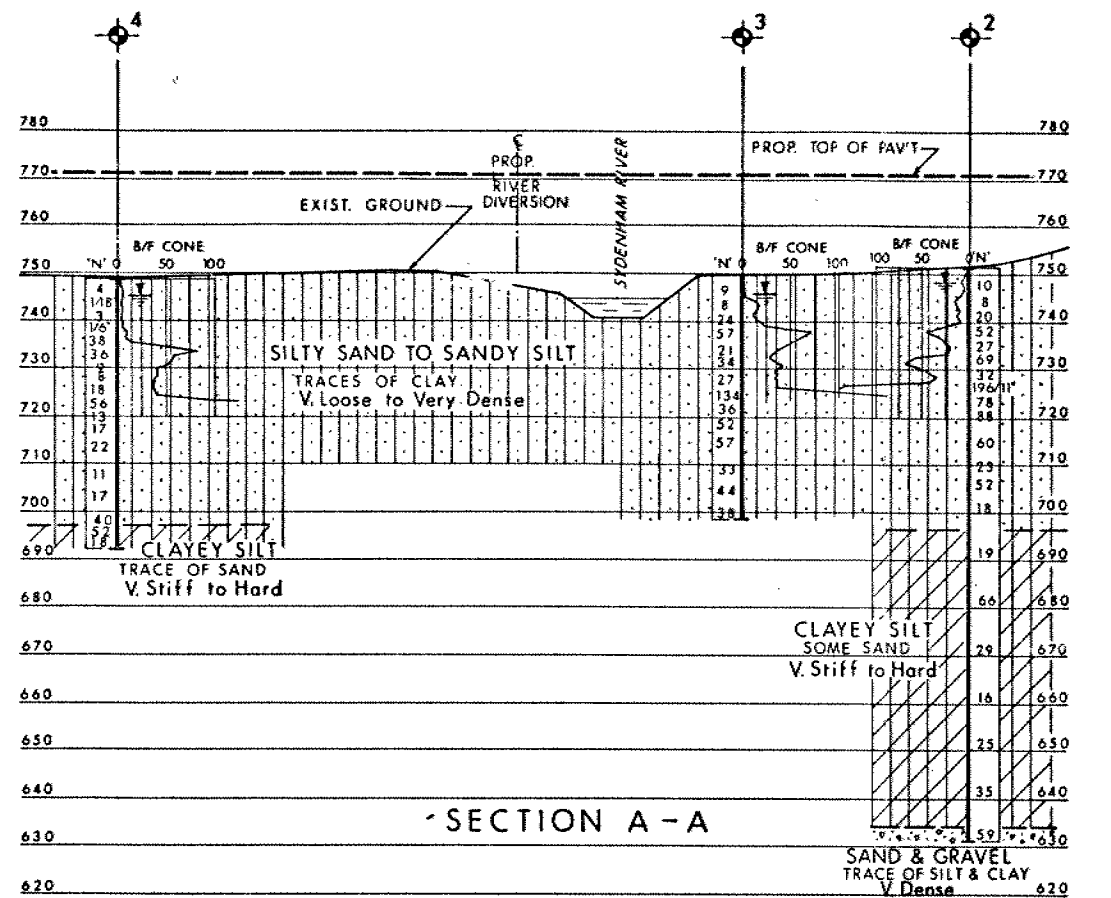
## FOUNDATIONS

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
$\beta$	ANGLE OF SLOPE TO HORIZONTAL





**LEGEND**

- Bore Hole
- Dynamic Cone Penetration Resistance Test (B/F CONE - Blows/Ft. Cone Test (350 ft. lbs. energy/blow))
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, NOV. 1975
- NO Water Levels established in Bore Hole No. 6

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	774.7	15,618,163	1,247,288
2	751.8	15,618,265	1,247,352
3	749.8	15,618,298	1,247,316
4	748.2	15,618,390	1,247,223
5	749.6	15,618,271	1,247,184
6	748.0	15,618,315	1,247,143

**NOTE: FOR CONTRACT DOCUMENTS**

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the LONDON District Office.

**NOTE**

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

REVISION	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

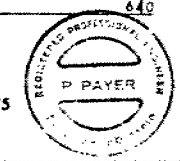
**SYDENHAM RIVER**

HIGHWAY NO Proposed 402 LINE 'A' DIST NO 2  
CO MIDDLESEX  
TWP CARADOC LOT 20 CON 10

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBMIT P.P.	CHECKED	W.P. NO 40-66-17 & 18	DRAWING NO
DRAWN O.L.J.	CHECKED	W.D. NO	406617 & 18-A
DATE 10 FEB. 1976	SITE NO 19-524	BRIDGE DRAWING NO	
APPROVED	CONT NO		

REF. E-5386-1 JULY 1975



DOCUMENT MICROFILMING IDENTIFICATION

G.J-20 SEPT 1976

GEOCRES No. 40713-45

DIST. 2 REGION Southwestern

W.P. No. 40-66-17/18

CONT. No. 79-51

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. 402

LOCATION Sydenham River Bridges

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 4

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

very stiff to hard clayey silt with traces to some sand. The cohesive deposit is followed by a very dense deposit of sand and gravel with trace of silt and clay. The boundaries of the various deposits are shown on the accompanying Record of Borehole Sheets. The stratigraphical sections plotted on Drawing No. 406617 & 18-A have been inferred from this data. From ground level downward the various soil types encountered are described in some detail as follows:

### (3.2) Silty Sand to Sandy Silt, Traces of Clay

This deposit was intersected at every boring location immediately below ground surface but was not penetrated to its full extent in each borehole. The thickness was found to range from 52 to 81 ft. in Borehole #4 and 2 respectively.

The material in the stratum consists of sands and silts with varying proportions. The chief constituent is sand in the upper segment, while the lower part of the deposit contains a larger percentage of silt. Traces of clay were also found within this zone. Grain size distribution testing was carried out on selected samples from the deposit. The results are plotted in envelope form on Figure 1.

Standard penetration testing was carried out within this granular deposit and the results are plotted on the Record of Borehole Sheets. The obtained 'N' values ranged from 1 blow/18" to 196 blows/11 inches. Based on these results, it is estimated that the relative density of this deposit varies from very loose to very dense. The natural moisture content ranges from 5% to 23%.

### (3.3) Clayey Silt, Some to Trace of Sand

The granular deposit is underlain by a cohesive stratum in Boreholes #1,2,4 and 6 at approx. elev. 697. At the other borehole locations, the borings were terminated in the silty sand to sandy silt deposit. The stratum also contains some to traces of clay.

A limited number of laboratory tests carried out on selected samples indicate the following physical properties:

	<u>RANGE</u>
Liquid Limit (%)	17-32
Plastic Limit (%)	11-16
Natural Moisture Content (%)	16-22

The results of grain size distribution tests are plotted on Figure 2 of the Appendix.

