

## DEPARTMENT OF HIGHWAYS ONTARIO

## MEMORANDUM

TO: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Division,  
Admin. Bldg.

FROM: Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: July 31, 1967

OUR FILE REF.

IN REPLY TO

AUG 2 1967

## SUBJECT:

## FOUNDATION INVESTIGATION REPORT

For

Contract #8 (Blue)

Hwy. #27 Improvement

District #6 (Toronto)

W.J. 67-F-16 -- W.P. 275-64-3

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure 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.

AGS/WdeF  
Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (2)  
F. Allen  
W. S. Melinyshyn  
T. J. Kovich  
B. A. Singh

Foundations Files  
Gen. Files ✓

  
A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER

## TABLE OF CONTENTS

1. INTRODUCTION.
  2. DESCRIPTION OF THE SITE AND FIELD INVESTIGATION.
  3. SOIL CONDITIONS:
    - 3.1) General.
    - 3.2) Burnhamthorpe Rd. Site.
    - 3.3) Rathburn Rd. Site.
  4. GROUNDWATER CONDITIONS.
  5. DISCUSSION AND RECOMMENDATIONS:
    - 5.1) General.
    - 5.2) Bridge #60 - Burnhamthorpe Rd. Underpass - (W.P. 262-65). 37-230
    - 5.3) Bridge #59 - Rathburn Rd. Underpass - (W.P. 261-65). 37-229
    - 5.4) Recommendations for both structures.
  6. MISCELLANEOUS.
-

# FOUNDATION INVESTIGATION REPORT

For

Contract #8 (Blue)

Hwy. #27 Improvement

District #6 (Toronto)

W.J. 67-F-16 -- W.P. 275-64-3

## 1. INTRODUCTION:

A foundation investigation was requested by Mr. W. S. Melinyshyn, Regional Bridge Location Engineer, in a memo dated November 24, 1966. The request called for foundation reports at the sites of three bridges. These bridges are incorporated in Contract #8 (Blue), which in turn, covers the section of the proposed Hwy. #27 improvement from just north of Bloor St. to just south of Hwy. #27 and #401 interchange. In a later memo dated June 1, 1967, we were advised, however, by the Regional Bridge Location Engineer, that in the modified contract only two bridges were to be included: namely, Bridge #59, Rathburn Rd. underpass, and Bridge #60, Burnhamthorpe Rd. underpass.

According to the request, a field investigation was carried out by this Section in order to determine the existing soil conditions at the sites of the two bridges. Presented in this report are the results of the investigation as well as recommendations pertaining to the foundations.

## 2. DESCRIPTION OF THE SITE AND FIELD INVESTIGATION:

The general area is flat, densely populated urban development, with commercial and residential buildings.

Geologically, the site belongs to the "Iroquois Plain" physiographic region, which was formed by undulating till plains above the lowland, bordering Lake Ontario. This low-lying terrain was inundated by a body of water known as Lake Iroquois in the

cont'd. /2 ...

2. DESCRIPTION OF THE SITE AND FIELD INVESTIGATION: (cont'd.) ...

late Pleistocene times. Some alluvial terrace land may therefore be found in certain areas.

A limited scale foundation investigation was already carried out at the site of the proposed two bridges by this Section in 1965 (W.J. 65-F-120). Some 3 of these boreholes, numbered 8, 10, and 11, are incorporated in this report. During the recent field work, additional boreholes were placed at the locations of the proposed abutments and piers.

Borings were achieved by using two Pennsylvania flight augers, taking split-spoon samples at regular intervals. Standard penetration tests were performed according to conventional methods, the results of which are plotted on the attached borelog sheets, together with laboratory tests.

3. SOIL CONDITIONS:

3.1) General:

Glacial till deposits form the overburden at both bridge sites. At the location of the proposed Burnhamthorpe Rd. structure the till was found to be predominantly of a granular nature; at Rathburn Rd. it is mainly cohesive.

The estimated soil stratigraphy is plotted on Drawings #67-F-16A and 67-F-16B accompanying this report.

A brief description of the soils follows:

3.2) Burnhamthorpe Rd. Site:

A four-to-eight ft. thick fill was observed as the surficial layer in the majority of the boreholes. The fill was identified to be clayey silt with traces of sand and gravel. The consistency of this stratum ranges from firm to hard, corresponding to penetration 'N' values of 5 to over 100 blows

cont'd. /3 ...

3. SOIL CONDITIONS: (cont'd.) ...

3.2) Burnhamthorpe Rd. Site: (cont'd.) ...

per ft. The original organic topsoil was detected at some locations, right beneath the fill. The main body of the overburden, underlying the surficial layer, is silt~~y~~ sand to sand with gravel and traces of clay. The relative density of the deposit, generally, is very dense with penetration resistances exceeding 100 blows per ft. The clay content of the stratum appears to increase slightly with depth, so that the material exhibits some plasticity in the lower portions.

All the boreholes were terminated within the overburden, around el. 416 - 426 ft.

3.3) Rathburn Road Site:

A cohesive clayey silt deposit with some sand and traces of gravel was found in every borehole at the proposed crossing. The consistency of the material is stiff within the upper 3 - 4 ft.; otherwise, it is generally hard, corresponding to 'N' values much in excess of 100 blows per ft. The layer has slight to medium plasticity, the range of plastic limits being 12 to 18%, and those of liquid limits between 19 and 26%. The natural moisture contents of the samples were found to be below the plastic limits indicating the preconsolidated nature of the glacial deposit.

The sieve and hydrometer analyses of the samples disclosed very variable grain-size distributions. No bedrock was encountered within the investigated 30 - 50 ft. depth.

4. GROUNDWATER CONDITIONS:

At the time of the recent field work, groundwater level was established - at the Burnhamthorpe Rd. site - at depths of 5 - 13 ft. below ground surface - i.e., el. 446 - 451 ft. At the Rathburn Rd. site, the groundwater was found to lie between 2 and 5 ft. below ground level, corresponding to el. 476 - 480 ft.

cont'd. /4 ...

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

It is proposed to construct new bridges at the crossings of Burnhamthorpe Rd. and Rathburn Rd. over Hwy. #27.

