

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. P. Watt, (2) FROM: Foundations Office,  
Regional Structural Planning Eng., Design Services Branch,  
Southwestern Region, West Bldg., Downsview.  
London, Ontario.

ATTENTION: Mr. B. J. McKenna.

DATE: August 9, 1972

OUR FILE REF.

IN REPLY TO AUG 11 1972

SUBJECT:

40 P2-30  
STAMPED

FOUNDATION INVESTIGATION REPORT  
For  
Oxford County Rd. #14 Underpass  
Of Proposed Hwy. #403, 17.8 Mi. West  
of Brantford West Limits  
District #4, Hamilton  
W.O. 72-11047 -- W.P. 165-60-00

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 design requirements. Should additional information be required, please do not hesitate to contact our Office.

REVISED TO METRIC  
840130 So  
DNG N23

*A. G. Stermac*

AGS/ht  
Attch.

A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.

c.c. Messrs. D. W. Farren

B. R. Davis

A. Rutka

~~W. A. Zornberg~~ A. McConnell

C. R. Robertson

B. J. Giroux

J. R. Roy

G. A. Wrong

B. A. Singh

Foundations Files ✓  
Documents

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For  
Oxford County Rd. #14 Underpass  
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of Brantford West Limits  
District #4, Hamilton  
W.O. 72-11047      ---      W.P. 165-60-00

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1. INTRODUCTION:

The results of a foundation investigation conducted at the site of Oxford County Rd. #14 underpass of proposed Hwy. #403 are reported. The investigation was requested by Mr. B. J. McKenna, Bridge Location Engineer, Southwestern Region, in a memo dated March 8, 1972. This project is one of the several bridges, being planned along proposed Hwy. #403.

According to the request a field investigation was carried out under the supervision of this Office. The boreholes were located and surveyed by personnel of the Engineering Surveys Office, Southwestern Region.

In the following sections some discussions of the topography and soil conditions are given together with recommendations pertaining to structure foundations.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

Oxford County Road #14 is an asphalt paved road of some 20 ft. width with very narrow shoulders, partially covered with grass. The surrounding area has a gently undulating topography, sloping westward, towards Kenny Creek, some 900 ft. west of the bridge site. The land use is agricultural, farms usually growing crops.

Geologically the terrain is part of the physiographic region known as the "Mount Elgin Ridges," consisting of a

succession of ridges and vales. The ridges are moraines of pale brown calcareous clay or silty clay, while in the vales it is common to find alluvium of gravel, sand or silt. The ridges are usually well drained; in the hollows, however, poor drainage prevails. The nearby ridges are drained by Keeny Creek, which is a tributary of the Grand River.

### 3. FIELD AND LABORATORY INVESTIGATIONS:

The field investigation was carried out by means of a hollow stem auger (CME-55). Altogether five sampled boreholes and ten dynamic cone penetration tests were implemented at the locations of the proposed footings, as shown on Drawing #72-11047A in the Appendix. The estimated soil stratigraphy, based on the borehole information is also plotted on the same drawing. Soil sampling was performed by using split spoon samplers. The sampler was advanced by a 140 lb. free falling hammer, dropped from a distance of 30 inches. The number of hammer blows required to advance the sampler 12 inches into the undisturbed soils were recorded as Standard Penetration Resistances (N = blows/ft.). The 2 inch diameter cones were also driven by the above method and were terminated at depths where 100 blows/ft. resistances were obtained.

The soil samples were identified, recorded and stored in glass jars immediately upon recovery. In the laboratory visual classifications were carried out on each sample. In addition representative specimens were subjected to laboratory testing, such as moisture content determinations, Atterberg limits and grain size analyses. All the field and laboratory test results are compiled on the borelog sheets, appended to this report.

### 4. SUBSOIL CONDITIONS:

#### 4.1) General:

Two distinct soil strata was found in the boreholes, the deepest of which extended to elevation 908.6 ft. some 38.8 ft.

below ground level. The upper deposit was classified to be clayey silt to silt, the lower being silty fine sand. Due to the very dense relative density of the fine sands all the borings were terminated within this layer.

In the following sections a brief summary of the physical properties of the deposits is given.

4.2) Clayey Silt to Silt with Some Sand, Occasional Traces of Gravel:

From ground level extending to elevation 914 ft. - 927 ft. a 20-33 ft. thick layer of clayey silt to silt was encountered in every borehole. The deposit contains some sand and occasionally traces of fine gravel. The material has some cohesion, the consistency, measured by Standard Penetration Tests was found to vary between stiff and hard. The minimum "N" value obtained in the field was 9 blows per ft., the maximum being 65 blows per ft. The weighted average penetration resistance within the uppermost 15 ft. layer was computed to be 23 blows per ft., roughly the equivalent of an undrained shear strength of 3000 p.s.f.