The consistency of the stratum varies from very stiff to hard.

#### (3.4) Sand and Gravel, Traces of Silt and Clay

In Borehole #2 a very dense deposit of sand and gravel with traces of silt and clay was encountered below the cohesive deposit. The lower boundary was not determined.

#### 4. GROUNDWATER CONDITIONS

The following groundwater levels were observed during the field investigation:

Borehole #1	Elevation	758.5
#2		748.5
#3		746.0
#4		745.0
#5		745.0
#6		Not Established

#### 5. DISCUSSION AND RECOMMENDATIONS

##### (5.1) General

It is proposed to build three-span (61'-61'-61') twin structures at the crossing of the realigned Sydenham River and future Hwy. #402. The centre line of the proposed river diversion will be at Sta: 119 + 65<sub>+</sub>.

The proposed profile grade of Hwy. #402 will be approx. 30 ft. above the riverbed. In the vicinity of the E.B.L.'s east abutment up to 5 ft. of cut will be required.

## (5.2) Foundations

### (5.2.1) Pile Support

All the footings (Abutments and Piers) for both structures may be supported on one of the following pile types:

#### (a) Franki Piles

Franki type displacement caissons may be used for footing support. The base of the pile, can be formed at the following elevations:

West Abutments ✓ (N & S Structures)	Elevation	740 ±
West Piers ✓ (N & S Structures)	Elevation	738 ±
East Piers (N & S Structures)	Elevation	740 ±
East Abutment ✓ (N Structure)	Elevation	740 ±
East Abutment ✓ (S Structure)	Elevation	755 ±

For different sizes of piles the following safe design loads are recommended:

14 in.	-	70 tons
18 in.	-	125 tons
22 in.	-	150 tons

#### (b) Steel Tube Piles

The footings may be supported on steel tube piles driven to approx. elev. 750 for the east abutment (E.B.L.) and elsewhere to elev. 724. In the case of 12 3/4" O.D. and 1/4" thick wall steel tube piles, a safe design load of 40 tons per pile may be used. Pile driving should be controlled by employing the Hiley Dynamic Pile Driving Formula (MTC Standards SS3-10 & 11).

#### (5.2.2) Spread Footings on Compacted Fill

The abutments with the exception of south structure's (E.B.L.) east abutment, may be supported on spread footings placed on well compacted suitable granular material within the approach fills. A safe design load of 2.0 t.s.f. may be assumed.

The granular material should consist of granular 'A' and should be fully compacted according to the current MTC standards. A construction scheme is outlined on Figure 3 of the Appendix.

The east abutment of the north structure (W.B.L.) will be situated on a sidehill. To avoid the condition, where part of the footing is located on original ground and partially on compacted fill, it is recommended that the subsoil be excavated for a minimum of 4 ft. below the base of footing and backfilled with Granular 'A'.

#### (5.2.3) Spread Footing in Original Ground

The east abutment of the south structure may be supported on spread footing placed within the dense to very dense zone of the subsoil, below elev. 766  $\pm$ . A safe net pressure of 3.0 t.s.f. may be assumed for design purposes.

#### (5.2.4) Hydrology Considerations

The suitability of spread footings at the proposed structure site depends on the magnitude of scour protection. This aspect will be investigated by the Hydrology Section and recommendations will be given.

#### (5.2.5) Frost Protection

The pile caps and the base of spread footings should be protected with a minimum of 4 ft. of earth cover.

#### (5.2.6) Dewatering

The observed groundwater level is located at or slightly above (Max. 12") the footing levels. (Elev. 746  $\pm$ ). Therefore, no major dewatering problems are anticipated. Any seepage into the excavations could be handled by pumping from sumps.

### (5.3) Approach Embankments

#### (5.3.1) Stability

The maximum height of the proposed approaches is in the order of 30 ft. (Measured from the existing river bottom). Cuts, up to 5 ft. deep will be required in the vicinity of the east abutment (E.B.L. only). The upper (Min 52 ft.) portion of the encountered subsoil is basically granular type material, followed by a deep deposit of very stiff to hard clayey silt. No stability problems are expected. The slopes of the approaches (cuts and fills) should be constructed with 2 horizontal and 1 vertical.

#### (5.3.2) Embankment Material

The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven and it is recommended that this portion of the fill contain grain sizes not larger than 3 in.

#### (5.3.3) Settlement

Settlements of the granular portion of the subsoil will be elastic in nature and should take place during or immediately after the completion of the embankment construction.

It is estimated that the settlement of the cohesive portion of the subsoil would not exceed 3 inches and would occur over a long term period.

#### (5.3.4) Topsoil Removal

The topsoil and any surficial organic material should be removed within the construction area in accordance with current MTC standards.

### (5.4) Stream Diversion

It is intended to realign the meandering Sydenham River at this location. As indicated on Plan E-5386-1 the centre line of the diversion will intersect the proposed Hwy. #402, Line 'A' at Sta: 119 + 65+.

At the time of the report writing details concerning the depth and

width of the new riverbed are not available.

Indications are, that the silty sand deposit encountered immediately below the ground surface may be subjected to scour and erosion. Several local slumping of the existing banks are visible.

In order to ensure the stability of the new river banks it is recommended that 2:1 slopes be constructed and protected with rip-rap cover to a level at least 2 ft. above the recorded high water level in the vicinity of the structure.

*P. Payer*  
P. Payer, P. Eng.  
Senior Engineer



*K. G. Selby*  
K.G. Selby, P. Eng.  
Supervising Engineer



## APPENDIX

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 1

WP 40-66-17/18 LOCATION Co-ords. 15,618,163 N; 1,247,288 E. ORIGINATED BY PP  
DIST 2 HWY 402 BORING DATE November 7, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Washbore-NX & BX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		25	50	75	100	125	$W_P$	$W$	$W_L$		
774.7	Ground Level															
0.0																
	Silty sand to sandy		1	SS	12	770										0 47 (53)
			2	SS	18											
	silt, traces of clay		3	SS	37											0 5 92
			4	SS	43											
			5	SS	64											
			6	SS	100	4"										0 87 (13)
			7	SS	100	5"										
			8	SS	100	5" 750										
	Compact to		9	SS	61											0 90 (10)
			10	SS	39											
	Very Dense		11	SS	44	740										
			12	SS	53											0 87 (13)
			13	SS	56	730										
			14	SS	137											
						720										
			15	SS	85	710										
						700										
696.7																
78.0	Clayey silt															
693.2	Hard		17	SS	52											
81.5	End of Borehole															

20  
15 5 % STRAIN AT FAILURE  
10

## OFFICE REPORT OF SOIL EXPLORATION

OFFICE REPORT OF SOIL EXPLORATION

OFFICE REPORT OF SOIL EXPLORATION

OFFICE REPORT OF SOIL EXPLORATION

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OFFICE REPORT OF SOIL EXPLORATION

RECORD OF BOREHOLE NO 2 cont.

