

73-10
30M11-107
Department of Transportation and Communications
~~XXXXXXXXXXXXXXXXXXXX~~

MEMORANDUM

TO: Mr. G. C. C. Burkhardt, (2) FROM: Foundations Office,
Regional Bridge Planning Engineer, Design Services Branch,
Central Region, Central Bldg., Downsview.
90 Floral Parkway,
ATTENTION: Downsview, Ontario.

DATE: February 7, 1972.

OUR FILE REF.

IN REPLY TO

FEB 15 1972

SUBJECT:

30M11-107

GEOCREP No.

FOUNDATION INVESTIGATION REPORT
For
Iron Street Underpass (Bridge #3) (REVISION)
Hwy. #409 (Belfield Expressway)
District No. 6 (Toronto)
W.O. 71-11134 -- W.F. 285-66
CONT 73-20

Attached we are forwarding to you our foundation investigation report at the revised location of Iron Street extension. This report should be read in conjunction with our original foundation report W.O. 71-11037. See 30M11-113

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please feel free to contact our Office.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER.

AGS/ao
Attach.

cc: Messrs. D. W. Farren
B. R. Davis
A. Rutka
G. K. Hunter
H. Greenland
G. A. Wrong
T. J. Kovich
B. J. Giroux
B. A. Singh

De Leuw, Cather & Co. Ltd. (R. Barr)

Foundations Files
Documents

INTRODUCTION.

SUBSOIL CONDITIONS.

DISCUSSION AND RECOMMENDATIONS.

Pier Foundation (Ref. B.H. #1).

Abutment Foundations (Ref. B.H.'s #2, 3, 4 and 5).

Abutment Foundations (Ref. B.H.'s #2, 3, 4 and 5).

Approach Embankments and Cuts.

MI SCCELLANEOUS.

[illegible]

FOUNDATION INVESTIGATION REPORT
For
Iron Street Underpass (Bridge #3)
Hwy. #409 (Belfield Expressway)
District No. 6 (Toronto)
W.O. 71-11134 -- W.P. 285-66

INTRODUCTION:

Since the original Foundation Report (71-11037) was submitted, June 23, 1971, for the above-mentioned project, a revision in the alignment for the Iron Street extension has been proposed, which would in effect shift the structure location some 60 feet easterly from the previous location. As a result of this, we have carried out three additional borings to supplement our original subsoil information. These borings revealed that the subsoil conditions are generally very similar to those encountered at the original foundation investigation site. This memo should be read in conjunction with our original Foundation Investigation Report (71-11037) for details of subsoil and ground-water conditions.

SUBSOIL CONDITIONS:

The predominant stratum across the site is composed of a competent glacial till; this stratum was proven to extend a minimum of 52 feet below existing ground surface. The upper 40 to 49 feet of the stratum is cohesive, it is composed of a mixture of clayey silt binding sand and gravel. Below this cohesive zone the glacial till is granular in nature; i.e., it is composed of a heterogeneous mixture of silt, sand and gravel, with traces of clay. Within the glacial deposit distinct layers of silty sand were encountered between elevation 507 and elevation 521 at B.H.'s #1, #2, and #3.

In the upper cohesive portions of the glacial till the 'N' values ranged randomly from 10 blows/ft. to 135 blows/ft.

being generally greater than 40 blows/ft. Based on these results it is estimated that the consistency varies from stiff to hard. The 'N' values in the lower granular zone of the glacial till vary from 48 blows/ft. to in excess of 100 blows/ft., which indicates that the relative density is generally very dense.

The groundwater level observations have been carried out in the open boreholes. These observations indicate that the water level varies between elevations 547 and 551, which corresponds to depths of 1 to 5 feet from ground surface.

The gradational variation within the glacial deposit as determined at various borehole locations, are shown on the accompanying borelog sheets. The stratigraphical sections, shown on Drawing No. W.O. 71-11134 A, have been inferred from this data.

DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct an east-west expressway in the vicinity of Belfield Road which will connect Hwy. #401 in the Islington/Kipling area with the Toronto International Airport. The new Belfield Expressway (Hwy. #409) will be 3.3 miles long and will require interchanges at Kipling Ave., Martin Grove Road, Atwell Road, new Hwy. #427 and Airport Road. In addition, structures will be required at the crossing of Iron Rd., Canadian National Railways, old Hwy. #27 and Mimico Creek with the proposed expressway.