Atterberg limit tests performed on representative samples resulted in plastic limits between 5%-11% and liquid limits between 16% - 31%. The range of plasticity indices is 5 to 11. Some samples were subjected to sieve and hydrometer analyses. The tests yielded 0% - 4% gravel, 2% - 25% sand, 54% - 89% silt, and 8% - 30% clay size particles within the samples tested.

4.3) Silty Fine Sand:

Underlying the cohesive clayey silts a granular type material, classified as silty fine sand was noted. Very high relative densities characterize this stratum; penetration "N" values usually being over 100 blows per ft. In a few occasions quick conditions occurred in the boreholes, indicating that the fairly uniform sand deposit is susceptible to conditions of unbalanced hydrostatic head. The few unreasonably low "N" values,

obtained within this layer, were believed to be caused by above phenomenon; consequently, these were disregarded. Particle distributions, determined by laboratory grain size analysis resulted in 71-89% fine sands, the remainder being silt and clay.

All the borings were terminated within this deposit between elevation 908 ft. and 918 ft., some 29 ft. - 39 ft. below ground levels.

#### 4.4) Groundwater Conditions:

Water level observation was carried out in every borehole during and after drilling operations. Water levels were found to be very high, usually lying between elevation 946 ft. and 949 ft., some 0.7 ft. - 2 ft. below ground level. Since these water levels are some 15 - 20 ft. higher than the water level of Kenny Creek, there appears to be a seepage towards the creek.

### 5. DISCUSSION AND RECOMMENDATIONS:

#### 5.1) General:

According to the bridge site plan, submitted to us by the Bridge Location Engineer, Southwestern Region, three proposals are being considered for this crossing. These proposals are: (1) 4 span AASHO Beam, (2) 2 span post-tensioned voided slab, and (3) 2 span composite steel box beam underpass structures. The grade of Oxford County Rd. #14 at the crossing is designed to be approx. elevation 975 ft., some 25 ft. above existing pavement. The top of pavement of Hwy. #403 will be around elevation 950 ft., essentially the same as the existing county road. It is assumed that perched abutments will be designed for each proposal.

Subsoils consist of a 20-33 ft. thick layer of stiff to hard clayey silt, underlain by silty fine sands of very dense relative density.

#### 5.2) Foundations:

Below the uppermost surficial layer, the clayey silt deposit appears to have sufficient undrained shear strength to

support the structures on spread footings. Footings may be designed at or below elevation 943 ft. for both the two, as well as for the four span proposals, using safe design loads of 2.5 t.s.f.

Perched abutments, or the entire structure, piers as well as abutments, may also be supported on piles. The type of footing adopted should be governed by economy. In the case of choosing piled foundations, piles should be driven to 60 ton per pile capacity according to Standard BD-82-7. It is estimated that in using 12-3/4 inch O.D. steel tubes above loads will be achieved by driving the piles to elevation 910 ft. - 915 ft., some 30 - 35 ft. below existing ground levels.

Piles at the abutment locations may be driven through the approach embankments, pile caps being formed within the fills. In this event it should be specified that no bouldery material be placed at the abutment locations. Pile caps as well as spread footings should have a minimum cover of 4 ft. in order to prevent frost damage.

#### 5.3) Excavations and Approach Fills:

It is anticipated that some seepage will occur in the footing excavations, however, on account of the cohesive strength of the deposit, no major dewatering problems are foreseen. Conventional open pumping from shallow sumps will likely keep the excavations dry. If the excavations remain open for some time it would be desirable to apply a lean concrete working slab at the bottom of excavations, so that no softening may occur, due to surface water. No stability problems are expected for the approach fills provided that they are constructed with 2 horizontal to 1 vertical slopes.

#### 6. MISCELLANEOUS:

The field work was carried out during April 26 to May 1, 1972, under the supervision of Mr. W. V. Urie, Field Technician.

Equipment used was owned and operated by P.V.K. Drilling Company, Burford, Ontario.

This report was prepared by Mr. A. K. Barsvary, Senior Foundations Engineer, and reviewed by Mr. K. G. Selby, Supervising Foundations Engineer.

*A. K. Barsvary*

A. K. Barsvary, P. Eng.



*K. G. Selby*

K. G. Selby, P. Eng.

AKB/ao

August 1, 1972.



APPENDIX I

CHECKED BY

[illegible]

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

## RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

DESIGN SERVICES BRANCH

JOB 72-11047

LOCATION Sta. 98 + 85, 13 ft. Rt. of CORIGINATED BY W.V.U.

W.P. 165-60-00

BORING DATE April 28, 1972COMPILED BY A.K.B.DATUM GeodeticBOREHOLE TYPE Dynamic Cone Penetration Only.CHECKED BY SK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$		BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	RESISTANCE	PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$		
0.0	Ground level.											
287.0												
289.4												
949.5												
941.7												
7.8												
2.4												
						940						

FOUNDATION SECTION

CHECKED BY                     

[illegible]

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

94975.5 4.0 m

LOCATION St. 99 + 21, 13 Ft. Rt. of C

ORIGINATED BY W.V.U.