WP 40-66-17/18 LOCATION Co-ords. 15,618,256 N; 1,247,352 E. ORIGINATED BY PP  
 DIST 2 HWY 402 BORING DATE November 12-17, 1975 COMPILED BY OJ  
 DATUM Geodetic BOREHOLE TYPE Washbore-NX & BX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		25	50	75	100	125	$W_p$	$W$	$W_L$		
	continued						SHEAR STRENGTH					WATER CONTENT %				
							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					10 20 30				GR SA SI CL
634.8			20	SS	35	640										
117.0	Sand & gravel, traces															
631.3	of silt & clay		21	SS	59											40 48 (12)
120.5	End of Borehole															

OFFICE REPORT SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 40-66-17/18 LOCATION Co-ords. 15,618.298 N; 1,247,316 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE Nov. 18, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Washbore-NX Casing CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT			LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			UNIT WEIGHT $\gamma$	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		25	50	75	100	125	$w_p$			$w$
						SHEAR STRENGTH						WATER CONTENT %			
						O UNCONFINED + FIELD VANE						10 20 30			
						● QUICK TRIAXIAL X LAB VANE									
749.8	Ground Level														
0.0	Silty sand to sandy  silt, traces of clay      Loose to Very Dense		1	SS	9										
			2	SS	8										
			3	SS	24										
			4	SS	57										
			5	SS	21										
			6	SS	34										
			7	SS	27										
			8	SS	134										
			9	SS	36										
			10	SS	52										
			11	SS	57										
			12	SS	33										
			13	SS	44										
698.3			14	SS	38										
51.5	End of Borehole														

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 40-66-17/18 LOCATION Co-ords. 15,618,390 N; 1,247,223 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE November 17-18, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		25	50	75	100	125	$W_p$	$W$	$W_L$		
748.2	Ground Level															
0.0	Silty sand to sandy  silt.   Very Loose to  Very Dense		1	SS	4											
			2	SS	1/18"											
			3	SS	3											
			4	SS	1/6"											
			5	SS	38											
			6	SS	36											
			7	SS	9											
			8	SS	8											
			9	SS	18											
			10	SS	56											
			11	SS	13											
			12	SS	17											
			13	SS	22											
			14	SS	11											
			15	SS	17											
697.2			16	SS	40											
51.0	Clayey silt, trace of sand.		17	SS	52											
691.7	Very Stiff to Hard		18	SS	18											
56.5	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 4C-66-17/18 LOCATION Co-ords. 15,618,271 N; 1,247,184 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE November 18 - 19, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		25	50	75	100	125	$W_P$	$W$	$W_L$		
749.6	Ground Level			'N' VALUES		SHEAR STRENGTH					WATER CONTENT %				GR SA SI CL
0.0	Silty sand to sandy silt, traces of clay  Very Loose to  Very Dense		1	SS	5									0.91 (9)	
			2	SS	1/12										
			3	SS	1/18										
			4	SS	1/12										
			5	SS	1/18										
			6	SS	46										
			7	SS	22										
			8	SS	16										
			9	SS	11										
			10	SS	76										
			11	SS	107										
			12	SS	10										
			13	SS	21										
			14	SS	15										
			15	SS	24										
698.1			16	SS	19										
51.5	End of Borehole														

# RECORD OF BOREHOLE NO 6

WP 40-66-17/18 LOCATION Co-ords. 15,518,315 N; 1,247,143 E. ORIGINATED BY MK  
DIST 2 HWY 402 BORING DATE November 19-20, 1975 COMPILED BY OJ  
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

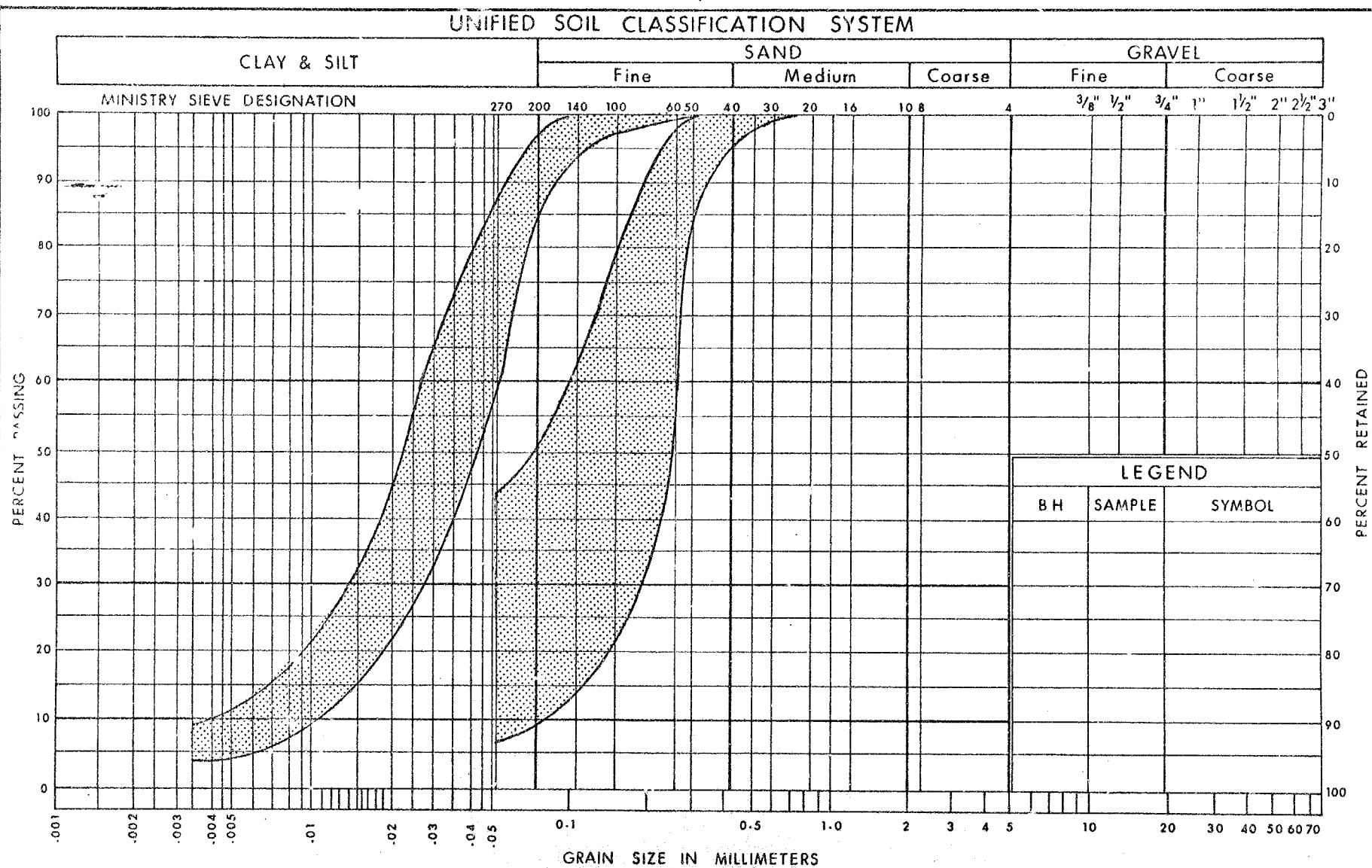
SOIL PROFILE			SAMPLES		GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 25 50 75 100 125 SHEAR STRENGTH O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ $W$ $W_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE					
748.0	Ground Level								
0.0	Silty sand to sandy silt, traces of clay  Very Loose to Very Dense	•	1	SS	4				
			2	SS	1/12"				
			3	SS	3				
			4	SS	62				
			5	SS	15				
			6	SS	15				
			7	SS	14				
			8	SS	33				
			9	SS	10				
			10	SS	66				
			11	SS	17				
			12	SS	25				
			13	SS	22				
			14	SS	18				
			15	SS	25				
697.0			16	SS	61				0 7 92 1
51.0	Clayey silt, traces of sand.  Very Stiff to Hard	/							
			17	SS	22				0 1 92 7
			18	SS	20				0 16 78 6 0 1 77 22
			19	SS	20				0 0 71 29
			20	SS	64				0 5 69 26
			21	SS	26				0 0 79 21

