

MEMORANDUM

GEN. FILES
~~23-66-296~~
 296

To: Mr. A. M. Toye,
 Bridge Engineer,
 Bridge Division.

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

Attention: Mr. S. McCombie

DATE: August 7, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Intersection at the crossing
 of New Hwy. 401 & Dixon Road, County
 of York, Twp. of Etobicoke, Dist. #6.

W.J. 64-F-45 -- ~~W.P. 251-2 & 3 and~~
 W.P. 612-64 ✓
 W.P. 251-61-2 & 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 you will find the factual data
 and recommendations contained therein, adequate for your future
 design work. Should further information be required, please
 do not hesitate to contact our Office.

KYL/MdeF
 Attach.

cc: Messrs. A. M. Toye (2)
 H. A. Tregaskes
 H. D. McMillan
 G. K. Hunter (2)
 C. Fraser
 T. J. Kovich
 A. Watt

[Signature]
 for A. G. Stermac,
 PRINCIPAL FOUNDATION ENGINEER

Foundations Office
 Gen. Files

TABLE OF CONTENTS

1. INTRODUCTION.
 2. SUBSOIL CONDITIONS.
 3. GROUND WATER CONDITIONS.
 4. DISCUSSION AND RECOMMENDATIONS:
 - 4.1) Hwy. 401 over Martin Grove Road.
 - 4.2) Ramp N.W. over Martin Grove Road.
 - 4.3) Ramp S.-E.W. over Martin Grove Road.
 5. MISCELLLLANEOUS.
-

FOUNDATION INVESTIGATION REPORT

For

Proposed Intersection at the crossing
of New Hwy. 401 & Dixon Road, County
of York, Twp. of Etobicoke, Dist. #6.

W.J. 64-F-45 -- W.P. 251-2 & 3 and
W.P. 612-64

1. INTRODUCTION:

In conjunction with the present Hwy. 401 reconstruction programme, it is proposed to construct four new structures at the Hwy. 401 and Dixon Rd. Interchange. These structures are as follows:

- 1) Hwy. 401 over Dixon Road ----- (W.P. 251-61-1)
- 2) Hwy. 401 over Martin Grove Road ---- (W.P. 612-64)
- 3) Ramp N.W. over Martin Grove Road --- (W.P. 251-61-3)
- 4) Ramp S.-E.W. over Martin Grove Road -(W.P. 251-61-2)

The soil investigation results for No. 1 structure have already been reported (W.J. 63-F-92). The present report covers the results of soil investigation pertaining to the other three structures (No's. 2, 3 & 4), mentioned above.

2. SUBSOIL CONDITIONS:

The subsoil at this site was found to be quite uniform. It consists of a very stiff to hard deposit of glacial origin, composed of a heterogeneous mixture of clayey silt, sand and traces of gravel, extending for a depth of at least 38 ft., which was the maximum depth penetrated by the boreholes.

2. SUBSOIL CONDITIONS: (cont'd.) ...

The 'N' values for the overall deposit ranged from 26 to more than 100 blows per foot. In boreholes 2, 7 & 8, about 8 ft. of firm fill material similar to the main deposit, was encountered.

3. GROUND WATER CONDITIONS:

The ground water levels as observed in the boreholes, are as follows:

B.H. #1	--	Elev. 531.0
B.H. #2	--	Elev. 530.0
B.H. #8	--	Elev. 531.5

4. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct four new structures for the new interchange at the crossing of Dixon Road and widened Hwy. 401. The recommendations pertaining to the main structure have been reported under W.J. 63-F-92.

Subsoil was found to consist of a heterogeneous mixture of clayey silt, sand with some gravel with a hard consistency.

Our recommendations pertaining to each structure, are as follows:

4.1) Hwy. 401 over Martin Grove Road (Ref. B.H. #1, 2, 3, 4, 6 & 7)

A three-span structure some 240 ft. long and 60 ft. wide is proposed at this location. The bridge footings should be founded at or below elev. 531.0 in which case, a safe net bearing pressure of 3 t.s.f. may be used for design purposes.

cont'd. /3 ...