BORING DATE May 1, 1972

COMPILED BY A.K.B.

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY AK

[illegible]

CHECKED BY AK

[illegible]

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$		BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	20 40 60 80 100	PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$		
289.6 950.1	Ground level.											
0.0												
286.8 941.1												
9.0 2.8	End of Cone Test					940						

CHECKED BY

[illegible]



CHECKED BY ✓/K

[illegible]

CHECKED BY *AK*

[illegible]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT ——— W <sub>P</sub> WATER CONTENT ——— W		BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	WATER CONTENT %			
							20    40    60    80    100				
							○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB. VANE	$w_p \quad w \quad w_L$			
289.6 250.0	Ground level.										
0.0											
286.8 941.0											
9.6 2.8	End of cone test.					940					

## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - 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>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

### TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

# ABBREVIATIONS 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
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

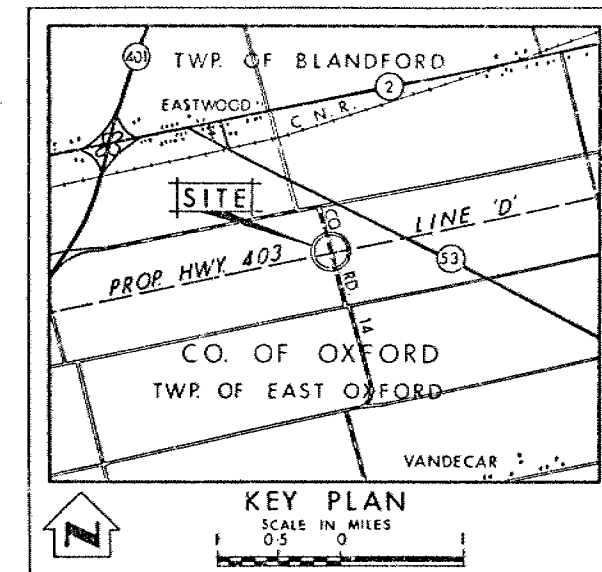
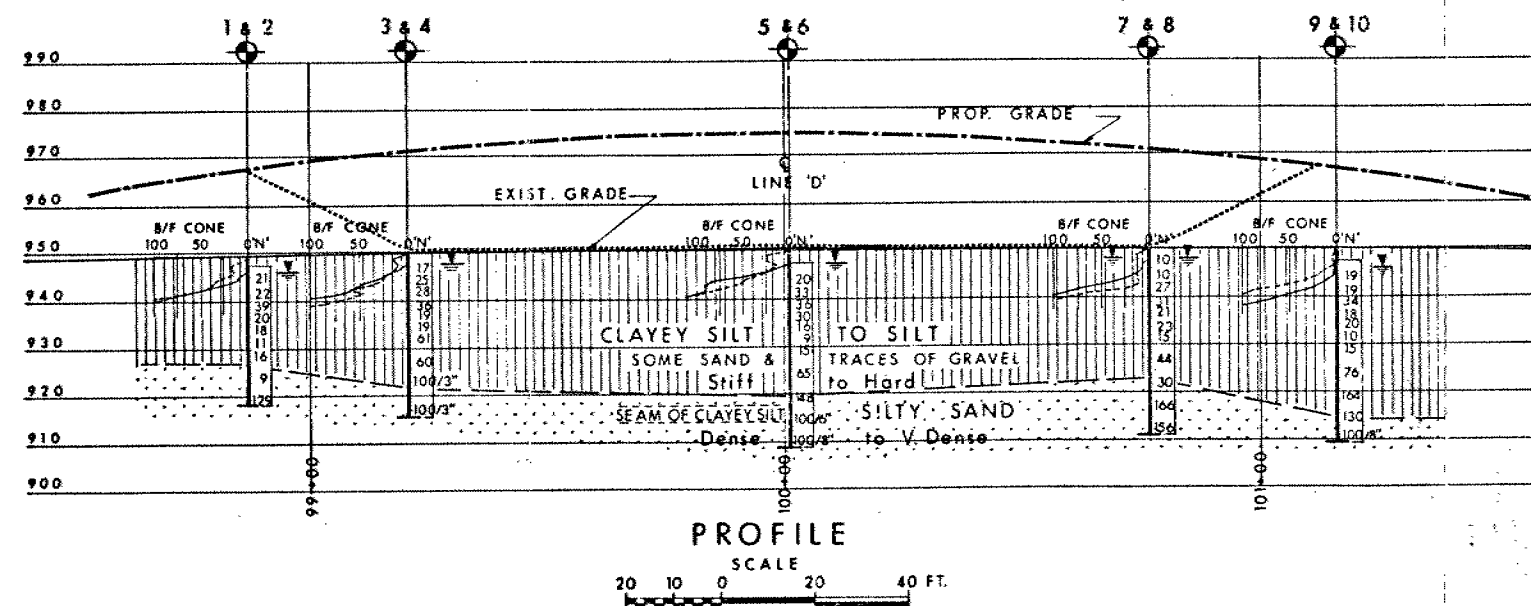
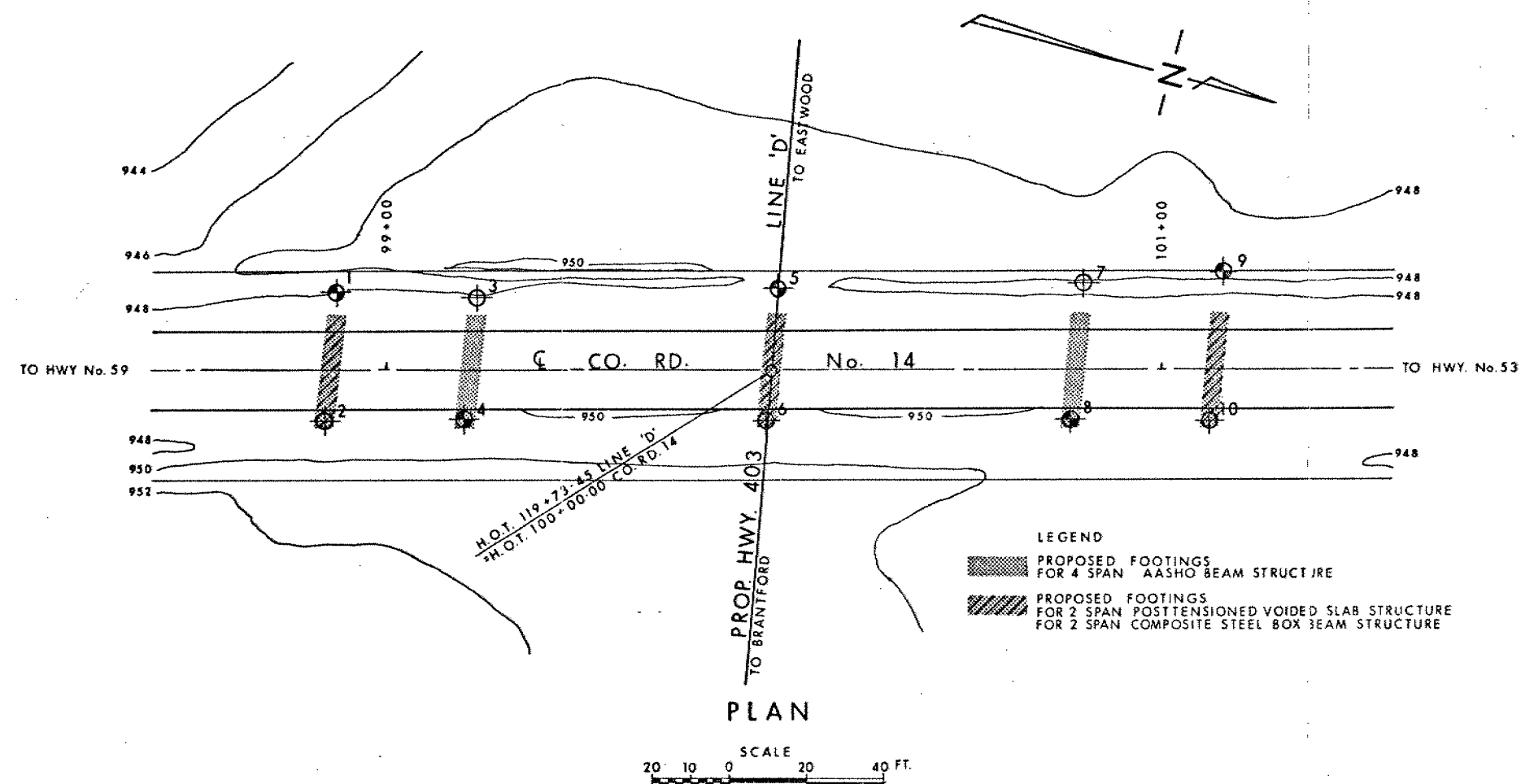
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