The proposal calls for 5-span structures, the design finished grades of Hwy. #27 being at approx. el. 460 ft. beneath the Burnhamthorpe Rd. structure, and around el. 478 ft. at Rathburn Rd.

Recommendations as to the structure foundations for the individual bridges, are given below:

5.2) Bridge #60 - Burnhamthorpe Rd. Underpass (W.P. 262-65):

Soil conditions at this site appear to be favourable for spread footings. Footings should be placed at four ft. below existing ground level except for Pier #2 (See Drawing 67-F-16B). At the latter location, boreholes (No's. 3 & 5) revealed that the approximately 8 ft. thick fill layer did not exhibit adequate strength to support the pier within the fill. Moreover, the original organic topsoil was observed below the fill. The footings of Pier #2, therefore, should be placed below the fill and organic materials, or may be supported on steel H-piles.

Footings for perched abutments may be placed within the approach fills and supported on steel H-piles.

The elevations above which the footings should not be placed, are tabulated below for each pier and abutment.

Footings For -	Placed Not Higher Than El. (Ft.) -	Elevation of Pile Tips For Perched Abutments (Ft.) .
East Abutment	448.0	440.0 - 445.0
Pier #1	446.0	
Pier #2	446.0	435.0 - 440.0
Pier #3	453.0	
Pier #4	455.0	
West Abutment	454.0	445.0 - 450.0

5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

5.3) Bridge #59 - Rathburn Rd. Underpass (W.P. 261-65):

Spread footings are recommended for this structure as well, with a provision of four ft. cover above the base of footings for frost protection.

Perched abutments may also be supported on steel H-piles with the pile caps being formed within the fills.

Regardless of the finished grade of Hwy. #27, footings should not be placed higher than the elevations listed below:

Footings For -	Placed Not Higher Than El. (Ft.) -	Elevation of Pile Tips For Perched Abutments (Ft.).
East Abutment	478.0	455.0 - 465.0
Pier #1	477.0	
Pier #2	476.0	
Pier #3	475.0	
Pier #4	475.0	
West Abutment	477.0	450.0 - 460.0

5.4) For Both Structures - safe loads of 4 t.s.f. may be assumed on spread footings placed on or below the listed elevations. 12 BP at 53 steel H-piles driven to the recommended elevations will support 70 Ton per pile; the working loads, however, should be checked during pile driving by means of the Hiley formula (D.H.O. Standards DD 1218 and DD 1219).

For excavations below the groundwater level at the Burnhamthorpe Rd. site, some dewatering scheme may be necessary due to the granular nature of the soils. At the Rathburn Rd. crossing, no dewatering problems are foreseen since the soils appear to have adequate cohesion to prevent 'boiling' of the excavation bottoms.

cont'd. /6 ...



5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

5.4) (Cont'd.) ...

The approach fills will be stable provided they are constructed of well compacted material with 2 horizontal to 1 vertical slopes.

6. MISCELLANEOUS:

The field work, carried out during the period of June 7 to 14, 1967, was supervised by Messrs. K. A. Liljefors and B. Gray, Project Foundation Engineers.

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

July 1967.



APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-16

LOCATION Co-ord. 190,085 N; 205,390 E.

ORIGINATED BY KL

W.P. 262-65

BORING DATE June 7, 1967

COMPILED BY LK: BG

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY *Mo*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — WL PLASTIC LIMIT — wp WATER CONTENT — w			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT % wp — w — WL 10 20 30				
458.2	GROUND LEVEL														
0.0	Clayey silt with some sand, traces of gravel.														
454.2			1	SS	100/5"										
4.0	Sandy silt with gravel, traces of clay.		2	SS	100/5"	450									
			3	SS	100/2"										
			4	SS	100/5"										
			5	SS	100/2"	440									
	Very dense.		6	SS	78										
			7	SS	109	430									
426.7			8	SS	100/5"										
31.5	End of Borehole														

447.2'  
Gr. 10, Sa. 50  
Sl. & Cl. 40

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-16

LOCATION Co-ord. 189,952 N; 205,495E.

ORIGINATED BY KL

W. P. 262-65

BORING DATE June 7, 1967

COMPILED BY KL: BG

DATUM \_\_\_\_\_ Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

[illegible]

**MATERIALS & TESTING DIVISION**

FOUNDATION SECTION

LOCATION Co-ord. 190.059 N; 205.717 E.

ORIGINATED BY AKB

BORING DATE July 21, 1967

COMPILED BY AKB

BOREHOLE TYPE Washboring, BX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W <div>WP ——— W ——— WL</div>				BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %					
456.0	Ground Level															
0.0	Sandy silt to sand, traces of gravel. Compact	•••	1	SS	11	450										
450.5	Organic clayey silt	/ / /	2	SS	18											
448.0	Sandy <del>silt</del> silt with gravel. Very dense.	•••	3	SS	35											
443.0		•••	4	SS	100											
13.0	End of Borehole					440										

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 67-F-16

LOCATION Co-ord. 190,160 N; 205,523 E.

ORIGINATED BY KL

W. P. 262-65



BORING DATE June 9, 1967

COMPILED BY \_\_\_\_\_ KL; BG

DATUM \_\_\_\_\_ Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY                     

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT % 10      20      30			
457.0	Ground Level												
0.0	Clayey silt, trace of sand and gravel.												451.0'   Gr. 15, Sa. 5h Si. & Cl. 3h
452.0	Hard.		1	SS	83								
5.0	Silty sand with gravel, traces of clay.		2	SS	44	450							
			3	SS	88								
			4	SS	100	4"							
			5	SS	100	3"	440						
	Very dense.		6	SS	100	1"							
			7	SS	110	6"	430						
425.5			8	SS	100	1.5"							
31.5	End of Borehole												

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 67-F-16

LOCATION Co-ord. 190,220 N; 205,660 E.