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

4.1) (cont'd.) ...

The proposed grade of Martin Grove Road will be at approx. elev. 531.0, and this requires a maximum of 20 feet cut at the approaches. In view of the hard consistency of the subsoil, no stability problems are anticipated for standard 2:1 side slopes.

4.2) Ramp N.W. over Martin Grove Rd. (Ref. B.H. #9 & #10)

The proposed structure is approx. 220 ft. long with three spans. The presence of a hard glacial till deposit immediately below the ground surface will provide adequate bearing capacity for spread footing type of foundations for the proposed structure. For footings located at or below elev. 532.0, a safe design load of 3 t.s.f. may be used.

The maximum approach cuts will be in the order of 6 feet and no stability problems are anticipated for the standard 2:1 side slopes.

4.3) Ramp S.-E.W. over Martin Grove Rd. (Ref. B.H. #5, 6, 7 & 8)

A 200-ft. three span (50' - 100' - 50') is planned at the crossing of Martin Grove Rd. extension and proposed S.-E.W. Ramp. The site is generally underlain by a hard glacial till deposit except in the vicinity of B.H. #7 & #8 where an 8-ft. layer of fill material was encountered immediately below the ground surface. The proposed grade is such that the footing excavations will be carried out below the fill material into the hard till stratum. A safe design load of 3 t.s.f. may be used provided the footings are located at elev. 529.0 or below.

cont'd. /4 ...

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

4.3) (cont'd.) ...

The maximum approach cuts will be in the order of 15 feet since the profile grade of Martin Road is at approx. elev. 529.0. No approach cut stability problems are anticipated for the standard 2:1 side slopes.

For all the above three structures, no major dewatering problems are anticipated since the footing excavations will be carried out in a relatively impermeable type of subsoil. However, care should be taken to prevent softening of the foundation material by surface run-off.

At the time of writing this report, the type of abutments, such as closed type or open end types, are not available for any of the above-mentioned structures. More detailed recommendations may be given for the abutment footing design when the abutment details are available.

5. MISCELLANEOUS:

The field work was carried out from June 10 to June 25, 1964, under the supervision of Mr. V. Korlu, Project Foundation Engineer, who also wrote this report. The report was reviewed by Mr. M. Devata, Senior Foundation Engineer. The drilling equipment was supplied by Dominion Soil Investigation Co. Ltd. of Toronto.

August 1964

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

64-F-45

LOCATION Hwy. 401 & Martin Grove Road

ORIGINATED BY V.K.

W P 251-61

BOHRING DATE June 12, 1964.

COMPILED BY V.K.

Datum Geodetic

BOREHOLE TYPE Penn-Drill

CHECKED BY M.D.

SOIL PROFILE			SAMPLES			ELEV. SCALE	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		20 40 60 80 100	W _p W _L			
536.5	Groundlevel										
0.0											
	Heterogeneous mixt. of clayey silt, sand with gravel-Glacial till. Stiff to hard.		1	SS	10						
			2	SS	41	530					
			3	SS	107						
523.5	(Brown)		4	SS	95						
13.0	(Grey)		5	SS	69	520					
			6	SS	74						
			7	SS	74						
			8	SS	42	510					
505.0			9	SS	100	for					
31.5	End of borehole.				4"						
						500					

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

64-F-45

LOCATION Hwy. 401 & Martin Grove Rd

ORIGINATED BY V.K.

W P 251-61

BORING DATE June 12, 1964.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penn-Drill

CHECKED BY H.D.