## 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
$\rho$	ANGLE OF SLOPE TO HORIZONTAL



LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation APR. & MAY 1972		
NO.	ELEVATION	STATION	OFFSET
1	947.2	98+87	20' LT.
2	949.5	98+85	13' RT.
3	947.5	99+23	19' LT.
4	949.8	99+21	13' RT.
5	947.4	100+01	21' LT.
6	950.1	99+98	13' RT.
7	947.3	100+80	23' LT.
8	950.0	100+77	13' RT.
9	947.3	101+16	20' LT.
10	950.0	101+13	13' RT.

**NOTE**

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

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

**COUNTY ROAD No. 14**

HIGHWAY NO. 403 PROP. LINE 'D' DIST. NO. 2  
CO. OXFORD  
TWP. EAST OXFORD LOT 6 & 7 CON. 2

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBWD. A.B.	CHECKED	W.P. NO. 165-60-00	DRAWING NO.
DRAWN O.K.J.	CHECKED	JOB NO. 72-11047	<b>72-11047A</b>
DATE 26 JULY 1972	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		
PRINCIPAL FOUNDATION ENGINEER			



REF. No. E-4173-1



# RECORD OF BOREHOLE No 1

METRIC

W P 165-60-01 LOCATION Sta. 10 + 034.0 6.1 m Rt Q, Cord. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 04 26 CHECKED BY LD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA Si CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
288.7 0.0	Ground Level												
	Clayey Silt to Silt with some sand Stiff to Hard Brown		1	SS	21		288						1 25 54 20 1 9 61 29
			2	SS	22								
			3	SS	39		286						
			4	SS	20								
			5	SS	18								
			6	SS	11		284						
			7	SS	16								
282.6 6.1	Silty Fine Sand Loose to Very Dense Greyish-Brown		8	SS	9		282						0 74 (26)
279.8 8.9	End of Borehole		9	SS	129		280						

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

## METRIC

W P 165-60-01 LOCATION Sta. 10 + 035.0 4.0 m Lt C Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 04 28 CHECKED BY [Signature]

[illegible]

+3, x5 : Numbers refer to Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10





# RECORD OF BOREHOLE No 3

METRIC

W P 165-60-01 LOCATION Sta. 10 + 023.2 5.8 m Rt. Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 04 26 CHECKED BY SO

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
288.8	Ground Level									
0.0										
286.4										
2.4	End of Cone Test									

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 4

METRIC

W P 165-60-01 LOCATION Sta. 10 + 024.2 4.0 m Lt. Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 05 01 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES								
289.5 0.0	Ground Level												
	Clayey Silt to Silt Traces of Coarse Sand Very Stiff to Hard		1	SS	17								
			2	SS	25								
			3	SS	28								
			4	SS	36								
			5	SS	19								
			6	SS	19								
			7	SS	61								
			8	SS	60								
281.0 8.5	Silty Fine Uniform Sand Very Dense		9	SS	100/9 cm								
279.1 10.4			10	SS	100/9 cm								
	End of Borehole												



Ministry of  
Transportation and  
Communications  
Ontario

# RECORD OF BOREHOLE No 5

METRIC

W P 165-60-01 LOCATION Sta. 9 + 999.6 6.4 m Rt. C Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 04 26 & 27 CHECKED BY io

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES								
288.8	Ground Level											
0.0		1	SS	20								
		2	SS	33								
		3	SS	36								
	Clayey Silt to Silt	4	SS	30								2 21 54 23
	Some Sand	5	SS	16								0 2 84 14
	Stiff to Hard	6	SS	9								
	Brown	7	SS	15								
		8	SS	65								
280.2		9	SS	148								0 88 (12)
8.6	Silty Fine											
	Uniform Sand											
	Seam of Clayey Silt	10	SS	1007	15 cm							
	Very Dense											
276.9		11	SS	1007	20 cm							
11.9	End of Borehole											

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 6

METRIC

W P 165-60-01 LOCATION Sta. 10 + 000.6 4.0 m Lt. C Co. Rd. 14 ORIGINATED BY AKB  
 DIST 4 HWY 403 BOREHOLE TYPE Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1972-04-28 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
289.6												
0.0												
286.8												
2.8	End of Cone Test											

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

## METRIC

W P 165-60-01 LOCATION Sta. 9 + 975.4 7.0 m Rt. C Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972-04-27 CHECKED BY [Signature]

[illegible]

+3, x5 : Numbers refer to Sensitivity

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



# RECORD OF BOREHOLE No 8

METRIC

W P 165-60-01 LOCATION Sta. 9 + 976.4 4.0 m Lt. Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 05 01 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
289.6 0.0	Ground Level												
	Clayey Silt to Silt Some Sand and traces of gravel Stiff to Hard Brown		1	SS	10								
			2	SS	10								
			3	SS	27								
			4	SS	31								
			5	SS	21								4 11 55 30
			6	SS	23								0 2 88 10
			7	SS	15								
			8	SS	44								1 6 68 25
281.3 8.3	Silty Fine Uniform Sand Dense to Very Dense		9	SS	30								
			10	SS	166								
			11	SS	156								0 74 25 1
277.7 11.9	End of Borehole												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 9

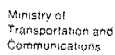
METRIC

W P 165-60-01 LOCATION Sta. 9 + 964.4 7.9 m Rt. Q Co. Rd. 14 ORIGINATED BY AKB  
 DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY SO  
 DATUM Geodetic DATE 1972 04 27 & 28 CHECKED BY *SD*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
288.7 0.0	Ground Level												
	Clayey Silt to Silt traces of coarse sand Stiff to Hard Brown		1	SS	19								
			2	SS	19								
			3	SS	34								
			4	SS	18								
			5	SS	20								
			6	SS	10								
			7	SS	15								
			8	SS	76								
			9	SS	164								
278.7 10.0	Silty Fine Sand Very Dense		10	SS	130								0 3 89 8
277.1 11.6			11	SS	1007/20 cm								0 89 (11) 0 71 25 4
	End of Borehole												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



