



## Memorandum

To: Mr. G.C.E. Burkhardt (2)  
Reg. Structural Planning Eng.  
Central Region  
3501 Dufferin Street  
Downsview, Ontario

From: Soil Mechanics Section  
Geotechnical Office  
West Bldg. Downsview

Date: May 9, 1975

Our File Ref. In Reply to MAY 14 1975

Subject:

FOUNDATION INVESTIGATION REPORT  
FOR  
THE PROPOSED LYNNWOOD DRIVE UNDERPASS  
ON THE PROPOSED B.S.A.R.  
DISTRICT #4 (HAMILTON)  
WP: 40-74-11

40 P1-67
GEOCRES No.

\*\*\*\*\*

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.

*K. G. Selby*

K.G. SELBY  
Supervising Engineer

cc: E.J. Orr  
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FOUNDATION INVESTIGATION REPORT  
FOR  
THE PROPOSED LYNNWOOD DRIVE UNDERPASS  
ON THE PROPOSED B.S.A.R.  
DISTRICT #4 (HAMILTON)  
WP: 40-74-11  
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1.        INTRODUCTION:

A field investigation was carried out by the Soil Mechanics Section at the intersection of the proposed Brantford South Access Road and Lynnwood Drive to determine the subsurface conditions.

This report contains the result of the investigation and the recommendations pertaining to the design of the structure foundations and approaches.

2.        DESCRIPTION OF THE SITE:

The site of the proposed Lynnwood Drive underpass is located in the City of Brantford at the intersection of Lynnwood Drive and Glenwood Drive. Approximately 500 ft. south of the site the flat terrain drops abruptly to form the Grand River Flood Plain.

Physiographically the site is a deltaic deposition of varved silts and clayey silts deposited in Lake Whittlesey and later covered by silts deposited in Lake Warren.

3.        FIELD AND LABORATORY INVESTIGATION

The field work consisted of three boreholes, one of which was advanced to bedrock, and of six dynamic penetration resistance tests. The boreholes were drilled with a hollow stem continuous flight auger mounted on a bombardier rig.

Disturbed samples were obtained by means of standard split-spoon sampler; the energy used in driving it conformed to the requirements of the Standard Penetration Test.

'Undisturbed' samples were recovered using 2-inch O.D. Shelby Tubes.

Wherever possible, in situ field vane tests were carried out.

All the samples were visually examined and identified both at the site and in the laboratory. Further laboratory tests were carried out on representative samples to determine the following properties:

- Atterberg Limits
- Natural Moisture Content
- Grain Size Distribution
- Undrained Shear Strength
- Bulk Density

All tests results are summarized in the record of borehole sheets.

All boreholes and cone holes were surveyed by personnel from the Central Region Engineering Surveys. The location and elevations of the borings are shown on Drawing #. 407411-A.

4. SOIL TYPES AND SOIL CONDITIONS:

4.1 General:

The overburden at the proposed underpass consists of a bed of sand and gravel, between 5 and 8 feet thick, followed by irregular layers of silt and clayey silt which extend for about 125 feet to bedrock (elev. 601). Between these layers a stratum containing silt and silty sand extending between elev. 665 and 687 was found.

The approximate stratigraphy of the soil is shown on Drawing #407411-A.

A brief description of the different soil types is as follows.

#### 4.2 Sand and Gravel:

Immediately below the surface top-soil layer, which is about 1 foot thick, the site is underlain by a stratum of fine to medium sand and gravel. The thickness varies from 4.5 ft. at B.H. 215 to 8 ft. at B.H. 212 and 9.5 ft. at B.H. 216. Standard Penetration values ranging from 14 to 45 indicate that the relative density ranges from compact to dense.

#### 4.3 Irregular Layers of Clayey Silt and Silt:

In every borehole two cohesive strata were found. They extend from the sand and gravel stratum (elev. 725) to the silt and fine sand stratum (elev. 688) and from the silt and fine sand stratum (elev. 672) to refusal (elev. 601).

The deposit is irregularly stratified with each layer consisting predominantly of clayey silt or silt, and less frequently of clay or fine sand. The irregularity of the material is also reflected in the thickness of the varves, which vary from 1/8" to 2 ft.; in the colour, which is predominantly grey but at times changes to red and brown; and in the bedding of the layers which are predominantly horizontal but at times are vertical or contorted.