SOIL PROFILE		SAMPLES			ELEV. SCALE	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	20	40	60	80	100	W _P			W _L
							SHEAR STRENGTH P.S.F.					WATER CONTENT % 10 20 30			
537.5	Groundlevel														
0.0															
	Heterogeneous mixt. of clayey silt, sand with some gravel- Glacial Till (Firm to hard) (Brown)		1	SS	7	530								Gr-15 Sa-42Cl-14 Si-29	
			2	SS	5									W.L. 7.5	
			3	SS	129										
522.0			4	SS	106	520								Gr-4 Sa-26 Si-52 Cl-18	
15.5	(Grey.)		5	SS	116										
			6	SS	85										
			7	SS	94	510									
			8	SS	55										
			9	SS	28										
501.0						500								Gr-18 Sa-34 Si-) Cl-)	
36.5	End of borehole.		10	SS	176									48	

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOE 64-F-45

LOCATION Hwy. 401 & Martin Grove Rd

ORIGINATED BY V.K.

251-61

BURNING DATE June 17, 1964.

COMPILED BY V.K.

Geodetic

BORE HOLE TYPE Penn-Drill

CHECKED BY M.D.

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT						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	20	40	60	80	100	WATER CONTENT % 10 20 30			
535.5	Groundlevel														
0.0															
	Brown		1	SS	43	530									Gr-1
	Heterogeneous mixt.		2	SS	45										Sa-23
	of clayey silt, sand		3	SS	104										Si-56
	with some gravel-		4	SS	40										Cl-20
	Glacial Till		5	SS	23	520									Gr-6
522.5	Hard		6	SS	31										Sa-23
13.0			7	SS	45										Si-46
	Grey		8	SS	26	510									Cl-26
			9	SS	166										
503.0															
32.5	End of borehole.					500									Gr-6
															Sa-25
															Si-51
															Cl-18

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOE 64-F-45	LOCATION Hwy. 401 & Martin Grove Rd	ORIGINATED BY V.K.
W.P. 251-61	BORING DATE June 17, 1964.	COMPILED BY V.K.
DATUM Geodetic	BOREHOLE TYPE Penn-Drill	CHECKED BY M.D.

SOIL PROFILE						SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— W _L PLASTIC LIMIT ——— W _P WATER CONTENT ——— W	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE		W _p W _L		
							20 40 60 80 100			
							SHEAR STRENGTH P.S.F.	10 20 30%		
533.5	Groundlevel									
0.0	Heterogeneous mixt. of clayey silt, sand with some gravel. Hard (Glacial Till Brown)		1	SS	40	530				
			2	SS	64					
			3	SS	100	for				
520.5			4	SS	67	520				
13.0	Grey		5	SS	49					
			6	SS	34					
			7	SS	34	510				
			8	SS	63					
502.0			9	SS	100	for				
31.5	End of borehole.				3"	500				

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 64-F-45

LOCATION Hwy. 401 & Martin Grove Rd

ORIGINATED BY V.K.

W P 251-61

BORING DATE June 18, 1964.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Penn-Drill

CHECKED BY _____ M.D.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		BLOWS / FOOT	20 40 60 80 100	WP ——— W ——— WL	WATER CONTENT % 10 20 30		
535.5	Groundlevel										
0.0	Brown										
	Heterogeneous mixt.		1	SS	33						
	of clayey silt, sand		2	SS	44	530				142	Gr-13 Sa-22 Si-46 Cl-19
	with some gravel-		3	SS	90						
	Glacial till		4	SS	99						
522.5	Hard		5	SS	53	520					
13.0	Grey		6	SS	44					145	Gr-5 Sa-29 Si-47 Cl-19
			7	SS	39						
			8	SS	60	510					
			9	SS	107						
499.0			10	SS	100	for	500				Gr-8 Sa-44 Si) Cl)48
36.5	End of borehole.				5"						
						490					

FOUNDATION SECTION

CHECKED BY M.D.

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION


RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

JOB 64-F-45 LOCATION Hwy. 401 & Martin Grove Rd ORIGINATED BY V.K.
 W. P. 251-61 BORING DATE June 19, 1964. COMPILED BY V.K.
 DATUM Geodetic BOREHOLE TYPE Penn-Drill CHECKED BY M.D.