## METRIC

W P 165-60-01 LOCATION Sta. 9 + 966.0 4.0 m Lt. C Co. Rd. 14 ORIGINATED BY AKB  
DIST 4 HWY 403 BOREHOLE TYPE Cone Test COMPILED BY SO  
DATUM Geodetic DATE 1972 04 28 CHECKED BY 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	Liquid Limit W <sub>L</sub>	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%)			
289.6 0.0	Ground Level												GR SA SI CL	
286.8 2.8	End of Cone Test													

+3, x5 : Numbers refer to Sensitivity

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



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

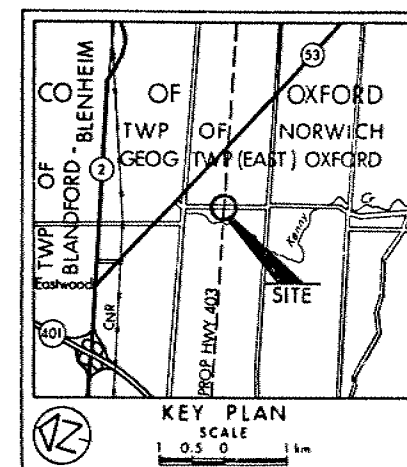
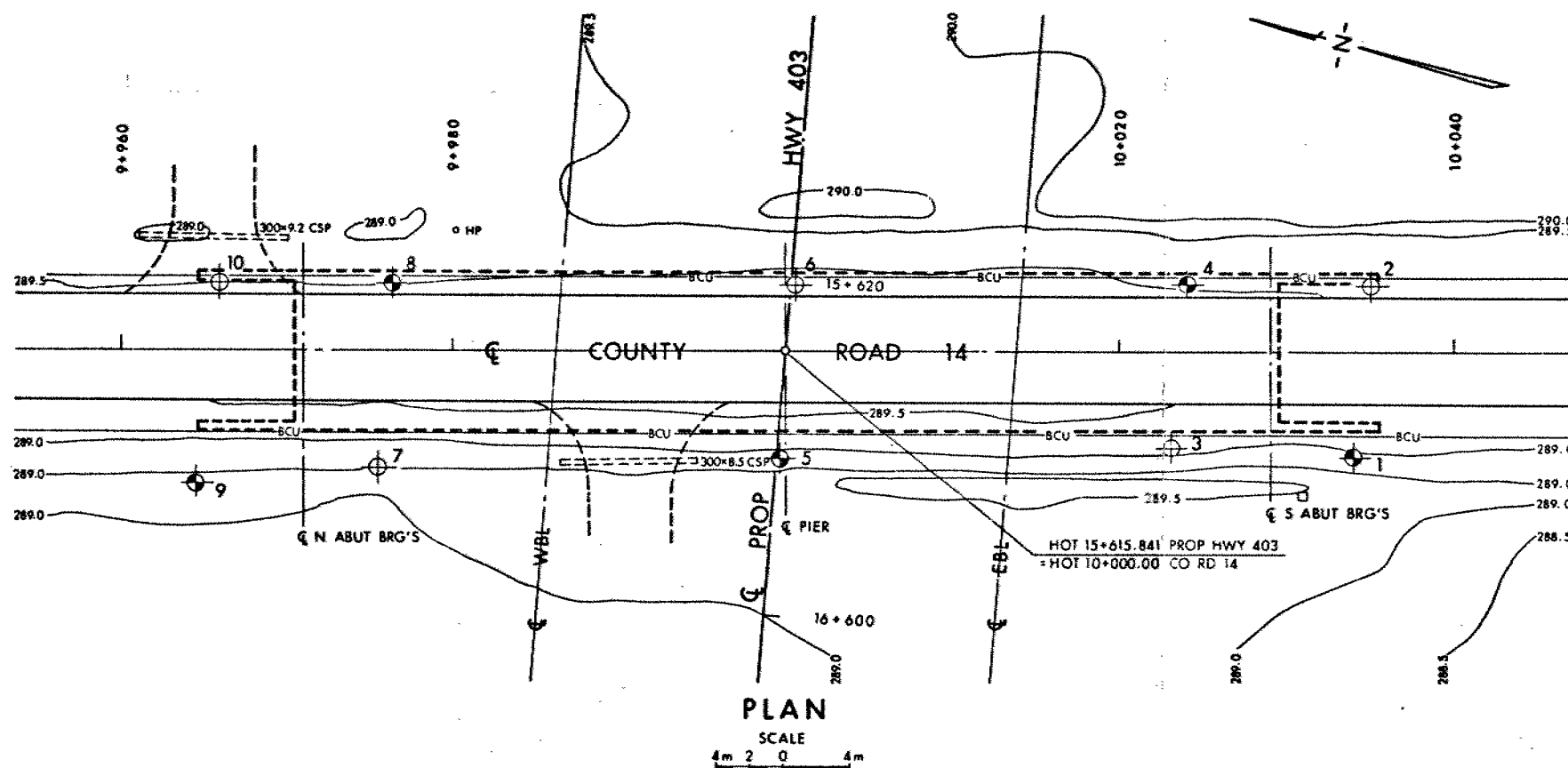
CONT No  
WP No 165-60-01