This discussion deals with the proposed underpass structure at the crossing of Hwy. #409 and the revised Iron Street Extension.

The proposed underpass at the revised Iron Street Extension and Hwy. #409 will be a two-span (85' - 85') structure incorporating a centre pier at the median and perched abutments within the approach fills. The new bridge will be 46 ft. wide. The profile grade of the Belfield Road Expressway (Hwy. #409) at the underpass location will be at elevation 540 - i.e., be of the order of 12 to 13 ft. below the existing ground surface.

The proposed grade of the Iron Street Extension within the proposed structure limits, varies from elevation 559 to elevation 560, which is some 6 to 8 ft. above the original ground surface. At these grades the maximum height of the approaches will be of the order of 20 ft.

The predominant stratum across the site is an extensive deposit of glacial till extending at least 52 ft. below the existing ground surface. The upper 40 to 49 ft. of the stratum is cohesive and below this zone the glacial till is granular.

The piers can be founded within the parent subsoil, while the abutments can be 'perched' within the proposed approaches. The foundation recommendations for these respective elements are discussed in the sections to follow.

Pier Foundation (Ref. B.H. #1):

The natural subsoil (glacial till) is competent. The centre pier, therefore, can be founded on a spread footing, located within this stratum below the proposed grade (elev. 540) of Hwy. #409. Four feet of earth cover should be provided to the underside of the footing for frost protection purposes. Spread footing founded at or below elevation 535, can be designed using a safe bearing pressure of up to 4.0 t.s.f.

The footing will be located below the groundwater level recorded during the period of the investigation. In view of the relatively impervious nature of the cohesive subsoil, no major dewatering problems are anticipated, during the footing excavation phase. Any minor groundwater seepage or surface runoff into the excavation could be handled using standard techniques, such as pumping from sumps, etc.

Settlement of the foundation subsoil will take place due to the induced footing pressure. For a footing, inducing the aforementioned bearing pressure, the settlement will be negligible, since the foundation subsoil is competent. Further, this settlement will be elastic in nature - i.e., take place during or immediately following the construction period.

Abutment Foundations (Ref. B.H.'s #2, 3, 4 and 5):

The proposed abutments may be "perched" within the approaches and supported on spread footings immediately below the existing ground surface within the glacial till stratum. A minimum of 4 ft. earth cover should be provided to the underside of the abutment footings for frost protection purposes. Spread footings, meeting the aforementioned requirements, can be designed using a safe bearing pressure of 2.5 t.s.f. at or below elevation 550.

No major dewatering problems are anticipated for the construction of abutments in view of the relatively impervious nature of the subsoil.

Settlements induced due to the footing pressure will be elastic in nature. These settlements will be negligible and will take place during or immediately following the construction of the structure.

Abutment Foundations (Ref. B.H.'s #2, 3, 4 and 5):

Alternatively, the abutments may be supported on spread footings placed within the approach fills. The fill material below the tops of the footings should consist of well compacted Granular 'A' material and should extend for a horizontal distance of at least 10 ft. from the footing edges in the plane of the footing tops. This portion of the fill should be built with side slopes of 2:1. The remainder of the fill should be completed to about profile grade for a distance of about 50 ft. behind the abutments before re-excavating for the abutment foundations. Spread footings for the abutments, on well compacted granular fill, can be designed using an allowable safe bearing pressure of 2.0 t.s.f.

The differential settlements between the pier and abutment footings should not exceed 1/2 inch.

Approach Embankments and Cuts:

The proposed profile grades of the Belfield Expressway (Hwy. #409) and Iron Street Extension will be approximately at

elevation 540 and 560, respectively. In order to achieve these grades at the approaches, embankments of the order of 8 ft., and cuts up to a maximum depth of 12 ft., will be required. No stability problems are anticipated for the proposed approach fills and cuts with standard 2:1 slopes.


The glacial till subsoil will settle due to the surcharge loading of the approach fills. The settlement will be elastic in nature and negligible in magnitude.