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.	WD	WL		
537.0	Groundlevel										
0.0	Fill Material										
	Clayey silt, sand and gravel.		1	SS	6						
529.0	Firm		2	SS	6	530					
8.0	Heterogeneous mixt. of clayey silt, sand with some gravel- Glacial till		3	SS	46						
			4	SS	100						
			5	SS	150						
518.5	Hard (Brown)		6	SS	60	520					
18.5	(Grey)		7	SS	53						
510.5			8	SS	50	510					
26.5											

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

W.L. 
 5.5
 Gr-5 Gr-4
 Sa-25 Sa-30
 Si-47 Si-48
 Cl-23 Cl-18
 Gr-3
 Sa-28
 Si-48
 Cl-21
 Gr-8
 Sa-31
 Si-45
 Cl-16

CHECKED BY M.D.

SOIL PROFILE			SAMPLES			ELEV SCALE	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. PLT	NUMBER	TYPE	BLOWS / FOOT		20 40 60 80 100	SHEAR STRENGTH P.S.F. w _p w w _L		
535.0	Groundlevel									
0.0	Heterogeneous mixt. of clayey silt, sand with some gravel. Glacial till Hard (Brown)		1	SS	47	530				
			2	SS	59					
			3	SS	91					
522.0			4	SS	80					
13.0	(Grey)		5	SS	62	520				
			6	SS	56					
			7	SS	52					
			8	SS	74	510				
503.5			9	SS	159					
31.5	End of borehole.					500				

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

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 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
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	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
β	ANGLE OF SLOPE TO HORIZONTAL

Hwy. 401 & Keele St.,
Downsview, Ontario.

Materials and Testing Division

February 3, 1966

Mr. J. C. Houston, P. Eng.,
Section Engineer - Bridge,
Foundation of Canada Engineering
Corporation, Limited (Fenco),
2200 Yonge Street,
Toronto 12, Ontario.

Re: Hwy. 401 - Dixon Road Interchange -
Parapet Wall and Handrail on Embankment.

Dear Mr. Houston:

With reference to your letter of December 29, 1965, and the attached sketch No. 3010-12T-4, we would like to make the following comments:

It is the Department's desire to have the parapet walls founded on piles. This applies to the portion of the wall which is adjacent to the structure. Although the parapet wall does not represent a significant weight which could cause settlements of the wall, the wall will settle due to the consolidation of the approach fill. Since the structure is founded on subsoil which will consolidate only negligibly, differential settlements of an unacceptable magnitude may develop between the structure and the parapet wall, causing the handrail to have a poor appearance. In order to avoid this, the use of piles for the support of the parapet wall is resorted to.

It is our opinion that adequate support of the parapet wall can be achieved by driving the proposed piles approximately 5 feet into the original ground. The description of the soil on your sketch No. 3010-12T-4 is somewhat misleading because, according to our information (Reports 64-F-45 and 63-F-92), the clayey silt and the glacial till are the same material, the latter being only a geological description of the former.

The above mentioned piles should assure that no differential settlements between the structure and the adjacent parapet wall, take place.

cont'd. /2

Mr. J. C. Houston, P. Eng.,
Section Engineer - Bridge, - 2 -
Fenco,
2200 Yonge St., Toronto.

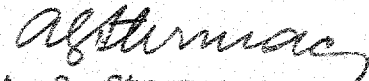
February 3, 1966

It is your proposal to put the rest of the parapet wall on friction piles which would allow the parapet wall to settle practically as much as the embankment settles. This would be achieved by driving the piles into the embankment and stopping them one or two feet above the natural ground. An expansion joint is to be made at the location where there is a change in pile lengths.

We are wondering whether it would not be better to have the entire parapet wall, from end to end, founded on "end-bearing piles" since we do not believe that a gradual transition is achievable. If a problem develops, it would be along the entire length of the wall, and could be remedied, if necessary, by using the same method or remedial approach.

As an alternative to the above recommendation, we would suggest that beyond the indicated expansion joint, all piles be left out and the parapet wall be built on spread footings.

Yours very truly,



A. G. Stermac,
Principal Foundation Engineer

AGS/MdeF

cc: Mr. C. Grebski

Foundations Office
Gen. Files

December 29, 1965

Mr. A.C. Stermac, P.Eng.
Principal Foundation Engineer
Department of Highways, Ontario
Downsview, Ontario

Dear Mr. Stermac,

HIGHWAY 401 - DIXON ROAD INTERCHANGE
PARAPET WALL & HANDRAIL ON EMBANKMENT

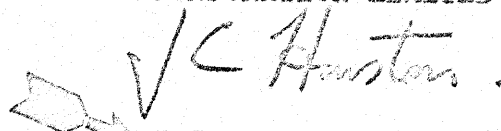
Please find herewith two prints of our sketch number 3010-12T-4 showing details of the above wall.

The design is similar to a wall already constructed on Highway 401 east of Keele Street. We propose to take the piles adjacent to the bridge wing walls down into hard glacial till under the embankment and gradually reduce the lengths of the piles to a minimum of 10 feet in order to transition from the embankment, which is likely to settle, to the rigid structure.

We would like your comments on the design and also any possible alternatives which may suit the soil conditions better. We would also like your recommendations on the type of pile which would be most suitable for this purpose.

If you require any further details or if you would like to discuss this further please do not hesitate to call.

Yours very truly,
FOUNDATION OF CANADA ENGINEERING
CORPORATION LIMITED

A handwritten signature in dark ink, appearing to read "J.C. Houston".

J.C. Houston, P.Eng.
SECTION ENGINEER - BRIDGE

JCH/mgm
3010-101-2
Enc.

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

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

February 18, 1966

Re: Hwy. 401 - Dixon Road Interchange -
Parapet Wall and Handrail on Embankment.

With reference to the above-mentioned parapet wall and our letter of February 3, 1966, to Mr. J. C. Houston of Fenco, we wish to make the following additional comments:

On the drawing (No. 3010-SK-1) prepared by Fenco, a dividing line between the "Clayey Silt" and "Hard Glacial Till" is shown. In our above-mentioned letter we stated that this is somewhat misleading because both materials are the same, the "Till" being only a geological term for the "Clayey Silt". However, there seems to be justification for this dividing line, but not for the reason of difference in materials but, rather, because the material below the line is original ground and the material above is the existing fill built a number of years ago, from the same material as the original ground. What is described as "Fill" on the drawing is actually "Future or Proposed Fill".

In view of this, we feel that our reasoning in the letter of February 3, 1966, may not be right and the recommendation may appear somewhat ambiguous.

As far as piles adjacent to the structure are concerned, there is no doubt that the proposed arrangement will provide a certain transition and no sudden breaks should be experienced. We feel that beyond the indicated expansion joints, piles could be dispensed with if the fill is well compacted and special care is taken in the construction and compaction of the embankment edges.

To compensate for any compaction deficiency, short piles driven into the new fill could be used as suggested, and proposed on drawing 3010-SK-1. These piles would also provide a certain anchorage for the parapet wall in case of impact and would assure a permanent and good alignment of the wall.

AGS/MieF

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

cc: Mr. J. C. Houston (Fenco)

Foundation Section
Gen. Files

#64-F-45

WP #612-648

W.P. #251-61-283

HWY #4018

DIXON RD.

BRIDGE # 4

BRIDGE # 1

PLAN

SCALE 1" = 20'

SECTION A-A

SCALE 1" = 10'

FILES @
5'-0" 4.0 ALT.

CHECK

DEPARTMENT OF HIGHWAYS - DIVISION

FENCE

PARAPET WALL ON FILL

PRELIMINARY GENERAL ARRANGEMENT

DEC. 17, 1965 N.W.

FENCE No. 3010 - 512-1