The physical properties of these strata are as follows:

Liquid Limit	$W_L = 13-33\%$
Plastic Limit	$W_p = 10-18\%$
Natural Water Content	$W = 16-27\%$
Undrained Shear Strength	600-1600 psf
Field Vane Shear Strength	> 2200 psf

#### 4.4 Silt:

The deposit was found in all three boreholes. Odd layers of silty sand were also encountered within this stratum. The upper boundary varies between elev. 687 and 689 and the lower boundary varies between elev. 665 and 672.

The Standard Penetration Tests carried out within this stratum indicate that the relative density ranges from compact to dense.

#### 5. GROUNDWATER CONDITIONS:

The non-cohesive stratum near the surface contains a perched water table which is subject to seasonal fluctuation. The water level at the time of the field investigation was found to be at about elev. 725.

#### 6. DISCUSSION AND RECOMMENDATIONS:

The proposed structure at Lynnwood Drive consists of a two span structure, which will be either supported on skewed abutments and a multi-columned pier with spans of 135' and 110' or will be supported on square abutments and a single columned pier with spans of 153' and 127'. The first alternative also includes the option of building only the 135' span at first with the pier serving as an abutment.

The existing ground elevation at the site ranges from 731 to 732, while the elevation of the B.S.A.R. under the bridge is 720<sup>±</sup>.

##### 6.1 Approaches:

The approaches, which consist of a combination of cuts and fills, at the most critical place are made up of an 11 ft. cut and a 12 ft. fill. This combination will pose no stability problems if slopes of 2:1 are employed. The settlement under the embankment will be in the order of 3 to 4 inches.

## 6.2 Structure Foundations:

The soil at the 16 ft. depth, which is approximately the bottom of the foundation, has a bearing capacity of 2 tons/sq. ft. It is expected that the differential settlement between the abutments and pier will not exceed 1 inch.

The abutment and piers might be supported on end bearing piles driven to bedrock. It is estimated that the piles will meet refusal at elev. 600<sup>±</sup>. The piles can be designed for the maximum allowable load for the respective pile section selected.

## 7. MISCELLANEOUS:

The field work, carried out during the period of March 18 to April 1, 1975, was supervised by G. Cautillo, Project Engineer.

Equipment used was owned and operated by Atcost Soil Drilling Inc.

This report was prepared by Mr. G. Cautillo, Project Engineer and was reviewed by Mr. K.G. Selby, Supervising Engineer.

*Gustavo Cautillo*

G. CAUTILLO,  
Project Engineer.

*K. G. Selby*

K.G. SELBY, P. Eng.

rjc - May 9, 1975

## APPENDIX



# 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

IN TERMS OF  
EFFECTIVE STRESS  
 $\tau_f = c' + \sigma' \tan \phi'$

IN TERMS OF  
TOTAL STRESS  
 $\tau_f = c_u + \sigma \tan \phi$

## GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF $\sigma$
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF $\sigma$ 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

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 "		

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

RECORD OF BOREHOLE NO 211

W.P. 40-74-11 LOCATION CO-ORDS. 15,674,823N; 803,618E. ORIGINATED BY G.C.  
DIST. 4 HWY. B.S.A.R. BORING DATE MARCH 18, 1975 COMPILED BY P.P.  
DATUM GEODETIC BOREHOLE TYPE CONE TEST ONLY CHECKED BY *[Signature]*

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		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT %
732.6	GROUND LEVEL																
0.0																	
713.6																	
19.0	END OF CONE TEST																

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 212

W.P. 40-74-11

LOCATION CO-ORDS. 15,674,838N; 803,655E.

ORIGINATED BY G.C.

DIST. 4 HWY. B.S.A.R.

BORING DATE MARCH 18, 1975

COMPILED BY P.P.