ORIGINATED BY KL

W. P. 262-65

BORING DATE June 14, 1967

COMPILED BY KL; BG

DATUM Geodetic

BOREHOLE TYPE Cont Flight Auger

CHECKED BY                     

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT						LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.									P.C.F.	
455.9	Ground Level															
0.0	Clayey silt with traces of sand & Gravel		1	SS	10											451.4
447.4	Stiff to very stiff.		2	SS	22											
8.5	Silty sand with gravel, traces of clay.		3	SS	98											
			4	SS	100/5"											
			5	SS	100/3"											
	Very dense		6	SS	100/2.5"											
			7	SS	100/2.5"											
425.4			8	SS	110/4"											
30.5	End of Borehole															

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 67-F-16

W.P. 262-65

DATUM Geodetic

LOCATION Co-ord. 180,205 N; 205,745 E.

BORING DATE June 8, 1967

BOREHOLE TYPE Cont Flight Auger

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

ORIGINATED BY KL

COMPILED BY KL: BG

CHECKED BY

[illegible]



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOA 67-F-16

W. P. \_\_\_\_\_ 262-65

DATUM Geodetic

LOCATION Co-ord. 190,062 N; 205,868 E.

BORING DATE June 13, 1967

BOREHOLE TYPE Cont. Flight Auger

RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

ORIGINATED BY KL

COMPILED BY KL; BG

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

308 67-F-16

LOCATION Co-ords. 190,080 N; 205,752 E.

ORIGINATED BY PMc.

W. P. 262-65

BORING DATE Nov. 15, 1965

COMPILED BY AKB

DATUM

BOREHOLE TYPE

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 62-E-16

LOCATION Co-ords. N. 193,279 E, 204,689

ORIGINATED BY P. Mc.

W. P. 261-65

BOREING DATE November 9, 1965

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT _____ WL PLASTIC LIMIT _____ WP WATER CONTENT _____ W 		
--------------	--	--	---------	--	--	-------------	--	--	--	--	--	--

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

JOB 67-F-16 LOCATION Co-ords. N.193,262 E.204,434 ORIGINATED BY P.Mc.  
W.P. 261-65 BORING DATE Oct. 29, 1965 COMPILED BY AKB  
DATUM Geodetic BOREHOLE TYPE Penn Drill and Washboring - BX Casing CHECKED BY 10

SOIL PROFILE		STRAT. PLOT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS				
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE		BLOWS / FOOT	BLOWS / FOOT	25	50			75	100	125	Wp
482.9	Ground Level														
0.0															
	Clayey silt with sand and traces of gravel.		1	SS	11	480									
			2	SS	34										
			3	SS	41										
	Glacial Till		4	SS	57	470									
			5	SS	59	460									
	Stiff to hard.		6	SS	40										
			7	SS	31										
			8	SS	65	450									
			9	SS	72										
					150	440									
			10	SS	58	430									
					75										
427.4			11	SS	125										
55.5	End of Borehole														

Si.90  
Cl.10

Gr.9, Sa.64  
Si.23, Cl.4

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

# RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

JOB 67-F-16

LOCATION Co-ord. 193,265 N; 204,290 E.

ORIGINATED BY BRG

W. P. 261-65

BORING DATE June 7, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

**CHECKED BY**

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 67-F-16

LOCATION Co-ord. 193,140 N; 204,395 E.

W.P. 261-65

BORING DATE June 7, 1967

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

FOUNDATION SECTION

ORIGINATED BY BRG

COMPILED BY                      BRG

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			BULK DENSITY  P.C.F.	REMARKS																																																																																																																							
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			$w_p$ $w$ $w_L$ 10      20      30 WATER CONTENT %																																																																																																																										
481.1	Ground Level																																																																																																																																			
0.0	Clayey sit with sand, traces of gravel.		1	SS	20	480																																																																																																																														

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 67-F-16

W. P. 261-65

DATUM Geodetic

RECORD OF BOREHOLE NO. 14

LOCATION Co-ord. 193,197 N; 204,450 E.

BORING DATE June 14, 1967

BOREHOLE TYPE Cont. Flight Auger

FOUNDATION SECTION

ORIGINATED BY KAL

COMPILED BY KAL

CHECKED BY

[illegible]



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

RECORD OF BOREHOLE NO. 15

FOUND Y SECTION

JOB 67-F-16

LOCATION Co-ord. 193,366N; 204,538 E.

ORIGINATED BY BRG

W. P. 261-65

BORING DATE June 9, 1967

**COMPILED BY** \_\_\_\_\_ **BNG**

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

JOB 67-E-16

LOCATION Co-ord. 193,252 N. 204,643 E.

ORIGINATED BY BRG

W.P. 261-65

BORING DATE June 9, 1967

COMPILED BY \_\_\_\_\_

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

# RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

JOB 67-F-16

LOCATION Co-ord. 193,407 N; 204,730 E.

ORIGINATED BY BRG

W. P. \_\_\_\_\_ 261-65

BORING DATE June 7, 1967

COMPILED BY BRG

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

[illegible]

## 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.F.	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

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	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
$\bar{\sigma}$	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
$K_o$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

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

### SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

## MEMORANDUM

To: Mr. A. Sternac,  
Principal Foundation Engineer,  
Room 107,  
Lab. Building.

From: Bridge Division,  
Downsview, Ontario.

Date: November 24th, 1966.

Our File Ref.

IN REPLY TO

SUBJECT: W.P. 275-64-3, G.D.G.B. Pav.  
Includes W.P. 262-65, Br. #60,  
W.P. 261-65, Br. #59,  
W.P. 373-65, Br. #2.

Contract #8

67-F-16

This will confirm our request for a foundation investigation of the above structures contained in Contract #8 (Blue) with completion date of 13th. Sept. 1967, as shown on schedule date 21st, Nov. 1966.

As we expect copies of 100' scale plan to be available by 30th November 1966, and will have suggested borehole locations plotted on the plans a few days later; and in view of the work already done at these sites, I would suggest that consideration be given to presenting a final foundation report on the required date rather than the preliminary/confirmatory report discussed recently.

I trust you will give this your full consideration.

*J. C. McAllister*

JCMcA/cew  
cc H. Crowley

J. C. McAllister,  
for W. S. Melnyshyn,  
Regional Bridge Location Engineer.

## MEMORANDUM

To: Mr. A. G. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Building.

From: Bridge Division,  
Downsview, Ontario

Date: June 1st, 1967

Our File Ref.

In Reply To

## SUBJECT:

W.P. 262-65, Bridge No. 60, Burnhamthorpe Road Underpass,  
W.P. 261-65, Bridge No. 59, Rathburn Road Underpass,  
Highway 27, District 6

Attached are two prints of the 100' scale layout for the above structures which comprise Contract No. 8.

The existing and proposed pavements have been coloured for clarification and the probable spans, pier and abutment locations have been marked.

Profiles are not yet available, however, approximate top of pavement elevations are shown in green for Burnhamthorpe Road. Highway No. 27 will be about elev. 460 here. Proper profiles should become available while the field work is under way.

*J. C. McAllister*

JCMCA/pr  
Attach.

cc. A. Crowley  
R. Forrest

J. C. McAllister,  
for W. S. Melinyshyn,  
Regional Bridge Location Engineer



MEMORANDUM

To: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107,  
Lab. Building.

FROM: Bridge Division,  
Downsview, Ontario.

DATE: June 23, 1967.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 261-65,  
Hwy. #27,  
District #6,  
Rathburn Rd. Underpass.

67-F-16

Following our memo of 1st, June 1967 requesting a foundation investigation at the above underpass, please find attached two prints of a plan showing approximate elevations of Rathburn Rd. structure. Hwy. #27 will be at approximate elevation 490.0.

478.0

*J. C. McAllister*

JCM/la  
Attach.  
c.c. A. Crowley

J. C. McAllister,  
for W. Melinyshyn,  
Reg. Bridge Location Eng.

110  
401 & Keele St.  
Downsview, Ontario

July 11, 1967

Johnston Drilling Co. Ltd.  
377 Munster Ave.  
Toronto, Ontario

Dear Sirs:

This is to confirm our request of June 5, 1967 for the supply of 2 Fan Drills together with all necessary equipment, as specified under the terms of our Contract Agreement, at Hwy. 47, Bloor St. to Hwy. 401, Toronto, Ontario, on June 7, 1967.

This project bears Job Number 67-F-16.

Yours truly,

*A. G. Sternac*

KGS:mt

K. O. Selby  
Supervising Foundation Engineer  
For: A. G. Sternac  
Principal Foundation Engineer

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac, Principal Foundation Eng., Room 107, Lab. Bldg.

Mr. W. Melnyshyn,  
Reg. Bridge Location Engineer,  
Bridge Division,  
Admin. Bldg.

Bridge Division,  
Downsview, Ontario.

November 28th, 1967.

Bridge No. 59,  
Rwy. 27 Underpass at  
Rathburn Road,  
W.P. No. 261-65, Site No. 37-229,  
Highway No. 27, District No. 6.

67-F-16

Attached herewith are prints of the Preliminary  
Bridge Plan Drawing D-6314-P for the above-mentioned  
structure.

The estimated cost of the proposed structure is  
approximately \$695,000.00. This cost includes tender,  
materials, engineering and sundry construction.

Any comments or revisions you may have should be  
submitted within three weeks.

CSS/oo  
Attach.

C.S. Grebaki,  
Bridge Design Engineer.

c.c. J. Anderson  
A. Stermac  
S. McCombie

NO COMMENTS

NOV 30 1967

A. L. B.  
K.L.

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. W. Melnyshyn,  
Regional Bridge Location Engineer,  
Central Region,  
Administration Building

Bridge Division,  
Downsview, Ontario

December 1, 1967

Bridge No. 60  
Hwy. #27 Underpass at  
Burnhamthorpe Road  
W.P. 262-65, Site No. 37-230  
Hwy. 401 & 27, District No. 6

67-F-16

Attached herewith are prints of the Preliminary Bridge  
Plan Drawing D-6315-P for the above-mentioned structure.

The estimated cost of the proposed structure is \$800,000.  
This cost includes tender, materials, engineering and sundry  
construction.

Any comments or revisions you may have should be submitted  
within three weeks.

CSG:rd

C.S. Grebski,  
Bridge Design Engineer

Attach.

c.c. S. McCombie  
A. Stermac (2)  
J. Anderson

NO COMMENTS

DEC. 5, 1967

A.K.B.

102

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Building

FROM: Bridge Division,  
Downsview, Ontario

ATTENTION:

DATE: July 4, 1968

OUR FILE REF:

IN REPLY TO

SUBJECT: Bridge No. 60  
Hwy. #27 Underpass at  
Burnhamthorpe Road  
W.P. 262-65, Site 37-230  
Hwys. 401 & 27, District 6

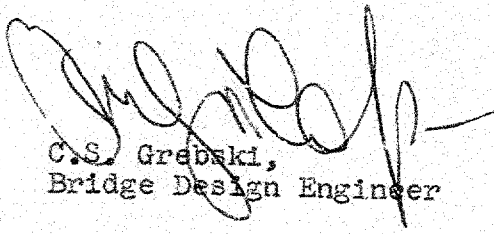
67-F-16

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:rd

Attach.

for   
C.S. Grebski,  
Bridge Design Engineer

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Building

Bridge Division,  
Downsview, Ontario

July 4, 1968

Bridge No. 60  
Hwy. #27 Underpass at  
Burnhamthorpe Road  
W.P. 262-65, Site 37-230  
Hwys. 401 & 27, District 6

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:rd

Attach.

C.S. Grebski,  
Bridge Design Engineer

Mr. C. S. Grebski,  
Bridge Design Engineer,  
Bridge Division,  
Admin. Bldg.

Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

July 8, 1968

Bridge No. 60,  
Hwy. #27 Underpass at Barmhamthorpe Rd.,  
W.J. 67-F-16, W.P. 262-65,  
District #6 (Toronto).

We have reviewed your final design for the above mentioned bridge. We have no comments as to the depth of spread footings; however, in view of the changed footing locations and recent experience at the site of Hwy. #401 & Hwy. #27, we suggest that the lengths of the piles be revised according to the list given below:

Structure	Location	No.	Type	Length (Ft.)	Design Load
North Structure	W. Abutment	24	12 BP 53	17.00	70 tons
	E. Abutment	19	"	20.00	"
	Piers	8	"	16.00	"
	"	24	"	16.00	"
South Structure	W. Abutment	19	12 BP 53	17.00	70 tons
	E. Abutment	24	"	20.00	"
	Piers	8	"	16.00	"
	"	24	"	16.00	"

The above lengths of piles include a 1.0 ft. allowance for cutting off buckled ends.

KGS/HdeF

cc: Mr. A. McKim

Foundations Files  
Gen. Files

*K. G. Selby*  
K. G. Selby,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Sternac,  
PRINCIPAL FOUNDATION ENGR.



#67-F-16

W.P. #275-64-3

W.P. #261-65

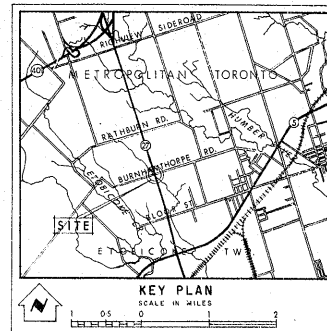
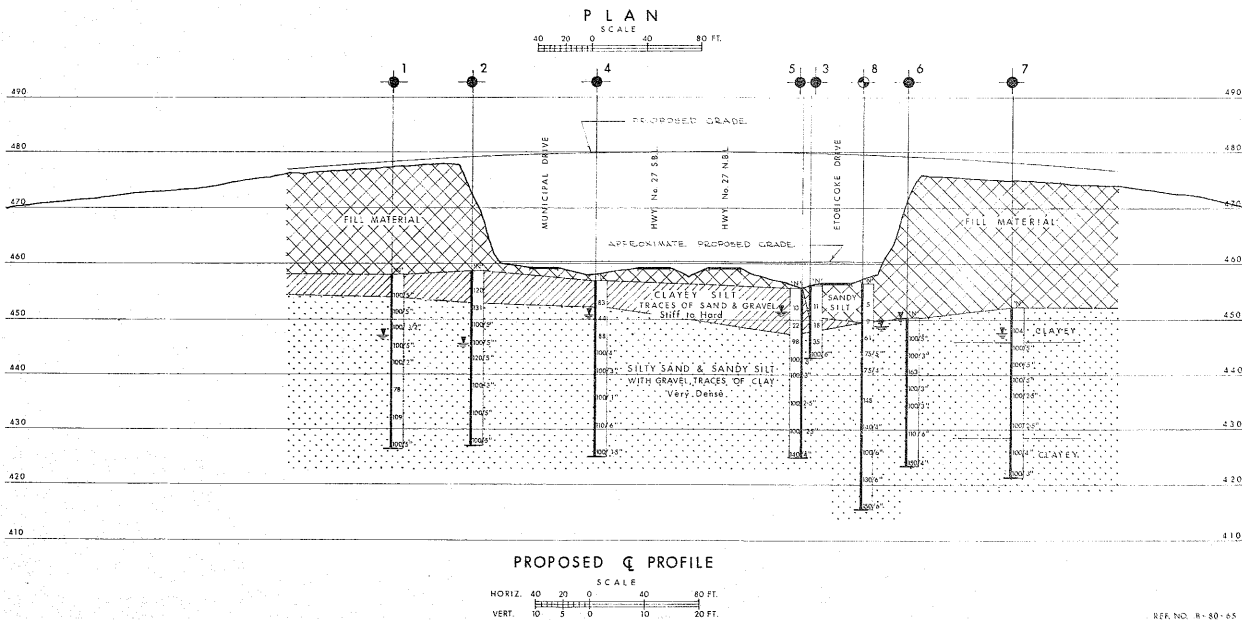
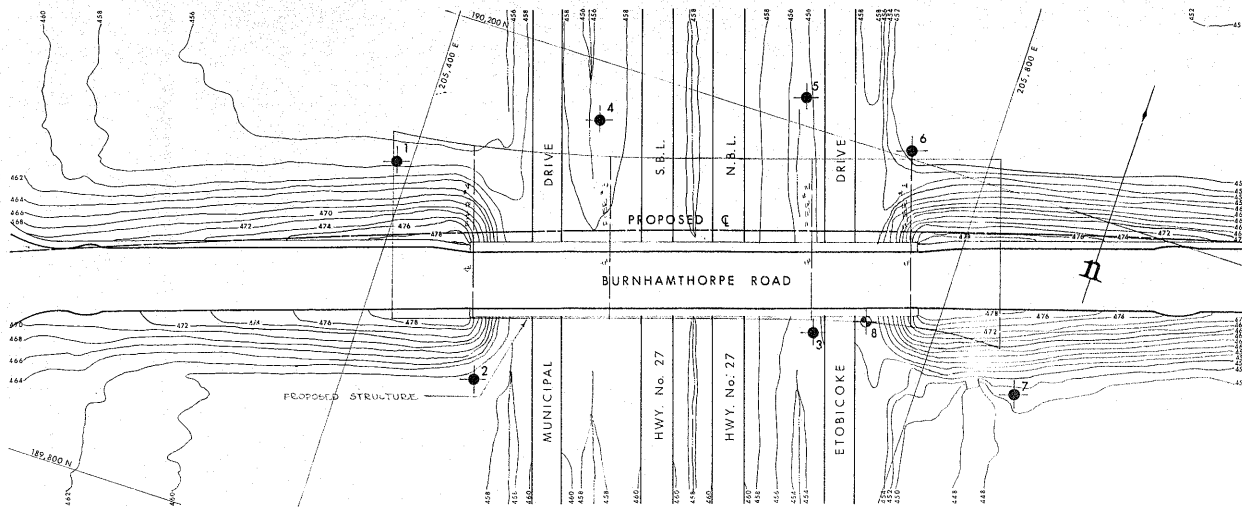
W.P. #262-65

Hwy. #27

BURNHAMTHORPE

Rd.





LEGEND				
	Bore Hole			
	Cone Penetration Hole			
	Bore & Cone Penetration Hole			
	Water Levels established at time of field investigation, June 1967			
NO.	ELEVATION	CO-ORDINATES		
		NORTH	EAST	
1	458.2	190,085	205,390	
2	459.0	189,952	205,495	
3	458.0	190,059	205,717	
4	457.3	190,160	205,523	
5	458.9	190,220	205,685	
6	450.2	190,705	205,745	
7	452.5	190,062	205,866	
8	456.7	190,080	205,752	

**NOTE**

The boundaries between soil strata have been established only of Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION - FOUNDATION SECTION

**BURNHAMTHORPE ROAD**

**BRIDGE No. 60**

KING'S HIGHWAY No. 27 IMPROVEMENT DIST. No. 6

CO. YORK METRO. TORONTO

TWP. ETOBICOKE LOT. CON.

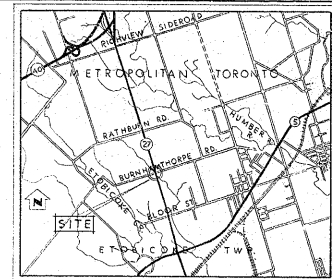
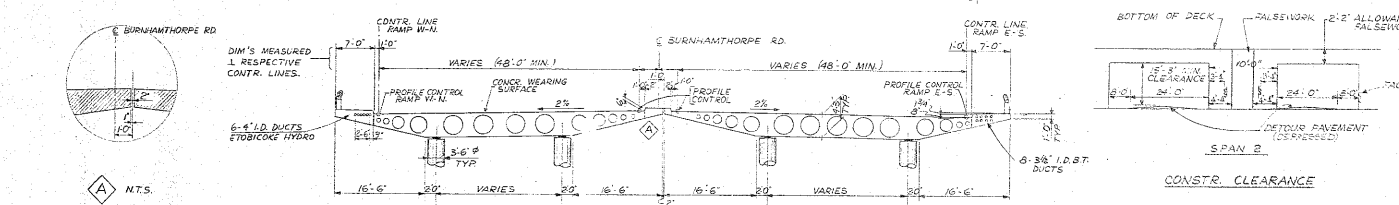
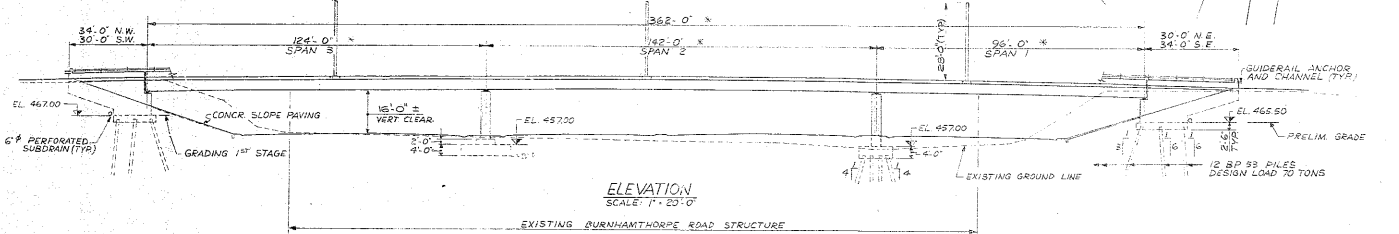
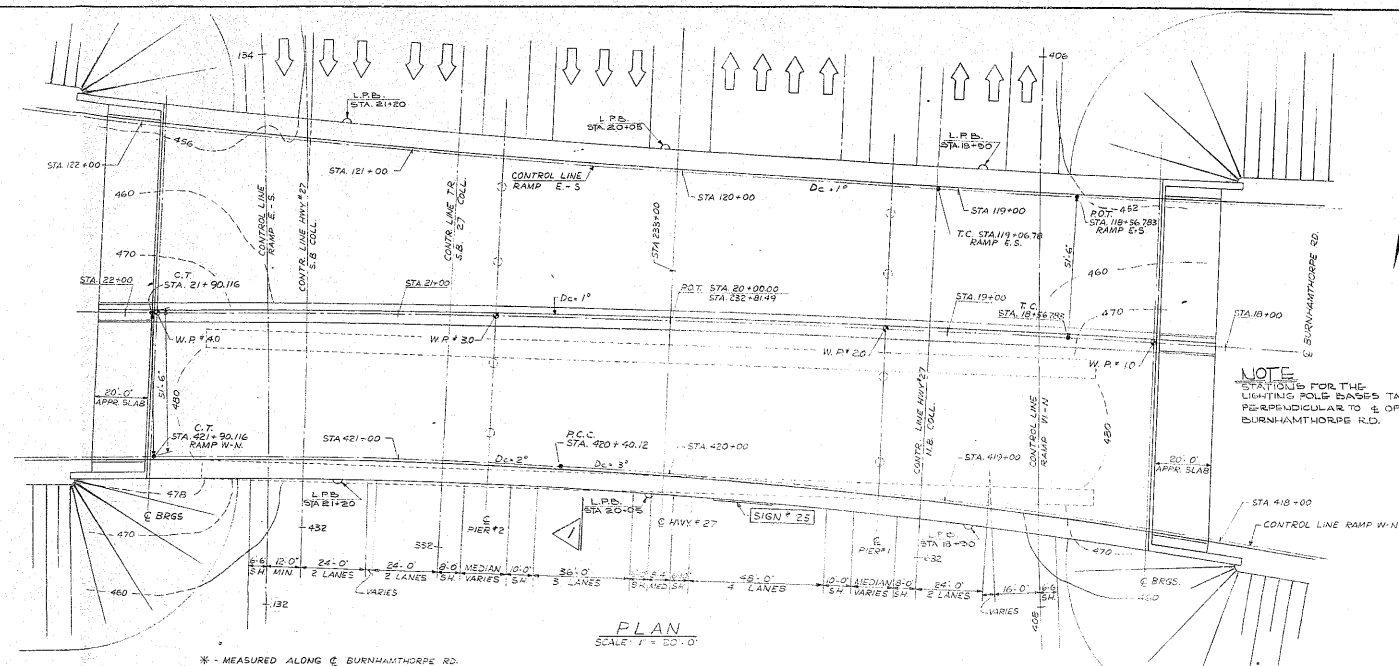
**BORE HOLE LOCATIONS & SOIL STRATA**

SUBD. A.B. CHECKED / W.P. No. 262 - 65 M.S.T. DRAWING NO.

DRAWN R.G.G. CHECKED / JOB No. 67-F-16 67-F-16 B

DATE JULY 28, 1967 SITE NO. BRIDGE DRAWING NO.

APPROVED *[Signature]* CONT. NO.



GENERAL NOTES

CLASS OF CONCRETE : DECK, CURBS, PARPET WALLS AND  
PIERS 5000 PSI; APPROACH SLABS, PIER FOOTINGS,  
ABUTMENTS AND ABUTMENT FOOTINGS 3000 PSI.

CLEAR COVER TO REINF. STEEL: FOOTINGS 3";  
ABUTMENTS AND PIERS 3"; CURBS 2"; PARAPET  
WALLS 1 1/2"; DECK - TOP 2", BTM 1 1/2", APPROACH  
SLABS 3".

### LIST OF DRAWINGS

GENERAL PLAN	1
BORE HOLE LOCATIONS & SOIL STRATA	2
FOOTINGS - DIMENSIONS & REINF. - S. STRUCT.	3
FOOTINGS - DIMENSIONS & REINF. - N. STRUCT.	4
ABUTMENTS - DIMS & REINF. - S. STRUCT. E.	5
ABUTMENTS - DIMS & REINF. - S. STRUCT. W.	6
ABUTMENTS - DIMS & REINF. - S. STRUCT. W. & S. STRUCT. E.	7
PIER DETAILS -	8
DECK DIMENSIONS - N. STRUCT.	9
DECK DIMENSIONS - S. STRUCT.	10
DECK REINFORCING - N. STRUCT.	11
DECK REINFORCING - S. STRUCT.	12
CABLE DETAILS -	13
CABLE DETAILS -	14
TRANSVERSE CABLE DETAILS - N & S. STRUCT.	15
APPROACH SLABS	16
PARADEY HALL DETAILS	17
STANDARD STEEL HARAPET HALL	18
DETAILS OF COLLECTIVE SLOPE PAVING	19
STANDARD DETAILS I	20
STANDARD DETAILS II	21
BRIDGE ELECTRICAL DETAILS - TYPE 'B'	22

[illegible]

DEPARTMENT OF HIGHWAYS ONTARIO  
BRIDGE DIVISION

BRIDGE # 60

HWY # 27 U'PASS AT BURNHAMTHORPE RD.

KING'S HIGHWAY No. 27 &amp; 401 DIST. No. 6

CO. YORK

**TWP. ETOBICOKE** **LOT** **CON.**

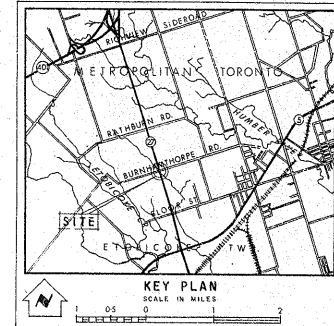
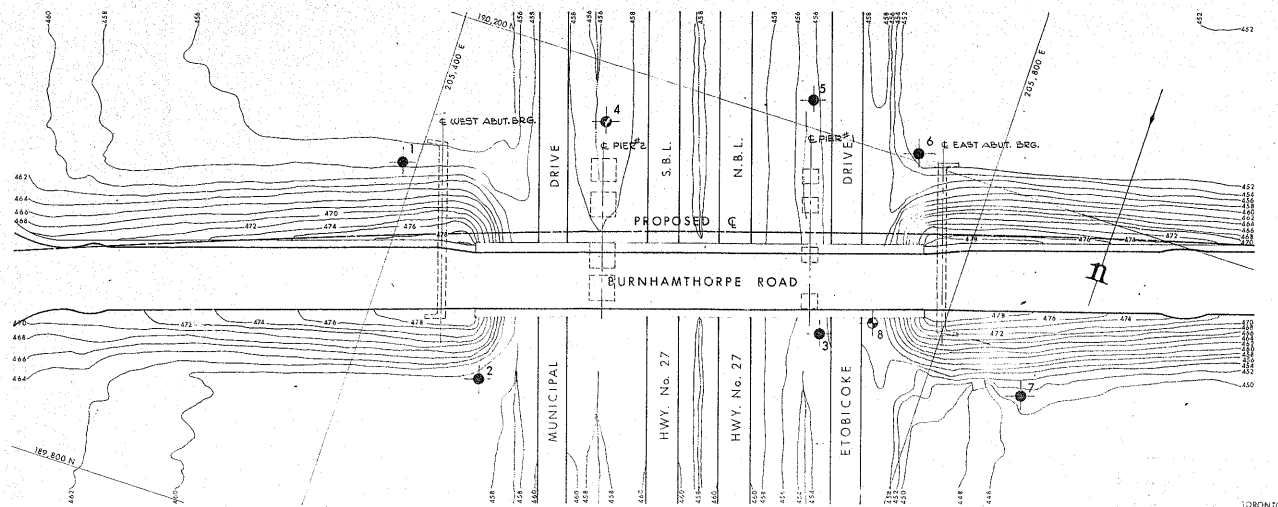
## GENERAL PLAN

SITE No.	W.P. No.
----------	----------

APPROVED	37-230	262-64
----------	--------	--------

BRIDGE ENGINEER				CONTRACT No.			
DESIGN	CHECK	CHECK	CHECK				

DESIGN	J. S.	CHECK	FL			
DRAWING	M. M.	CHECK	FL	DRAWING	D. 6315	



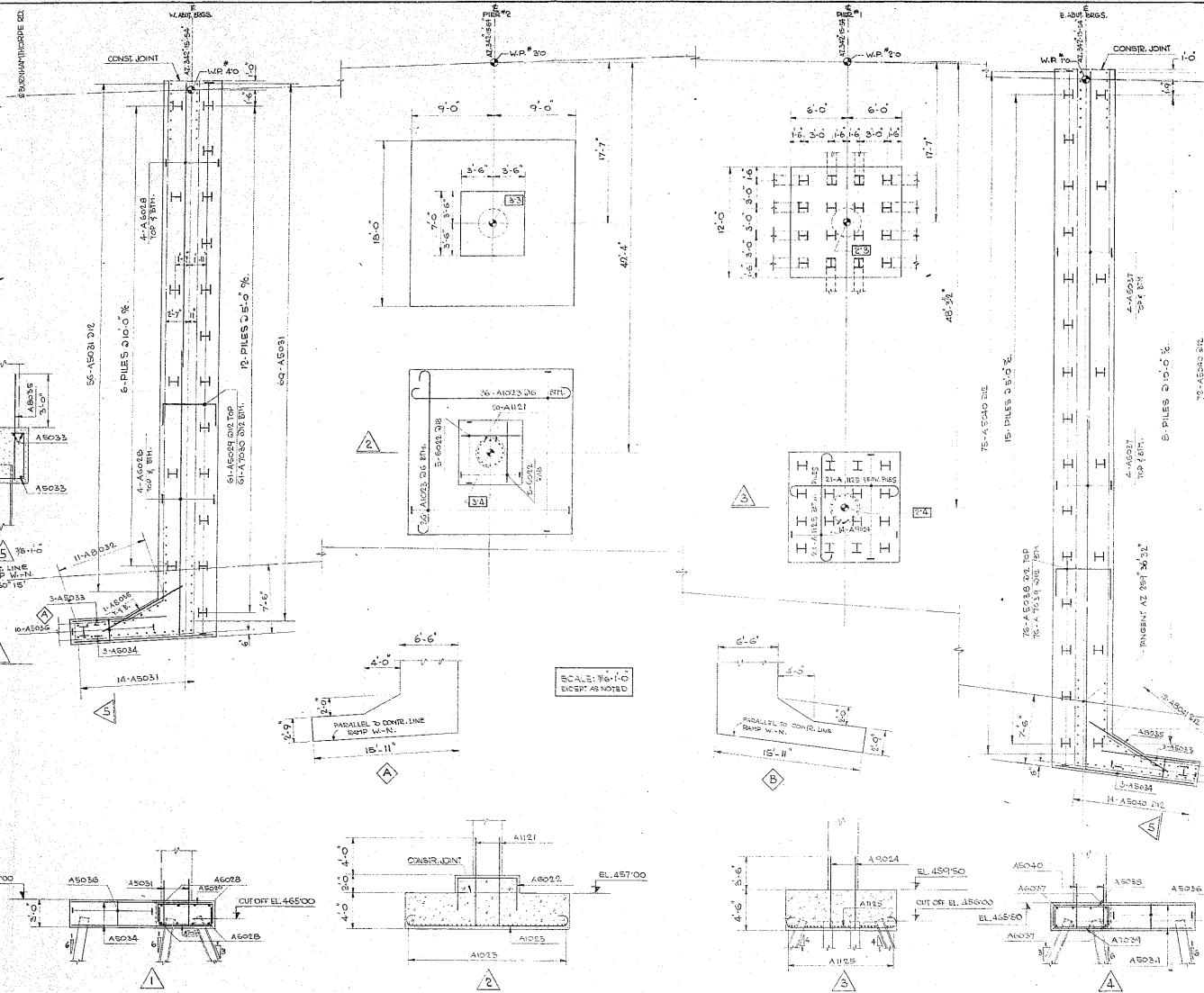
- NOTE -

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

[illegible]

REVISIONS			
	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING DIVISION - FOUNDATION SECTION			
<h2 style="margin: 0;">BURNHAMTHORPE ROAD</h2> <h3 style="margin: 0;">BRIDGE No. 60</h3>			
KING'S HIGHWAY No. 27 IMPROVEMENT		DIST. No. 6	
CO. YORK		METRO TORONTO	
TWP. E2B/C10KE	LOT	CON.	
<h2 style="margin: 0;">BORE HOLE LOCATIONS &amp; SOIL STRATA</h2>			
SURVEY A.B.	CHECKED	W.P. No. 762 - 65	H.S.T. DRAWING No.
DRAWN P.O.	CHECKED	S.P. No. 67-F-16	<h1 style="margin: 0;">67-F-16B</h1>
DATE JULY 28, 1967	SITE No.	27-E30	BRIDGE DRAWING No.
APPROVED <i>Adrian M. ...</i>		CONT. No.	
PREPARED BY <i>Adrian M. ...</i>		06315-B	



WORKING POINTS			
WP	STATION NO. BURNING TREE RD.	NORTH CO-ORDINATES	EAST
10	1-17-2000	190,154.74	205,105.021
20	1-17-2000	190,127.74	205,149.245
19	1-17-2000	190,110.50	205,648.401
24	1-17-2004	190,081.284	205,707.745
30	2-0-2000	190,059.267	205,537.937
33	2-0-2003	190,067.120	205,563.192
34	2-0-2009	190,043.553	205,510.728
40	2-1-2010	190,043.553	205,440.679

LIST OF PILES				
LOCATION	N°	TYPE	LENGTH	DESIGN LOAD
W. ABUT.	19	12 BP 53	23.00	70 TONS
E. ABUT.	24	DO	25.00	DO
PIERS	3	DO	18.00	DO
DO	24	DO	19.00	DO

[illegible]

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
BRIDGE #60 HWY. #27 U'PASS AT BURNHAMTHORPE ROAD			
KING'S HIGHWAY NO. 27 x 401		DIST. NO. 6	
CO. YORK		LOT CON.	
TWP. E10B/COKES		LOT CON.	
FOOTINGS DIMENSIONS & REINFORCING SOUTH STRUCTURE			
APPROVED BRIDGE ENGINEER		DATE REC'D 7-23-60	REC'D NO. 062-68
CONTRACT NO.		DRAWING NO.	
DESIGN 7-24-60	CHECK TPL	D635-3	
DATE MAY 1961	DOWNSIGNING REC'D MAY 30-61	D635-3	

[illegible]