MISCELLANEOUS:


The field work was performed during the period of December 2 to December 10, 1971, under the supervision of Mr. V. Korlu, Project Foundation Engineer who prepared this report.

Equipment used was owned and operated by F. E. Johnston Drilling Co. Ltd., Toronto.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.


V. Korlu, P. Eng.




M. Devata, P. Eng.

VK/ao
Feb. 7, 1972.

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11134 LOCATION Co-ords. 877,914 N; 978,812 E. ORIGINATED BY VK
W.P. 285-66 BORING DATE December 7, 1971 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Drill with Tricone and Bicone Bit CHECKED BY *AK*

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT 20 40 60 80 100				SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					WATER CONTENT % 10 20 30
551.1 0.0	Ground Level					550									GR. SA. SI. CL. = 550.1	
	Clayey silt, some sand and gravel	○	1	SS	48											
	Hard - Brown Glacial Till	○	2	SS	55											7 22 51 20
	Hard	○	3	SS	115	540										
	Grey	○	4	SS	65											
		○	5	SS	45											
		○	6	SS	48											
		○	7	SS	47	530										13 26 45 16
		○	8	SS	47											
		○	9	SS	40	520										13 26 45 16
514.1		○	10	SS	93											
37.0 511.1	Silty sand	●	11	SS	66	510										
40.0	Glacial Till Het. mix. of silt, sand, gravel & trace of clay	○	12	SS	48											
	Very Dense	○	13	SS	104	500										
495.6		○	14	SS	221											
55.5	End of Borehole					490										

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11134 LOCATION Co-ords. 878,081 N; 978,755 E. ORIGINATED BY VK
W.P. 285-66 BORING DATE Dec. 10, 1971 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Drill with Tricone and Bicone Bit CHECKED BY *AK*