DATUM GEODETIC

BOREHOLE TYPE CONT. FLIGHT AUGER (HS)

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
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	Wp	W	Wl		
732.2	GROUND LEVEL															
0.0	Sand and Gravel		1	SS	13	730										
	Trace of Silt		2	SS	41											
724.2	Compact to Dense		3	SS	35											
8.0	Irregular layers of clayey silt and silt		4	SS	23											
			5	SS	25											
			6	SS	39											
			7	SS	79											
			8	SS	54											
	Stiff to Hard		9	SS	18											
			10	TW	PH											
			11	TW	PH											
			12	TW	PH											
687.2			13	SS	46											
45.0	Silt with layers of Silty sand		14	SS	32											
	Compact to Dense		15	SS	22											
			16	SS	22											
665.2																
67.0	Irregular layers of clayey silt and silt		17	SS	13											
	Stiff to Very stiff															
650.7			18	SS	21											
81.5	End of Borehole															

RECORD OF BOREHOLE NO 213

W.P. 40-74-11

LOCATION CO-ORDS. 15,674,987N; 803,650E.

ORIGINATED BY G.C.

DIST. 4 HWY. E.S.A.R.

BORING DATE MARCH 21, 1975

COMPILED BY OJ

DATUM GEODETIC

BOREHOLE TYPE CONE TEST ONLY

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ 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 %	UNIT WEIGHT $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
731.7	GROUND LEVEL									GR. SA. SI. CL.
0.0						730				
						720				
						710				
						700				
695.7										
36.0	End of Cone Test									

RECORD OF BOREHOLE NO 214

W.P. 40-74-11 LOCATION CO-ORDS. 15,675,117N; 803,633E. ORIGINATED BY G.C.  
 DIST. 4 HWY. B.S.A.R. BORING DATE MARCH 21, 1975 COMPILED BY P.P.  
 DATUM GEODETIC BOREHOLE TYPE CONE TEST ONLY CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT %	UNIT WEIGHT $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
731.1	GROUND LEVEL									
0.0						730				
						720				
						710				
701.1										
30.0	END OF CONE TEST									

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 215

W.P. 40-74-11

LOCATION CO-ORDS. 15,675,116N. 803,595E.

ORIGINATED BY G.C.

DIST. 4 HWY. B.S.A.R.

BORING DATE MARCH 25, 1975

COMPILED BY G.C.

DATUM GEODETIC

BOREHOLE TYPE CONT. FLIGHT AUGER (HS)

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
731.3	GROUND LEVEL															
0.0	Silty sand - trace of gravel					730										
726.8	Compact		1	SS	18											2 75 (23)
4.5	Irregular layers of clayey silt and silt  stiff to very stiff		2	SS	19											
			3	SS	19											
			4	TW	PH											
			5	SS	29											
			6	SS	21											
			7	SS	25											
			8	SS	13											
			9	TW	PH											
			10	SS	21											
			11	SS	15											
			12	TW	PH											
688.3	Silt with layers of silty sand  loose to compact					720										
43.0			13	SS	27											
			14	SS	4											
	Irregular layers of clayey silt and silt  Firm To Stiff		15	SS	14											
672.3			16	SS	7											
59.0			17	TW	PH											
			18	SS	15											
			19	SS	16											
647.8	End of Borehole					650										

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

RECORD OF BOREHOLE NO 216

W.P. 40-74-11

LOCATION CO-ORDS. 15,674,959N; 803,607E.

ORIGINATED BY G.C.

DIST. 4 HWY. B.S.A.R.

BORING DATE MARCH 26-27 and APRIL 4, 1975

COMPILED BY G.C.

DATUM GEODETIC

BOREHOLE TYPE CONT. FLIGHT AUGER (HS)

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT		LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W		UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20 40 60 80 100	P.S.F.	W <sub>P</sub> — W — W <sub>L</sub>	WATER CONTENT %		
732.4	GROUND LEVEL											
0.0	Fine sand, some gravel, trace of silt		1	SS	29	730						
	Compact to Dense		2	SS	45							
722.9			3	SS	13							
9.5	Irregular layers of clayey silt and silt		4	SS	21							
			5	SS	14							
			6	TW	PH							
			7	SS	12							
			8	TW	PH							
			9	SS	9							
	Stiff to very stiff		10	SS	11							
			11	SS	25							
689.4			12	TW	PH							
43.0	Silt		13	SS	21							
			14	SS	30							
	Compact		15	SS	22							
673.4			16	SS	8							
59.0	Irregular layers of clayey silt and silt		17	SS	13							
			18	TW	PH							
	Firm to very stiff		19	SS	10							
			20	SS	19							
628.4			21	SS	18							
104.0												

Continued

20  
15 5 % STRAIN AT FAILURE  
10

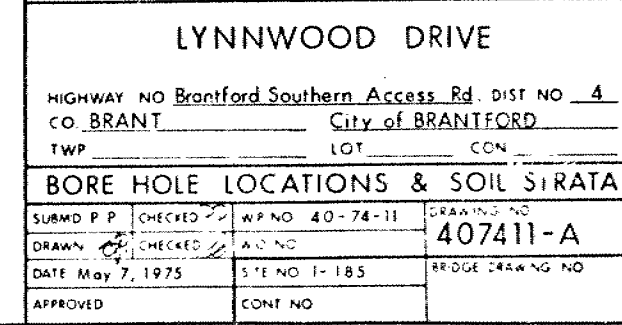
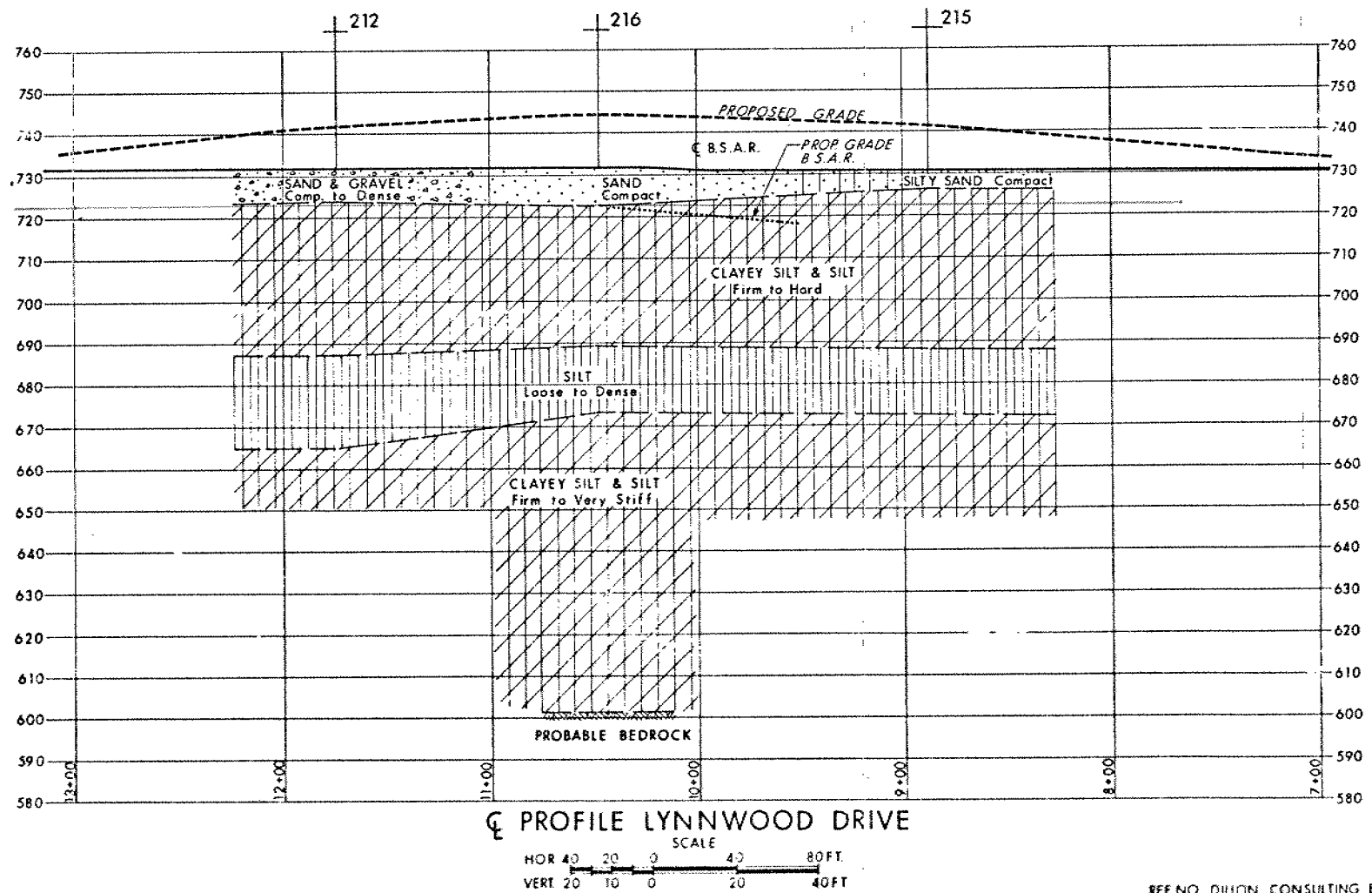
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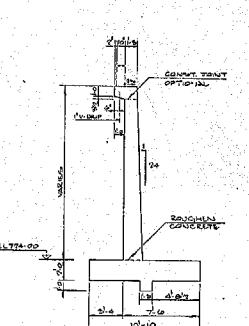
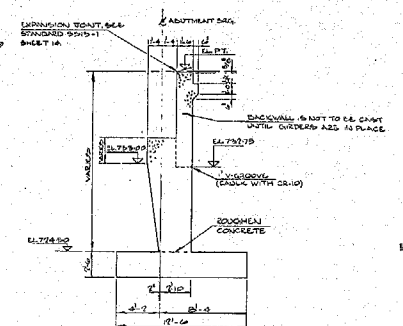
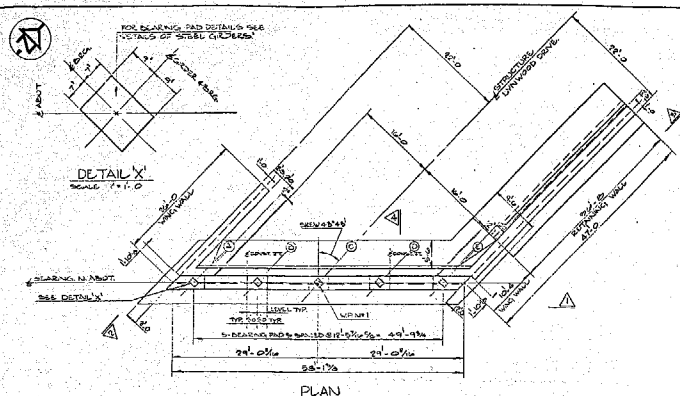
RECORD OF BOREHOLE NO 216 Continued

W.P. 40-74-11 LOCATION CO-ORDS. 15,674.959N; 803,607E. ORIGINATED BY G.C.  
 DIST. 4 HWY. B.S.A.R. BORING DATE MARCH 26-27 and APRIL 4, 1975 COMPILED BY G.C.  
 DATUM GEODETIC BOREHOLE TYPE CONT. FLIGHT AUGER (HS) CHECKED BY [Signature]

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		20	40	60	80	100	$w_p$	$w$	$w_L$	
628.4	CONTINUED														
104.0	Irregular layers of clayey silt and silt		22	SS	22	620									
	Firm to very stiff		23	SS	27	610									
601.3			24	SS	38/7"										
131.1	End of Borehole (Refusal) Probable bedrock														

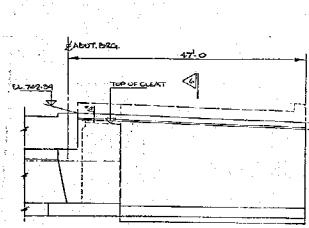
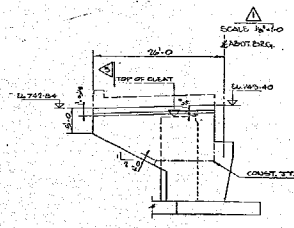
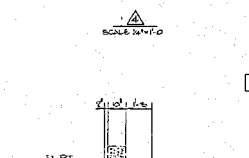
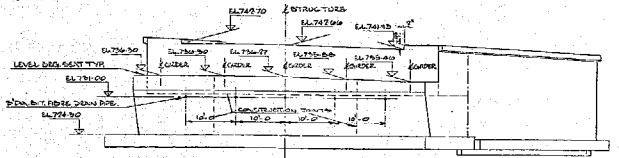






**TO BE USED  
FOR ESTIMATING  
PURPOSES ONLY**

DATE MAY 6 1970



PLAN OF FOOTINGS  
SCALE 1/4"=1'-0"

FOOTING NO.	FOOTING AREA
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS  
ONTARIO

**BRANTFORD SOUTHERN ACCESS ROAD  
LYNWOOD DRIVE UNDERPASS**

ROAD HIGHWAY NO. 8 S.S.R. DIST. NO. 4

CD. BRANT

IND. CITY OF BRANTFORD IND. PTH.

**LAYOUT OF NORTH ABUTMENT**

APPROVED	DATE	CONTRACT NO.
DESIGN	1/5	1/5
CHECKED	1/5	1/5
DATE	1/5/70	1/5/70

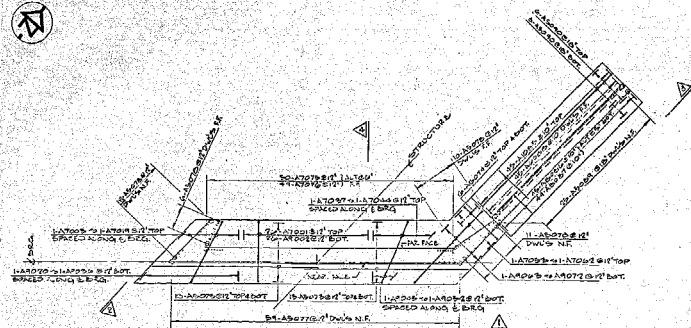
40-74-11

1-185

1/5/70

FOR REDUCED PLAN  
1/4"=1'-0"

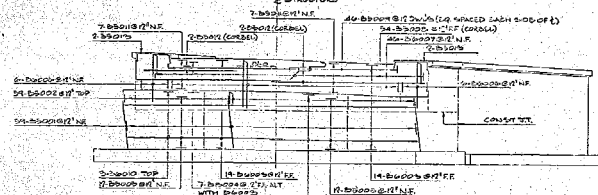
1/4"=1'-0"



FOOTING PLAN

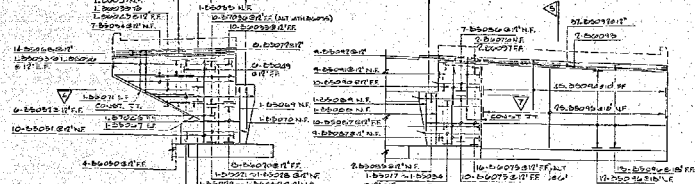
SCALE 1/8"=1'-0"

STRUCTURE



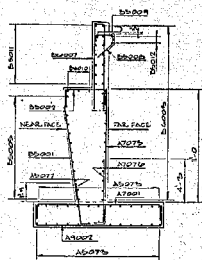
STRUCTURE

SCALE 1/8"=1'-0"



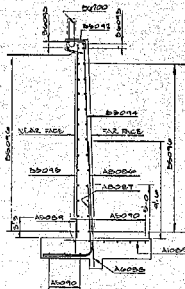
STRUCTURE

SCALE 1/8"=1'-0"



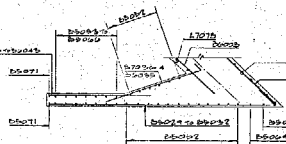
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SCALE 1/8"=1'-0"



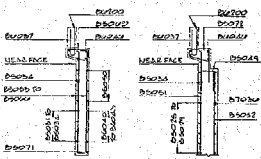
STRUCTURE

SCALE 1/8"=1'-0"



STRUCTURE

SCALE 1/8"=1'-0"



STRUCTURE

SCALE 1/8"=1'-0"

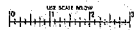
STRUCTURE

SCALE 1/8"=1'-0"

TO BE USED  
FOR ESTIMATING  
PURPOSES ONLY  
DATE MAY 6 1976



FOR REDUCED PLAN



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO			
BRANTFORD SOUTHERN ACCESS ROAD LYNWOOD DRIVE UNDERPASS			
BRIDGE HIGHWAY No. R. S. A. B. DIST. No. 4			
CO. BRANT			
THE CITY OF BRANTFORD USE -- SOIL --			
NORTH ABUTMENT REINFORCEMENT			
APPROVED	DESIGNED	CONTRACT NO.	
CHIEF ENGINEER	CHIEF DESIGNER	WR. No.	40-74-11
DATE	DATE	DATE	DATE
1976	1976	1976	1976
1-185	1-185	1-185	1-185