COUNTY ROAD 14 UNDERPASS

BORE HOLE LOCATIONS & SOIL STRATA

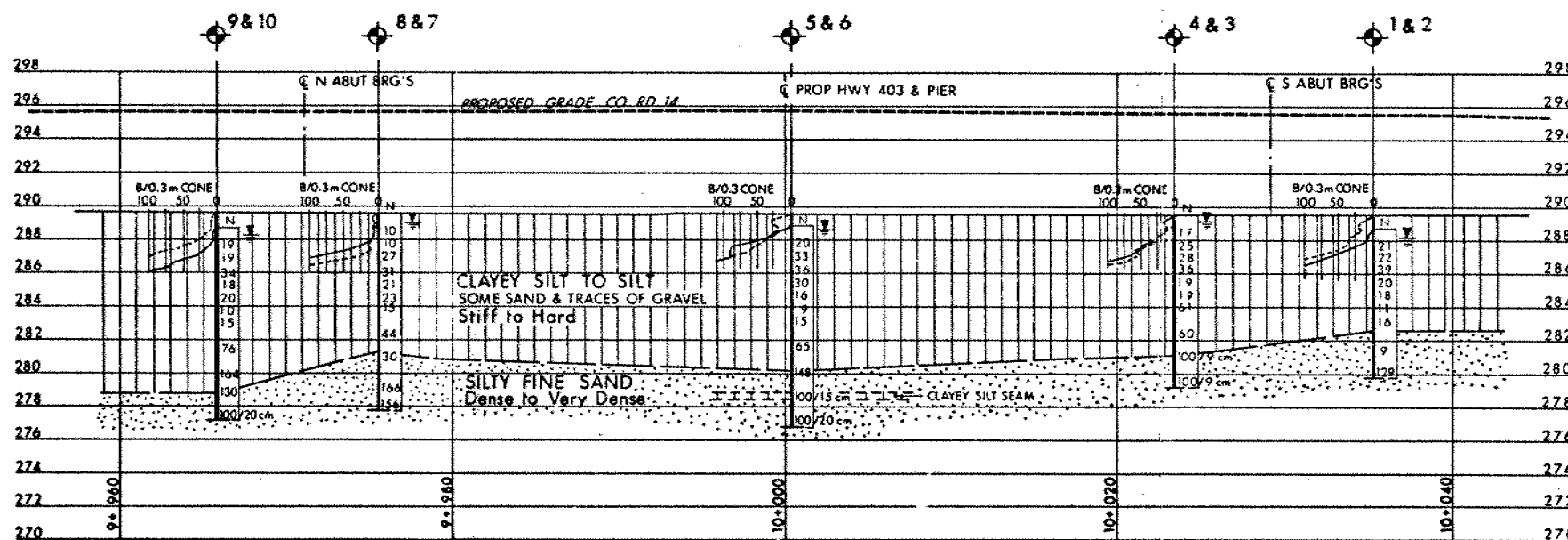


SHEET



**LEGEND**

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation 1972-04-05

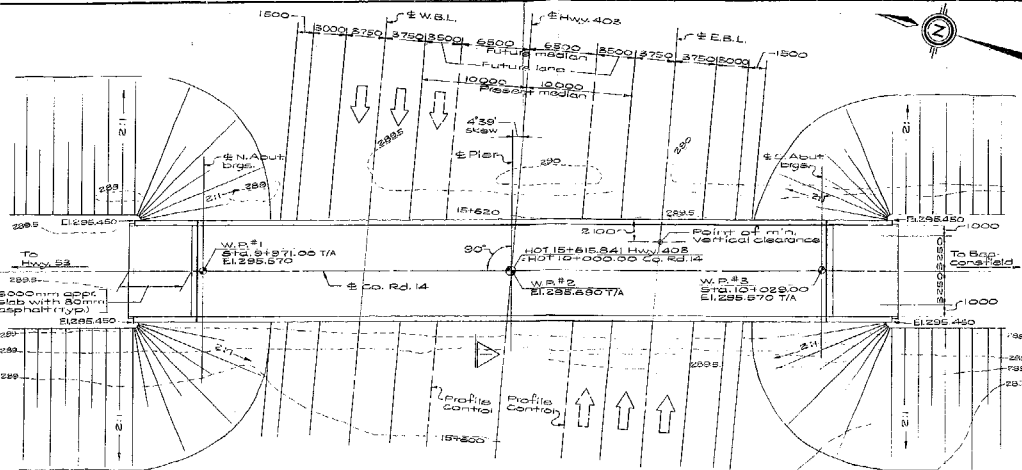


No	ELEVATION	STATION	OFFSET
1	288.7	10+034.0	6.1 m RT
2	289.4	10+035.0	4.0 m LT
3	288.8	10+023.2	5.8 m RT
4	289.5	10+024.2	4.0 m LT
5	288.8	9+999.6	6.4 m RT
6	289.6	10+000.6	4.0 m LT
7	288.7	9+975.4	7.0 m RT
8	289.6	9+976.4	4.0 m LT
9	288.7	9+964.4	7.9 m RT
10	289.6	9+966.0	4.0 m LT