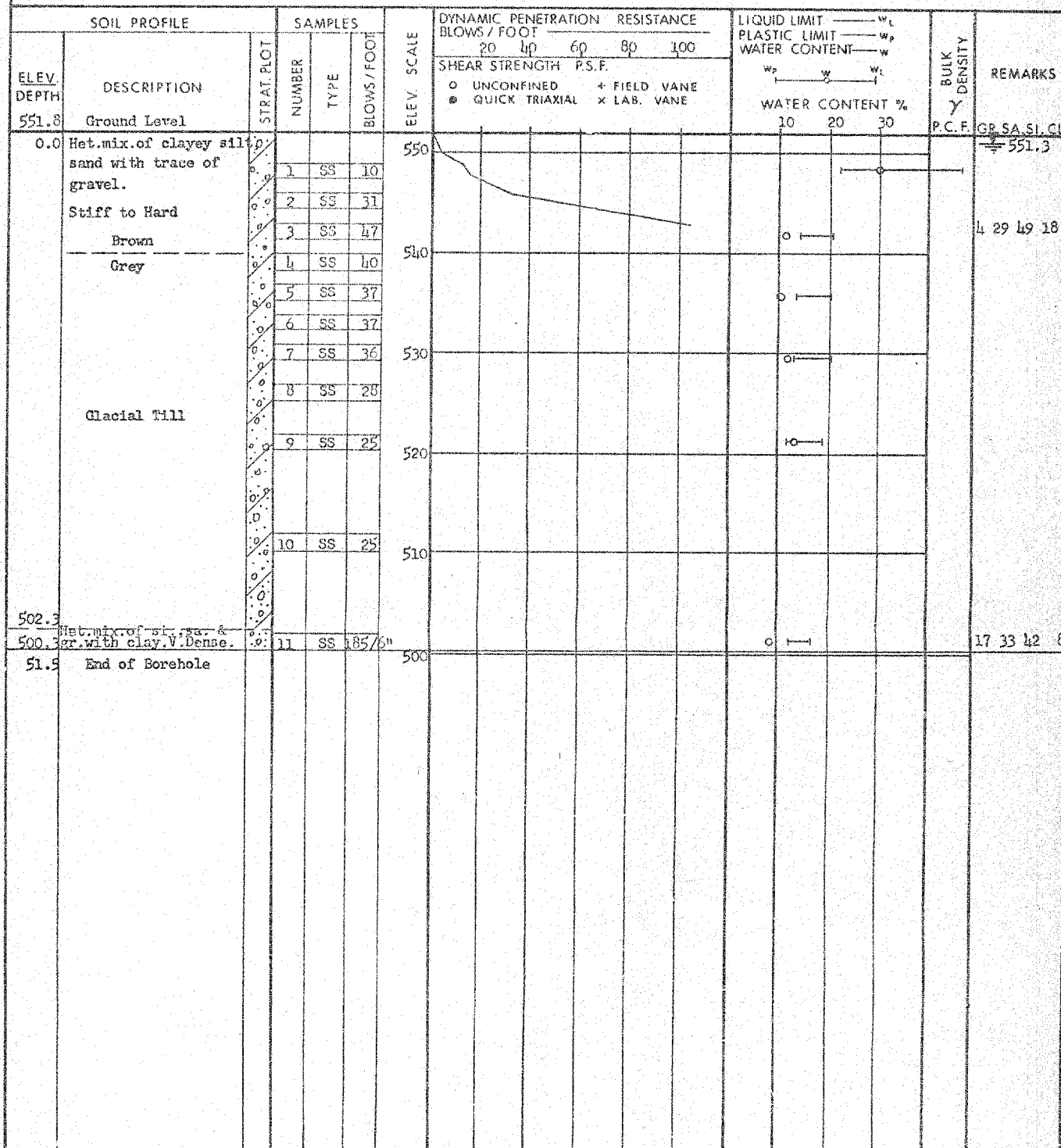
SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.					WATER CONTENT %			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					w_p — w — w_L		
552.7	Ground Level												10 20 30		
0.0	Glacial Till	0	1	SS	127	550									
	Clayey silt, some sand and gravel.	0	2	SS	135										
		0	3	SS	97										
	Hard	0	4	SS	78	540									
	Brown	0	5	SS	95										
	Grey	0	6	SS	58										
		0	7	SS	31	530									
		0	8	SS	44										
520.7		0	9	SS	52	520									
32.0	Silty Sand	0													
33.5		0													
515.7		0	10	SS	41										
37.0	Silty Sand	0													
510.7		0	11	SS	65	510									7 29 40 24
42.0		0													
504.7		0	12	SS	38										
48.0	Glacial Till	0													
	Net. mix. of silt, sand & gravel, trace of clay.	0	13	SS	154	500									7 34 53 6
		0	14	SS	229										
492.2	Very Dense	0													
60.5	End of Borehole	0	15	SS	20075"	490									

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4 (71-11037)

FOUNDATION SECTION

JOB 71-11134 LOCATION Co-ords. 877,906 N; 978,729 E. ORIGINATED BY VK
W.P. 285-66 BORING DATE April 29, 1971 COMPILED BY SG
DATUM Geodetic BOREHOLE TYPE Pen Drill CHECKED BY



JOB 71-11134 LOCATION Co-ords. 878,046 N; 978,722 E. ORIGINATED BY VK
W.P. 285-66 BORING DATE April 26, 1971 COMPILED BY SG
DATUM Geodetic BOREHOLE TYPE Pen Drill CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
552.7	Ground Level															
0.0	Het. mix. of clayey silt, sand and trace of gravel. Very Stiff to Hard Brown Grey Glacial Till		1	SS	49	550									GR. SA. SI. CL. 550.9	
			2	SS	64										2 23 54 21	
			3	SS	76										4 30 46 20	
			4	SS	113											
			5	SS	99	540										
			6	SS	146											
			7	SS	33											
			8	SS	148											
			9	SS	34	530										
			10	SS	43											
			11	SS	35	520										
			12	SS	144											
			13	SS	27	510										
505.0																
47.7	Het. mix. of silt, sand with trace of gravel and clay.		14	SS	169	500										
496.7	Very Dense		15	SS	100/5"										8 39 44 9	
56.0	End of Borehole					490										

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of

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

Structural Office,
West Building, DOWNSVIEW.

September 29, 1972

Iron Street Underpass,
W.P. #285-66, Site #37-965,
Hwy. #409, District #6.

71-11-134

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:dp
Attach.

C. S. Grebski,
Structural Design Engineer.

cc. Foundation Office. ✓



No Comments
SFA
B.D.
Oct 5/72

19 Aug 6 A.D.
19 Aug 72
CCL

Department of Highways Ontario

Copy for the information of

A. Stermac

C. Burkhardt

Reg. Bridge Planning Engineer,
23 Floral Parkway.

Structural Office,
West Bldg., Downsview.

April 13, 1972.

Re: Iron Street Underpass
over Highway 409,
S.P. 1285-66, Site 37-965,
Hwy. No. B.P.E. (409), District #6.

71-11-134

Attached herewith are prints of the Preliminary
Bridge Plan Drawing B-37-965-P1 for the above mentioned structure.

The estimated cost of the proposed structure is
\$156,000.00, which includes tender, materials, engineering and
sundry construction.

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

C.S. Grebski,
Structural Design Engineer.

CSG:sr
Attach.

c.c. A. McMillin
B. Davis
A. Stermac (2)
J. Anderson
R. Fitzgibbon

No Comment

M. Devato

25th April/72

CONT. 73-20

IRON ST. BR. #3

HWY. 409

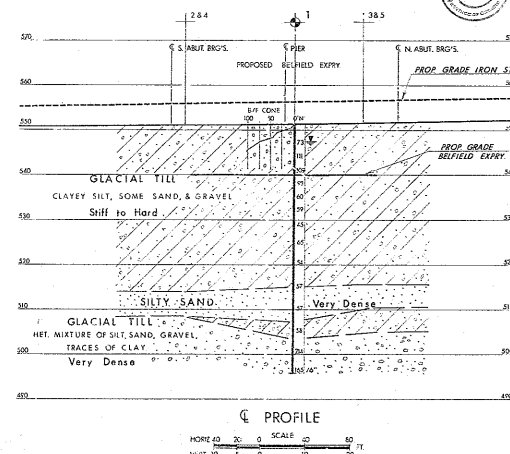
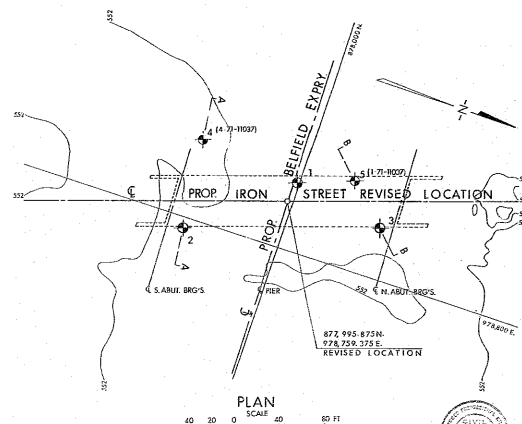
DIST. 6

30M11-107

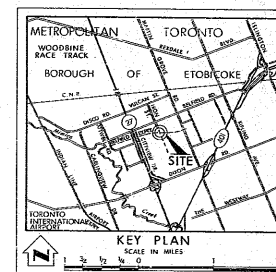






SECTIONS

10 5 0 SCALE 10 20 FT



HORIZ 40 20 0 20 40
VERT 10 5 0 5 10
SCALE



LEGEND		
	Bore Hole	
	Cone Penetration Test	
	Bore Hole & Cone Test	
	Water Levels established at time of field investigation. DSC 197	

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	552.3	877.997	978.7
2	551.1	877.924	978.8
3	552.7	878.088	978.7
4	551.8	877.906	978.7
5	552.7	878.046	978.7

— 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]

GPOCRES NO 30M11-197

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH ——— FOUNDATIONS SECTION

REVISED
IRON STREET EXTENSION

HIGHWAY NO. BELFIELD EXPRESSWAY DIST. NO. 6

CO. YORK METRO TORONTO
TWP. ETOBICOKE LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD. V.K.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 203-66	M.&T. DRAWING NO. 71-111244

DRAWN N.K.	CHECKED <input checked="" type="checkbox"/>	JOB NO. 71-11134	71-11134A
DATE JAN 19, 1972	SITE NO.	BRIDGE DRAWING NO.	

APPROVED <i>[Signature]</i> PRINCIPAL FOUNDATION ENGINEER	CONT. NO.
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