cont.



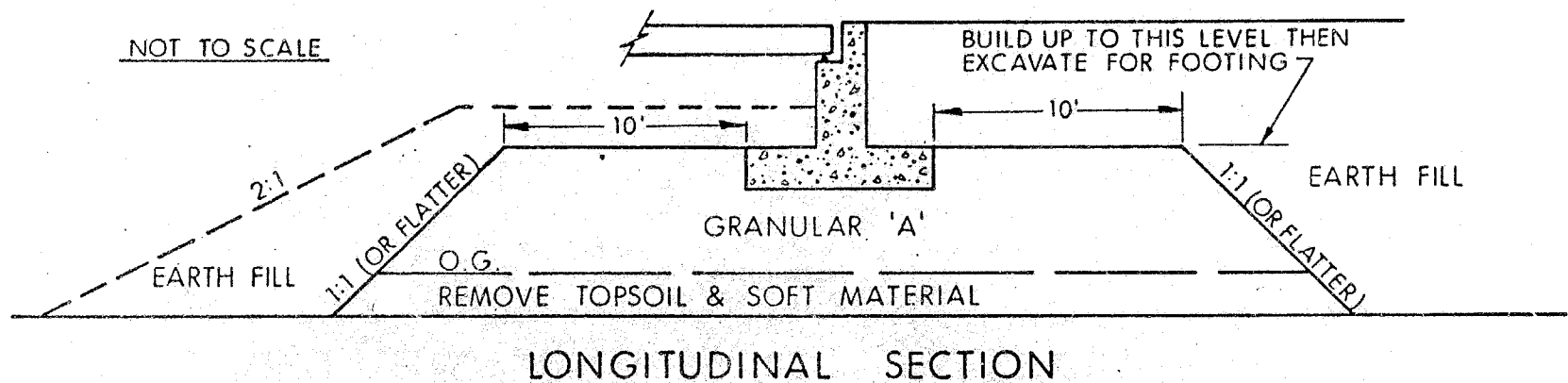
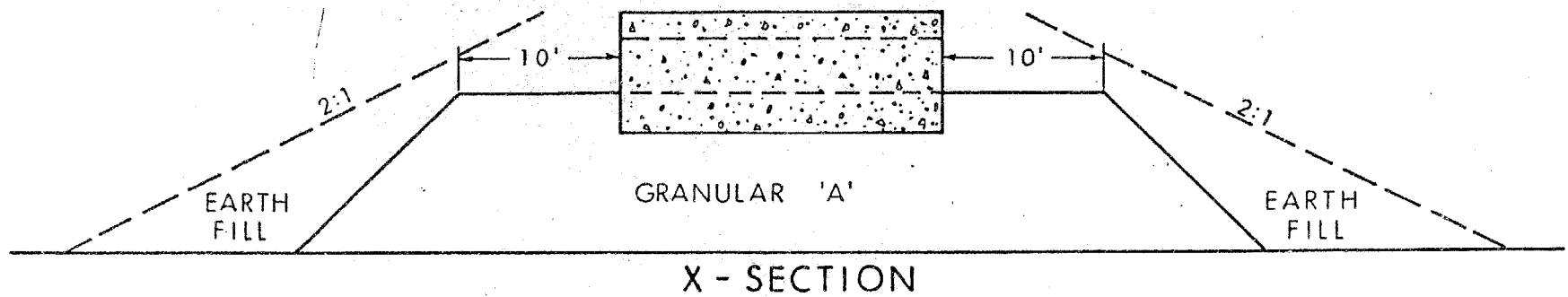
CHECKED BY

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10



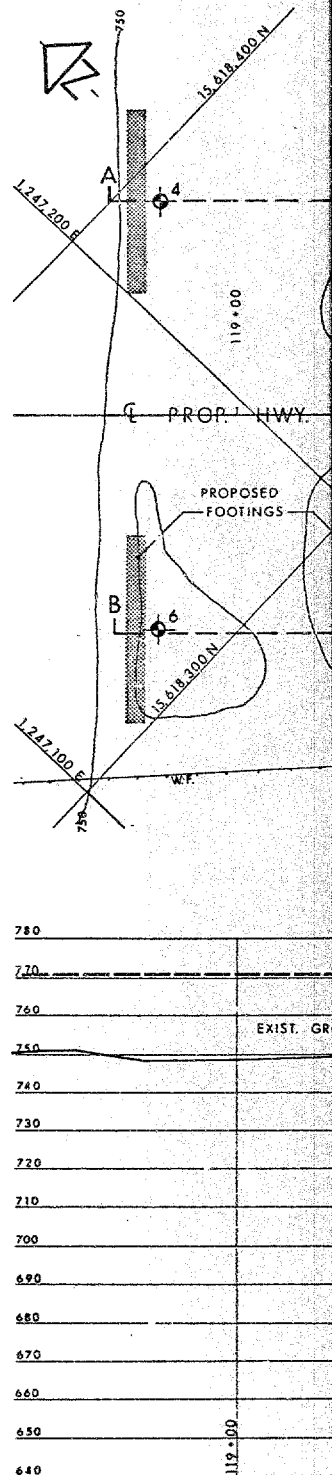
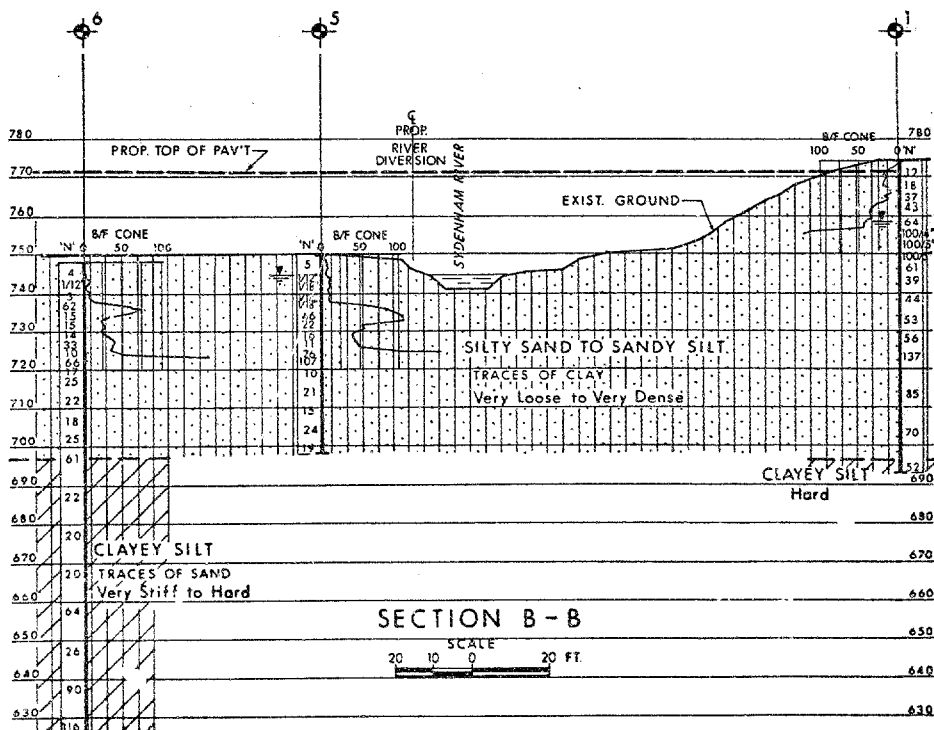
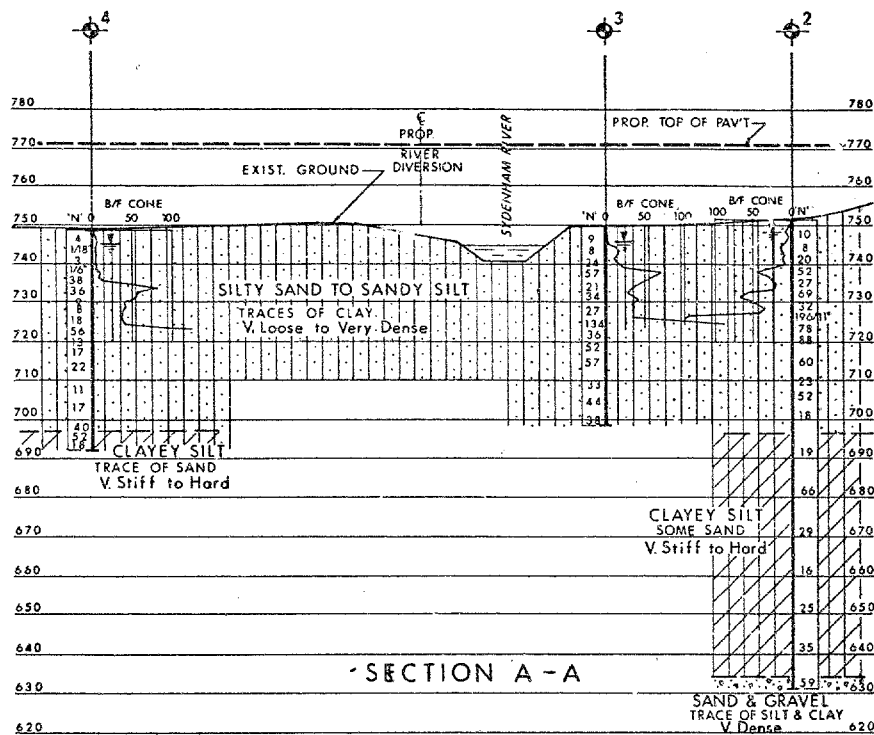


# ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



## NOTES

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.
- 2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS
- 3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.





STRUCTURAL REVIEW MEETING

Place: Boardroom "B" West Building.

Time:

Date: 78 03 15

Attending:

J. Keen  
A. McKim  
K. Selby ✓  
M. Stoyanoff

Sydenham River Bridge W.P. # 40-66-17 E.B.L. Site # 19-524A  
W.P. # 40-66-18 W.B.L. Site # 19-524B

The Soil Mechanics Section is satisfied with the foundations of the structures. Since the structures have been moved slightly from the site of the original investigation, additional information is to be obtained to confirm the original recommendations.

The Hydrology Section is satisfied with the hydrologic aspects of the structures. K. Jorns reviewed the plans following the meeting.

There were no comments or changes on sheets 1, 3, 5, 8, 9, 10, 11.

Dwg. 4 It was decided to leave the construction joint in the abutment of the E.B.L. Structure.

Dwg. 6 The joint between the deck and barrier wall is to be updated to a stepped joint with no water stop.

Dwg. 7 The Standard is to be revised to show the new joint detail.

Dwg. 12 Class "B" embedded anchor type of joint is to be permitted.

Dwg. 13 The standard showing crushed rock slope protection is to be removed.

The reinforcing steel table will be converted to metric in accordance with the instructions for stockpiled bridges.

The deck is to be machine finished.

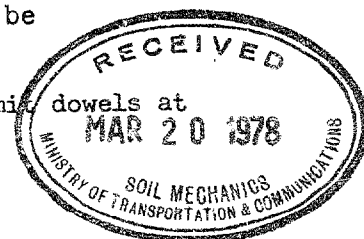
County Road #39 Interchange Underpass W.P. # 40-66-19 E.B.L. Site # 19-523A  
W.P. # 40-66-20 W.B.L. Site # 19-523B

The Soil Mechanics Section foresees no foundation problems at this site.

There were no comments on sheets 3, 4, 5, 6, 7, 11, 12, 13, 16, 17.

Dwg. 1. The cover to the steel in the barrier wall is to be "as shown".

Dwg. 8 The note on detail 4 is to be changed to read "Omit dowels at exterior of exterior girder".



Dwg. 9 The joint between the deck and the barrier wall is to be updated to a stepped joint with no water stop.

Dwg. 10 The standard is to be revised to show the new joint detail.

Dwg. 14 The note should be changed to "Class "A" Joint. Class "B" joint with embedded anchor system will be allowed. Movement range 1".

Dwg. 15 The designer is to check to see if standard SS 10-12 is required.

The reinforcing steel table will be converted to metric in accordance with the instructions for stockpiled bridges.

The deck is to be machine finished.

AEMch:ld

c,c.

All Present  
J.B.Wilkes  
R.A.Dorton  
J.H. Blevins  
A. Wittenberg  
N. Zolta



A.E. McKim,  
Head,  
Southwestern Section.





## Memorandum

To: Mr. K. G. Selby  
Supervising Engineer  
Soil Mechanics Section  
West Bldg., Downsview

From: Structural Planning Office  
Southwestern Region

Attention:

Date: May 12, 1976

Our File Ref.

In Reply to

Subject: W.P. 40-66-17/18, Bridge Site 19-524  
Sydenham River Bridges  
9.4 miles west of Highway 2  
Highway 402  
District 2, London

The final Hydrology Report for this site recommends that the structures be centred at Station 118 + 25 moving the proposed structure and stream diversion 140' to the west.

I have enclosed revised bridge site plan E-5386-1 with the new probable footing locations shown in purple.

Please evaluate the new situation and let me know if it will influence your foundation recommendations dated February 20, 1976. If so, please arrange for a revised Foundation Investigation Report for this location.

S. Jants  
Structural Planning Supervisor

SJ:sm  
Enc.

cc A. Crowley  
J. Anderson  
J. Forster



DOCUMENT VOUCHER IDENTIFICATION

GEOCRES No. 40313-45

DIST. 13 REGION Southwestern

W.P. No. 40-66-17/18

CONT. No. 79-51

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. 402

LOCATION Sydenham River Bridge

\_\_\_\_\_

\_\_\_\_\_

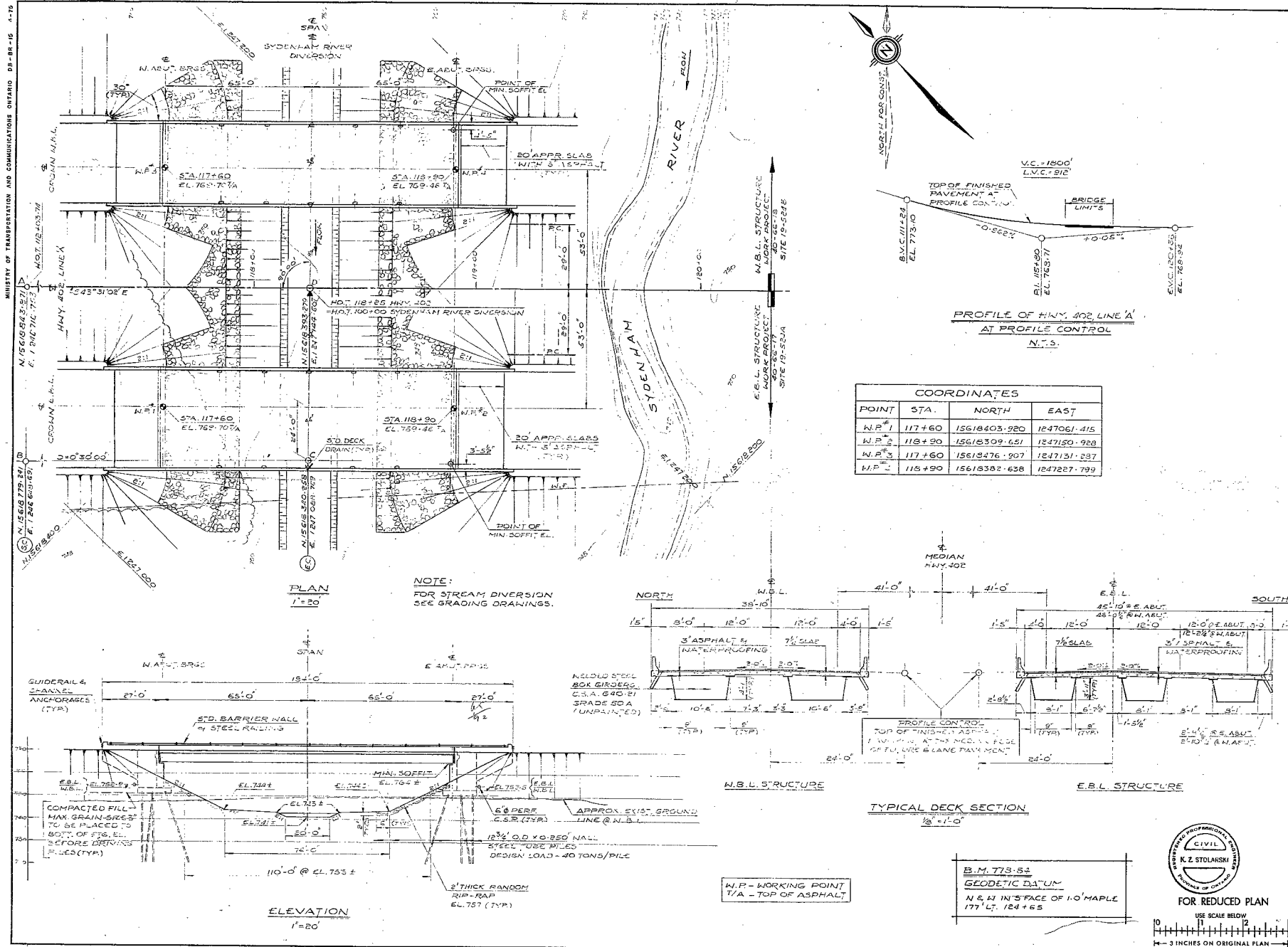
QUESTIONS TO BE ANSWERED BY THE FIELD 4

REMARKS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



4013-45

DIST. 2	
CONT No	
WP No. 40-66-18	
SYDENHAM RIVER BRIDGE	
N.B.L. 9-4 MILES OF HWY. 2	
GENERAL LAYOUT	
SHEET	

NOTES

CLASS OF CONCRETE

DECK AND BARRIER WALLS 4,000 P.S.I.  
REMAINDER 3,000 P.S.I.  
OR AS NOTED ON DRAWINGS.

CLEAR COVER ON REINFORCING STEEL

FOOTINGS AND ABUTMENTS 3" TOP, 1" BOT.  
AND/OR AS NOTED ON DRAWINGS.

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR  
FINISHING THE BEARING SEATS DEAD LEVEL  
TO THE SPECIFIED ELEVATIONS WITH A  
TOLERANCE OF 1/8".

NO CONCRETE SHALL BE PLACED ABOVE THE  
ABUTMENT BEARING SEATS UNTIL THE  
CONCRETE IN THE DECK HAS BEEN PLACED.

REINFORCING STEEL

DECK SLAB - 60  
REMAINDER - 50

STRUCTURAL STEEL QUANTITIES

STRUCTURAL STEEL FOR B.S.H.P. 20 - 100

CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW  
FOR THE APPROPRIATE CONCRETE LUMP  
SUM TENDER ITEMS:

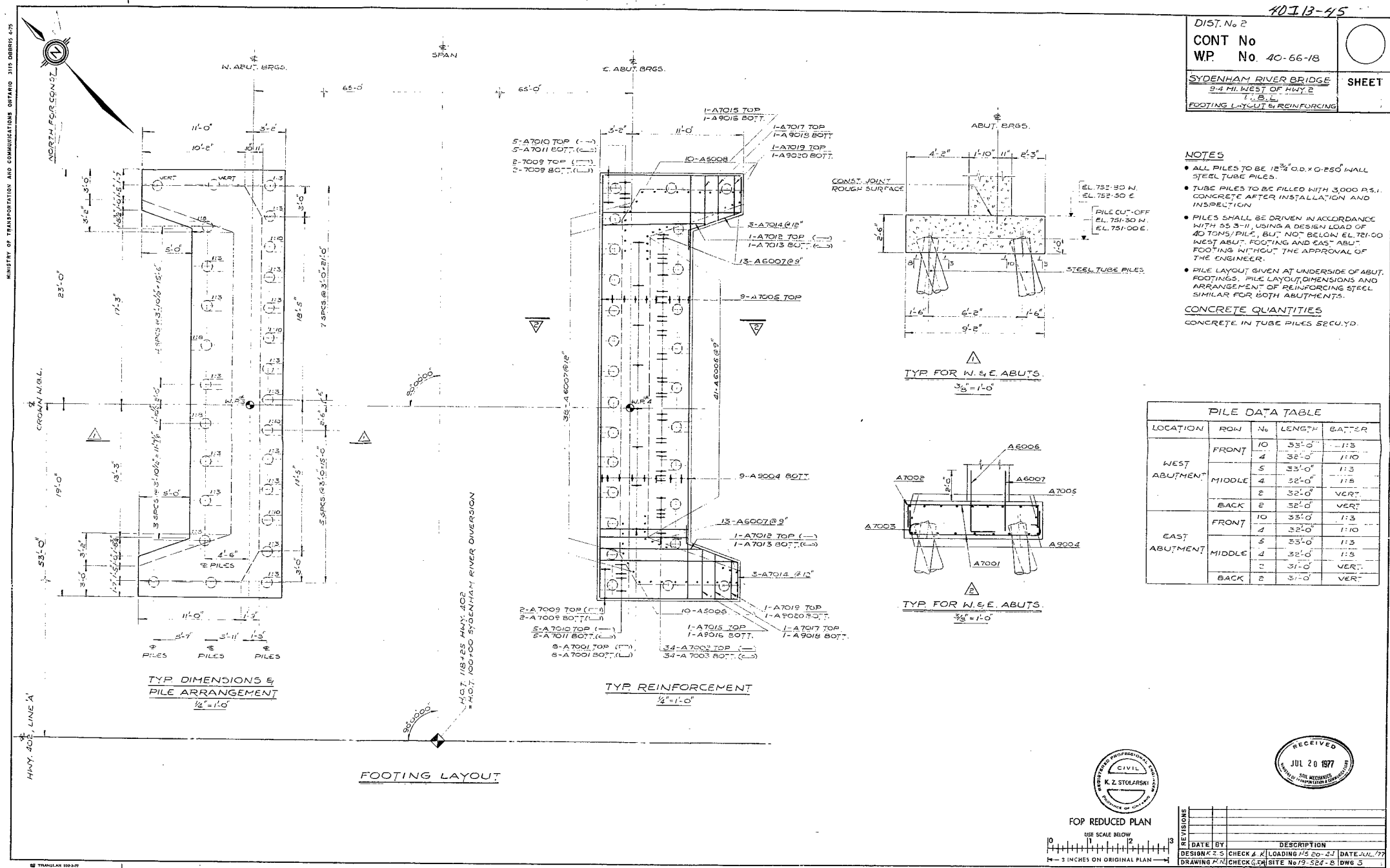
CONCRETE IN ABUTMENTS 4 197 CUYD  
CONCRETE IN DECK 121 CUYD  
CONCRETE IN BARRIER WALLS 28 CUYD  
CONCRETE IN APPROACH SLABS 35 CUYD

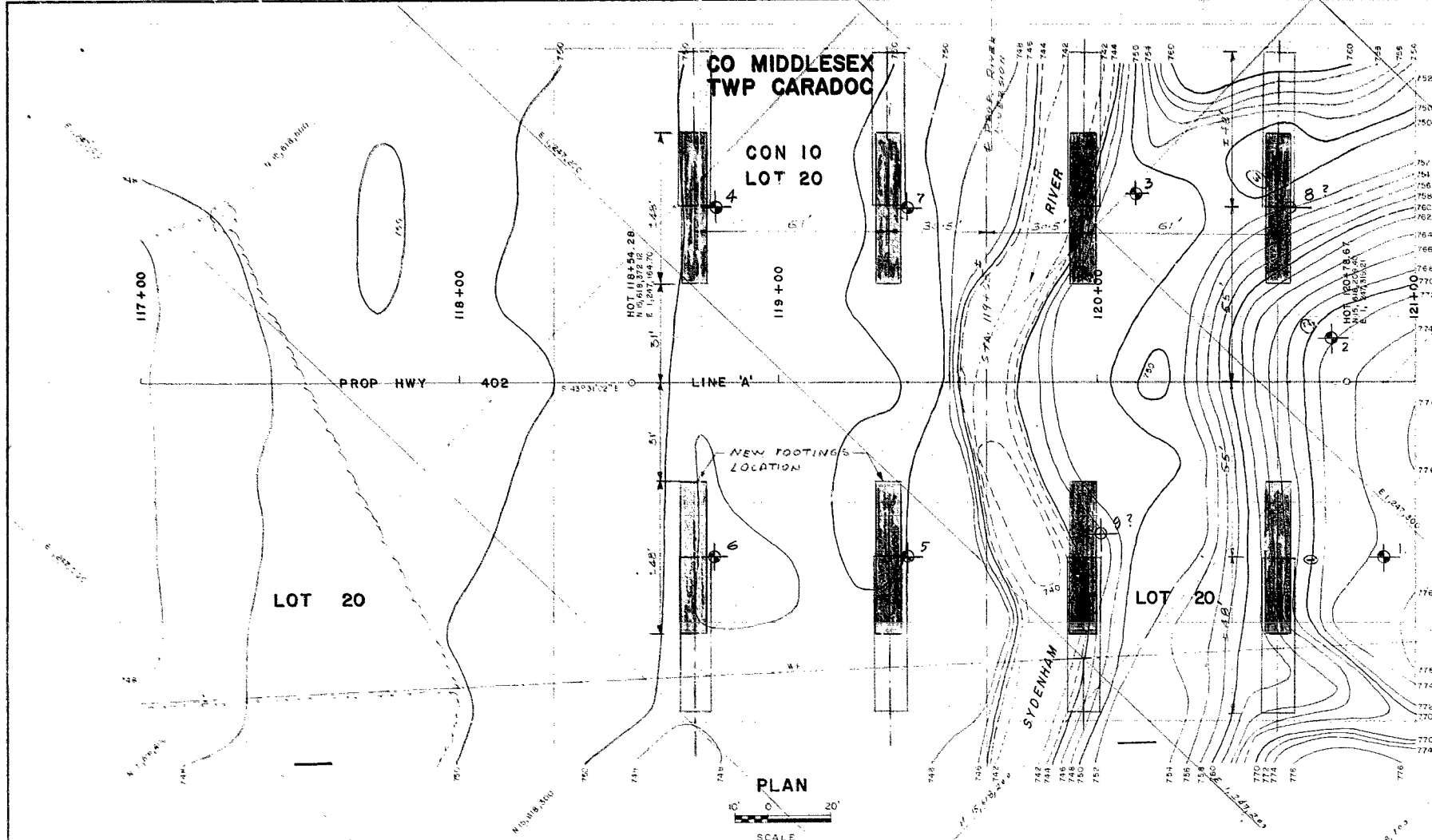
LIST OF DRAWINGS

19-5218-1 GENERAL LAYOUT  
2 BORE HOLE LOCATIONS & SOIL STRATA  
3 FOOTING LAYOUT & REINFORCING  
4 ABUTMENTS  
5 STRUCTURAL STEEL & BEARING  
DETAILS  
6 DECK  
7 BARRIER WALL  
8 STEEL RAILING (SINGLE TYPE)  
9 20 FT. APPROACH SLAB  
10 AS CONSTRUCTED ELEV. S. DIM.  
11 STANDARD DETAILS I  
12 STANDARD DETAILS II  
13 STANDARD DETAILS III

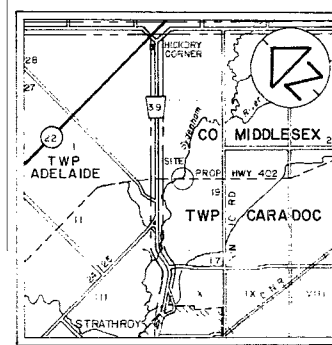
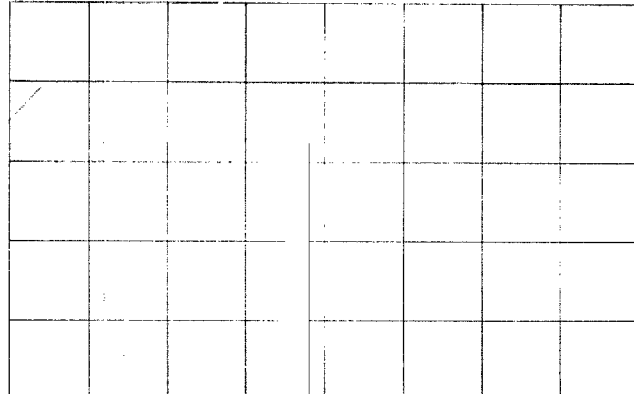


REVISIONS	
DATE BY	DESCRIPTION
DESIGN K. Z. 3	CHECK K. Z. 3
LOADING H. S. 20-42	DATE JUL 1/77
DRAWING H. N. 1	CHECK K. Z. 3
SITE No. 19-5218-1	DWG 1

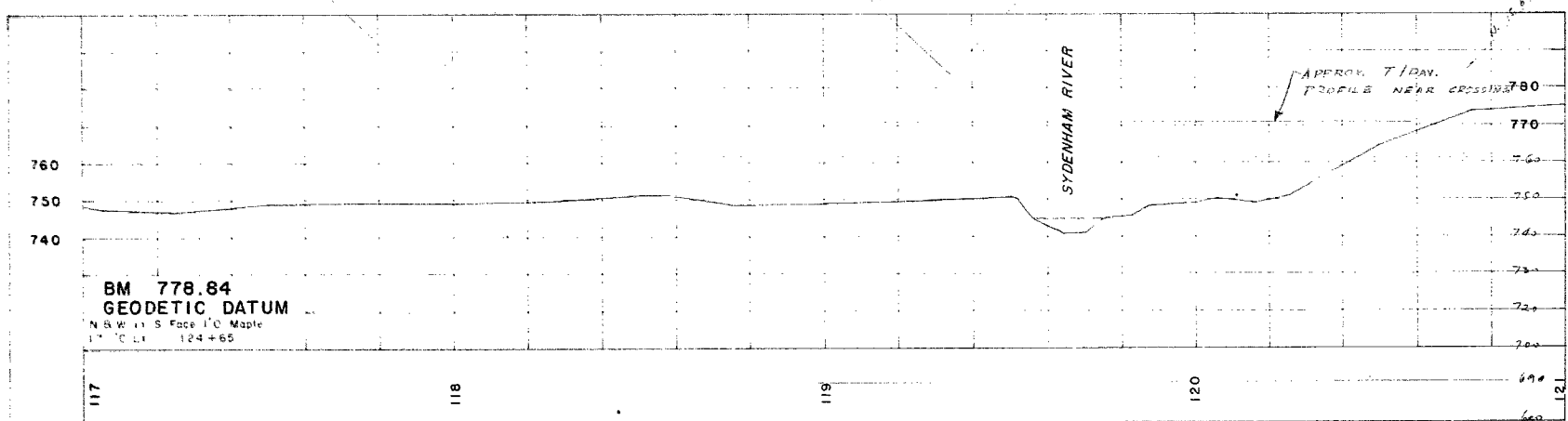




PROBABLE  
FOOTING LOCATIONS



KEY PLAN  
0.5mi 0 1Cmi  
SCALE



PROFILE  
SCALE  
Horizontal & Vertical

STR WP 40-66-17 EBL & STR WP 40-66-18 WBL			
DATE	REVISIONS & ADDITIONS	BY	CHK'D
40113-45			
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO DESIGN DIVISION DESIGN SERVICES BRANCH ENGINEERING SURVEYS OFFICE SOUTHWESTERN REGION			
BRIDGE SITE			
PROPOSED CROSSING AT PROP HWY 402 LINE 'A' AND SYDENHAM RIVER			
LOT 20 TWP CARADOC		CON 10 CO MIDDLESEX	
SCALE AS SHOWN	DISTRICT 2 LONDON	REGION SOUTHWESTERN	
WP 40-66-21	Date of Survey Apr. 75	SITE 19-524	
SURVEY BY Chief of Party G WHITE Supervisor W R AGNEW		DRAWN BY Draftsman J BAXTER & M RYAN Supervisor O SCHUR	
CHECKED BY Draftsman J JANUJ Supervisor O SCHUR		PLAN E-5386-1	