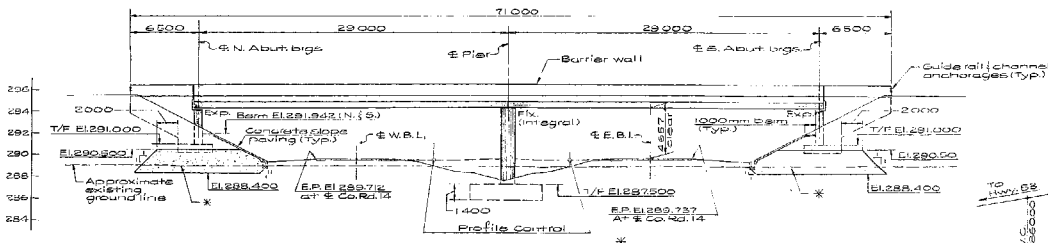
**NOTE**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

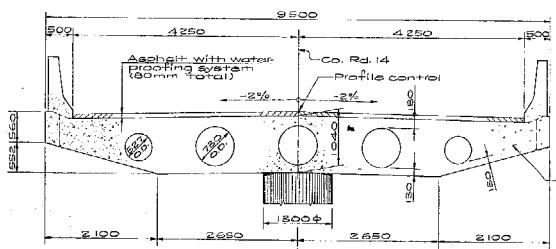
REV	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



PLAN  
11250

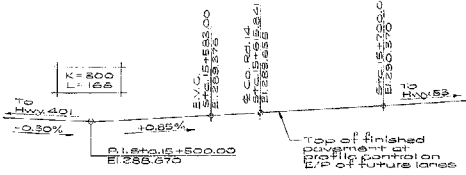


ELEVATION  
11250



PROFILE OF HWY 403  
N.T.S.

PROFILE OF CO. RD. 14  
N.T.S.



# METRIC

DIMENSIONS ARE IN MILLIMETRES  
UNLESS OTHERWISE SHOWN.  
ELEVATIONS, COORDINATES, CURVE  
AND ALIGNMENT DATA ARE IN METRES.  
STATIONS ARE IN KILOMETRES + METRES.

DIST. 4	CONT No	165-60-01	SHEET
	WP		
COUNTY ROAD 14 UNDERPASS Approximately 1 km west of Hwy. 53			
GENERAL ARRANGEMENT			

## NOTES:

CLASS OF CONCRETE  
DECK & PIER COLUMN 35 MPa  
ABUTMENTS, VINGWALLS & BARRIER WALL 30 MPa  
REMAINDER 20 MPa

REINFORCING STEEL  
GRADE 400  
BAR MARK WITH SUFFIX 'C' DENOTES COATED BAR

NOMINAL CLEAR COVER AND  
TOLERANCE TO REINFORCEMENT  
mm  
FOOTINGS 100 ± 25  
ABUTMENTS & VINGWALLS FRONT FACE 20 ± 25  
BACK FACE 75 ± 25  
PIER COLUMNS 50 ± 20  
DECK TOP 70 ± 10  
BOTTOM & SIDES 40 ± 10  
REMAINDER UNLESS OTHERWISE NOTED 70 ± 20

CONSTRUCTION NOTES  
THE CONTRACTOR SHALL FINISH  
THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED  
ELEVATIONS WITH A TOLERANCE OF ± 3 mm.

## LIST OF DRAWINGS

- 28-88-282-1 General Arrangement
- 2 Bridge Hole Location
- 3 Ball Structure
- 4 Reaching Layout
- 5 Reaching Reinforcing
- 6 North & South Abutments
- 7 Deck Details
- 8 Transverse Cable Details I
- 9 Transverse Cable Details II
- 10 Deck Reinforcing I
- 11 Deck Reinforcing II
- 12 Barrier Wall
- 13 6000mm Approach Slab
- 14 Details of Conc. Slope Paving
- 15 As Constructed Elev. 3 Dim
- 16 Bridge Data & Site Number Data
- 17 Standard Details
- 18 Quantities
- 19 Quantities

## LIST OF ABBREVIATIONS

- W.P. = Working Point  
T/A = Top of Asphalt  
T/P = Top of Paving  
F.F. = Front Face  
B.F. = Back Face  
B.P. = Back Face

DATE	BY	DESCRIPTION
DESIGN	2-11	DESIGN
CHECK	2-11	CHECK
DRAWING	2-11	DRAWING

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING