cc: Foundations Office

Mr. A. M. Foye,
Bridge Engineer.

Materials & Research Section.

August 2, 1960.

D.H.O. FOUNDATION INVESTIGATION.

W.P. 200-58 -- W.J. 60-F-56.

Attention: Mr. E. McCombie.

Re: Underpass at intersection of Hwy. 403 and Con. II & III, Twp. of Ancaster, Dist. 4.

Attached to this memo, we are forwarding to you, the foundation investigation report for the above mentioned location. The report has been prepared in our Section.

The conclusions and recommendations contained in this report are self-explanatory and we believe, adequate for your future design work.

Should there be any additional questions in connection with this site that you would like to discuss, please feel free to call on our office.

L. C. Soderman,
PRINCIPAL FOUNDATIONS ENGR.

Per:

Attermae,

(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/MdeP
Attach.
cc: Messrs. A. M. Foye (2)
H. A. Tregaskes
D. C. Ramsay
I. Campbell
E. E. Richardson
T. J. Kovich
A. Watt
Foundations Office
Gen. Files.

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FOUNDATION INVESTIGATION

For

Underpass at Intersection of Hwy. 403 and Con. II & III, Twp. of Ancaster, Dist. 4. Plan F 3637-4 -- W.J.60-F-56 -- W.P.200-58.

1. INTRODUCTION:

The proposed Line 'B' of the new Highway 403 crosses the relocated gravel road ¼ miles South-East of Ancaster, County of Wentworth, between Lots 48 and 49, Con. II & III. An underpass structure is planned for this intersection and a subsoil investigation was carried out by this Section in order to decide on the foundations of this structure.

The results of this investigation, as well as the foundation recommendations, are presented in the following paragraphs of this report.

2. DESCRIPTION OF SITE AND GEOLOGY:

The topography of the site is generally level to undulating. The area on the North side, where the gravel road is to be relocated, is uncultivated pastureland. Buildings exist on the South side of the gravel road.

The site is located in the Dundas Valley of the Niagara Escarpment which extends from the Niagara River to the tip of the Bruce Peninsula. According to the available geological information, the site and its surrounding areas occupy the valley of a pre-glacial river which joined the basins of Lake Ontario and Lake Erie.

The underlying dolomitic limestone bedrock is of Bois Blanc formation.

cont'd. /2 ...

3. DESCRIPTION OF FIELD AND LABORATORY WORK:

Field work consisted of 4 sampled boreholes with dynamic cone penetration tests adjacent to each borehole. The exploration programme was carried out by standard core-drill machines adapted for soil sampling. Conventional wash boring procedure was followed. Samples were recovered at depths required, by means of a 2" O.D. split-spoon sampler. The dimensions of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Rock samples were obtained by rotary drilling, using an AXT corebit and retained in a 5-ft. double tube corebarrel.

Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were performed on selected, representative samples.

Laboratory and field test results have been summarized in the borelogs and are included in this report under Appendix I. Drawing No. 60-F-56 A, shows the borehole locations and estimated subsoil stratigraphy.

4. SUBSOIL CONDITIONS:

4.1 General:

The investigation has shown the general stratification of the subsoil to be regular and uniform. Including bedrock, three typical soil types were encountered. In the order they have been encountered, they are listed below:-

4.2 Silt:

Below the top soil, a layer of inorganic silt was encountered. It exists in irregular beddings with interlayers of silty fine sand in its upper portion, and clayey silts at further depths.

The upper zone has been subjected to oxidation resulting in its present brown color. Below the oxidized zone, the color is predominantly grey. The material in this layer has a low to medium dry strength.

cont'd. /3 ...

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

4.2 Silt: (cont'd.) ...

In Borings 1 and 4, the thickness of this layer is 20' - (Approx. Elev. 758' to 738'). In Boring 2, it is 32' thick - (Elev. 764' to 732'), and in Boring 3, it is 28' thick, (Elev. 768' to 740').

The state of packing of this layer varies from loose to compact in Borings 1 and 4, and from dense to very dense in Borings 2 and 3.

4.3 Silty Till:

Just above the bedrock level and below the above-mentioned layer of silts, a layer of clay silt and a small amount of gravel was encountered in all the borings. Its state of packing is very dense and the layer is, on the average, 10' thick.

4.4 Bedrock:

Dolomitic limestone bedrock encountered, is of the Bois Blanc formation which prevails in this area. The color of this rock is grey on its outside with black spots on its inside. Generally, it is in a sound and hard condition, but a few signs of weathering were observed at certain points along its depth.

Bedrock is at Elev. 726.2' in Boring 1, Elev. 725.0' in Boring 2, Elev. 727.5' in Boring 3, and Elev. 728.3' in Boring 4. From the elevations of bedrock surface encountered in the four borings, it appears that the rock surface is slightly sloping in the South-Westerly direction.

cont'd. /4 ...

5. GROUND WATER CONDITIONS:

Observations and measurements carried out during boring and sampling operations, indicate the water table to be at approximately Elev. 749' in Borings 1 and 4 (West Abutment side), at Elev. 755' in Boring 2, and Elev. 759' in Boring 3.

Artesian water conditions were observed while coredrilling in bedrock, in Borings 1 and 4.

6. DISCUSSION AND RECOMMENDATIONS:

First, considering the East Abutment footing and referring to the bore logs appended to this report for borings 2 and 3, it can be seen that the upper layer of the silt material is competent to take the load of the proposed structure.

From the average 'N' value of 25, considering this layer as a cohesionless one, an allowable bearing load of 3.0 T/sq.ft. can be applied to spread footings at elevation 759' or below, and taking into account a factor of safety of 3.

Considering the West Abutment footing and referring to Borings 1 and 4, it is seen that the upper silt layer and the underlying very dense till layer are indeed competent to take the load of the proposed structure.

From an average 'N' value of 40, and considering it as a cohesionless layer, a bearing load of 4.0 T/sq.ft. can be applied to spread footings at an elevation 747.5' or below, with a factor of safety of 3.

Settlements resulting from the application of the above-mentioned bearing pressures will be within tolerable limits.

Depending on the ground water conditions during construction, ground water contol might be necessary during footing excavations. This condition will arise, especially on the West Abutment footing where the use of wooden sheet piles, driven to below the bottom of the footing, before excavation, is recommended to facilitate the pumping out of water.

cont'd. /5 ...

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

A second alternative to the provision of shallow spread footings, will be the use of steel 'H' bearing piles driven to bedrock. An allowable bearing load of 60 T/pile can be used for both abutments.

No approach fill stability problems will be encountered.

7. SUMMARY:

a) The investigated site consists mainly of two layers of different materials overlying bedrock. The sequence of these layers from the ground surface down to bedrock is as follows:- Silts, including silty sand and clay silt, and silty till.

b) Subsoil conditions are such that spread footing support can be obtained in the upper silt layer.

At Elev. 759' or below for the East Abutment footing;
At Elev. 747.5' or below for the West Abutment footing.

An allowable bearing pressure of 3 T/sq.ft. can be used for the East Abutment footing, and 4 T/sq.ft. for the West Abutment footing. Settlements resulting from the application of these bearing pressures, will be within tolerable limits.

c) Depending on the ground water conditions during construction, ground water control will be necessary during footing excavation. Use of wooden sheet piles are recommended for facilitating the removal of water at the West side footing.

d) The alternative to shallow spread footings are steel 'H' bearing piles resting on bedrock. An allowable bearing capacity of 60 tons per pile is recommended.

e) No approach fill stability problems are anticipated.

cont'd. /6 ...

8. MISCELLANEOUS:

Field work was commenced on June 28, 1960, and was completed by July 4, 1960, by using D.H.O. drilling machines. Mr. B. Ghadiali was supervising the field work.

July 1960.

REPORT PREPARED BY: B. Ghadiali,
Project Foundation Engr.

REPORT APPROVED BY: A. Stermac,
FOUNDATIONS OFFICE ENGR.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-56
W.P. 200-58

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	3'-4.5'	Silt with some sand and clay, loose to med. dense, brown.	20	-	-	-	-	-	
	S2	6'-7.5	Silt with some sand & clay, loose, grey.	7	16.4	-	-	-	-	
	S3	10'-11.5'	" " " "	19	-	-	-	-	-	
	S4	15'-16.5'	Silt with some sand & clay, dense grey.	41	18.4	-	-	-	-	
	S5	20'-21.2'	" " " "	>>100	-	-	-	-	-	
	S6	25'-26.5'	Clay silt and gravel (Till) v. dense grey.	77	-	-	-	-	-	
	S7	30'-31.5'	" " " "	117	17.5	-	-	-	-	
	RC8	32'-36.5'	Bedrock	-	-	-	-	-	-	89% Recovery
	RC9	36.5'-41.5'	(Dolomitic Limestone)	-	-	-	-	-	-	100% Recovery
2	S1	3'-4.5'	Silt with some sand and clay org. material, loose, brown	3	-	-	-	-	-	
	S2	6'-7.5'	" " " "	34	20?7	-	-	-	-	
	S3	10'-11.5'	" " " "	34	-	-	-	-	-	
	S4	15'-16.5'	" " " "	25	23.1	-	-	-	-	
	S5	20'-21.5'	" " " "	28	-	-	-	-	-	
	S6	25'-26.5'	" " " "	25	-	-	-	-	-	
	S7	30'-31.5'	" " " "	27	16.2	-	-	-	-	

Cont'd P. 2

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-56
W.P. 200-58

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
2	S8	35'-36'	Clay silt and gravels (Boulder)	74	-	-	-	-	-	
	RC9	39.8'-45'	Bedrock (Dolomitic Limestone)	-	-	-	-	-	-	100% Recovery
3	S1	3'-4.5'	Silt with clay and sand org. material, loose, brown.	5	23.0	-	-	-	-	
	S2	6'-7.5'	" " " "	52	19.2	-	-	-	-	
	S3	10'-11.5'	" " " " Grey	58	-	-	-	-	-	
	S4	15'-16.5'	" " " Dense Grey	32	-	-	-	-	-	
	S5	20'-21.5'	" " " "	34	23.4	-	-	-	-	
	S6	25'-26.5'	" " " "	27	-	-	-	-	-	
	S7	30'-31.5'	Clayey silt and gravels, dense, gr.	19	-	-	-	-	-	
	S8	40'-41.5'	Clayey silt and trace of gravel, v. dense, grey.	67	-	-	-	-	-	
	RC9	42.2'-46.5'	Bedrock (Dolomitic Limestone)	-	-	-	-	-	-	100% Recovery
4	S1	3'-4.5'	Silt with clay and sand, dense, br.	26	-	-	-	-	-	
	S2	6'-7.5'	" " " Compact Br. Grey	21	19.9	-	-	-	-	
	S3	10'-11.5'	" " " " Grey.	18	21.9	-	-	-	-	
	S4	15'-16.5'	" " " Dense Grey	39	-	-	-	-	-	
	S5	20'-21.6'	" " " " "	31	23.4	-	-	-	-	
	S6	25'-26'	Clay silt & gravel (Till) v. dense	84	-	-	-	-	-	

Cont'd P. 3

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-56

W.P. 200-58

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
4	S7	30'-31.3'	Clay silt and gravel (Till) v. dense grey.	>100	19.4	-	-	-	-	
	RC8	31.3'-36.3'	Bedrock (Dolomitic Limesonte)	-	-	-	-	-	-	100% Recovery

S denotes Split Spoon Sample

RC denotes Rock Core Sample

FORM OB-ML-126 (REV. 1959.) - 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 200-58 BORE HOLE NO. 1

JOB 60-F-56 STATION See Drawing

DATUM COMPILED BY H. S.

BORING DATE June 28/60. CHECKED BY B. M. G.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX W
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	G. L.	758.2	
	Topsoil	757.2	
	Silt, with some sand or clay W.L. ▽ in places. Trace of organic material Loose to compact Brown with depth changing to grey.	754.7	
	Clayey silt and gravel (Till) very dense, grey.	237.2	20
	Bedrock, dolomitic limestone.	726.2	30
	End of Borehole	716.6	40

STRENGTH AND PENETRATION RESISTANCE P.S.F.
BLOWS/FT. 20 40 60 80

CONSISTENCY
MOIST. CONTENT % DR. WT. 10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
RC8	-
RC9	-

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 350 ft./lbs. per blow.

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 200-58 BORE HOLE NO. 2

JOB 60-F-56 STATION See Drawing

DATUM COMPILED BY H. S.

BORING DATE June 28/60. CHECKED BY B. H. G.

2" DIA SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX X LI
LIQUID LIMIT —O—
PLASTIC LIMIT —|—

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground Level	765.0	
	Topsoil	764.0	
	Silt, with some clay or sand in places. Trace of organic material in top 10' to 12' depth. W.L. Dense Brown, with depth changing to grey		10, 20, 30
		732.0	
	Clayey silt and gravel (Till) Ver dense, grey.		40
		725.0	
	Bedrock Dolomitic Limestone	720.0	
	End of Borehole		50

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.
BLOWS/FT. 20 40 60 80

CONSISTENCY
MOIST. CONTENT - % DRY WT. 10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
S8	-
RC9	-

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 200-58 BORE HOLE NO. 3

JOB 60-F-56 STATION See Drawing

DATUM COMPILED BY H. S.

BORING DATE June 29/60. CHECKED BY B. M. G.

2" DIA SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE —o—o—
2" DIA CONE
2" SHELBY
CASING —x—x—

LEGEND

½ UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI x
LIQUID LIMIT —o
PLASTIC LIMIT |—

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Ground Level	769.7	
	Topsoil	767.7	
	Silt with some sand or clay in places. Trace of organic material in top 10' to 12' depth. W.L. ▽	759.2	
	Very dense to dense. Brown with depth changing to grey.		
	Clayey silt and gravel (Till) Very dense. Grey.	739.7	
	Bedrock Dolomitic Limestone	727.7	
	End of Borehole	723.2	

Penetration Resistance Profile shown, obtained by driving a 2" dia. come from ground surface to depth noted. Cone driven with energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.
BLOWS/FT. 20 40 60 80
10 20 30 40 50

CONSISTENCY
MOIST. CONTENT - % DRY WT.
10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
S8	-
RC9	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 200-58 BORE HOLE NO. 4

JOB 60-F-56 STATION See Drawing

DATUM COMPILED BY H. S.

BORING DATE June 29/60. CHECKED BY B. M. G.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST(C) AND SENSITIVITY(S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Ground Level	758.5	
	Topsoil	758.5	
	Silt with some sand or clay in places Trace of organic material in top 6' depth		
	W.L. ▽	749.7	10
	Compact to Dense. Brown with depth changing to grey.		
		737.5	20
	Clayey silt and gravel (Till) Very Dense, grey.	728.25	30
	Bedrock Dolomitic Limestone.	723.25	
	End of Hole		40

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to

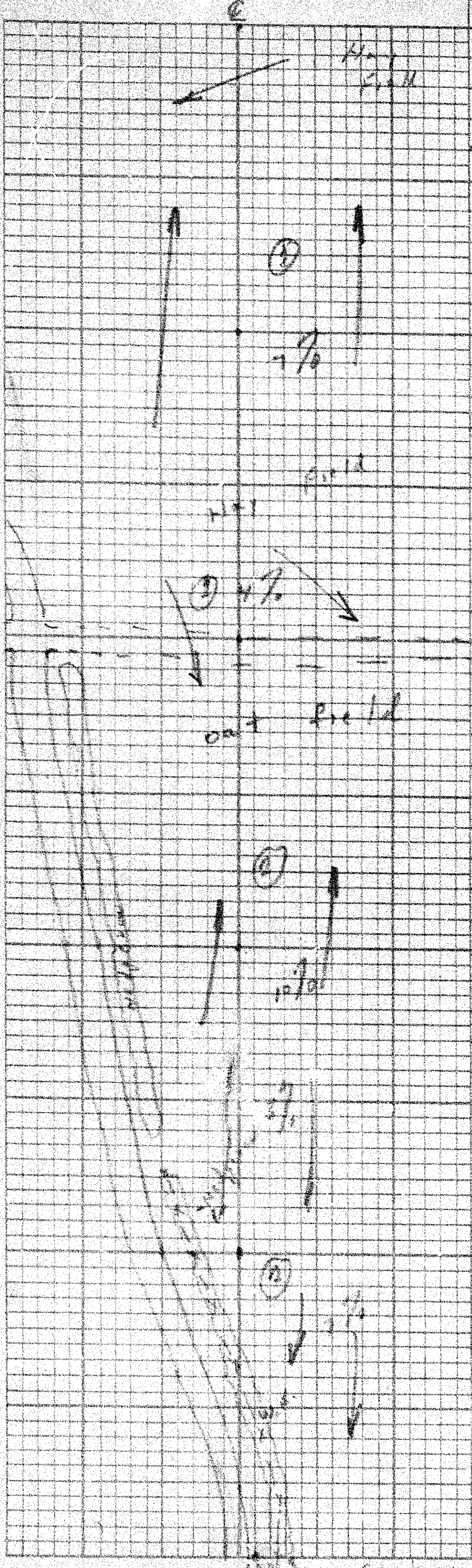
STRENGTH AND PENETRATION RESISTANCE P.S.F.
BLOWS/FT. 20 40 60 80

CONSISTENCY
MOIST. CONTENT- % DRY WT. 10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
RC8	-

PAGE NO. 1 | W.P. 200-58. | TL-89 REV.5

TWP. Ancaster | DATE July 11/60



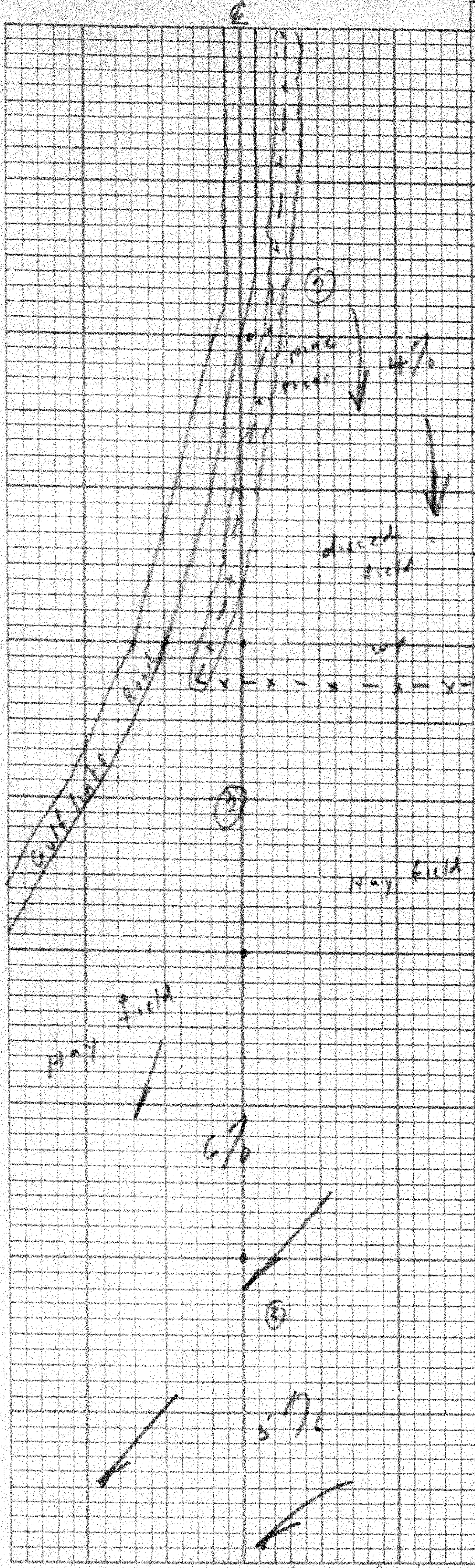
DEPTH	COLOUR	TEXTURE	MOT.	MOIST.	REMARKS
					H03A-11
0"–7"	BR	SALO Tops	N.I	Dry	HARD 10+00 ℄
7"–36"	BR	SALO	"	MOD	HARD
0"–6"	DKBR	SALO Tops	N.I	Dry	HARD 8+00 ℄
6"–36"	BR	SALO	"	MOD	HARD
36"+	"	FP	STONES		
0"–9"	DKBR	SALO Tops	N.I	Dry	HARD 6+00 ℄
9"–48"	BR	SALO	"	MOD	HARD
0"–3"	DKBR	SALO Tops	N.I	Dry	HARD 4+00 ℄
3"–48"	BR	SALO	"	MOD	HARD
0"–6"	DKBR	SALO Tops	N.I	Dry	HARD 2+00 ℄
0"–7"	DKBR	SALO Tops	N.I	Dry	HARD 0+00 10' Rt ℄ in [illegible]
7"–48"	BR	SALO	"	MOD	HARD

HWY. NO. ______ LOCATION Realignment of Golflinks Rd W/ STA 175 Hwy 403 ENGINEER W. Latimer

PAGE NO: 2
TWP. Ancaster

TL-89 REV. 58

DATE July 11/60



DEPTH	COLOUR	TEXTURE	MOT.	MOIST.	REMARKS
0"- 4"	DKBR	SALO 40%	N.I	Dry	18400±
4"- 26"	BR	SALO	"	MOD	Stony
0"- 4"	DKBR	SALO	N.I	Dry	16400±
4"- 48"	BR	SALO	"	"	
0"- 7"	DKBR	SALO Top	N.I	Dry	HARD 14400±
7"- 48"	BR	SALO	"	MOD	HARD
0"- 2"	DKBR	SALO Top	N.I	Dry	12400±
2"- 36"	BR	SALO	"	MOD	HARD

HWY. NO. ______ LOCATION Realignment of Golf Links Rd W.L. STA 175 Hwy 403 ENGINEER W. Latimer

cc: Gen. Files

Mr. A. M. Toye,

Bridge Engineer.

Materials & Research Section.

October 4, 1960.

RE: CORRECTION -

D.H.O. FOUNDATION REPORT.

Attention: Mr. S. McCombie.

Re: W.F. 200-58, Hwy. 403, Rd. All'ce. between Conc. II & III, Ancaster Twp., W.J. 60-F-56.

Would you please make the following correction to your copy of the Foundation Report for the above proposed structure site:-

The station numbers shown on the drawing 60-F-56A, an appendix to the report, should read: Sta. 176+26.45 for H.O.T., Hwy. 403, and Sta. 17+06.87, H.O.T., Rev'n. of the Rd. All'ce., instead of Sta. 176+25 & 15+00, respectively.

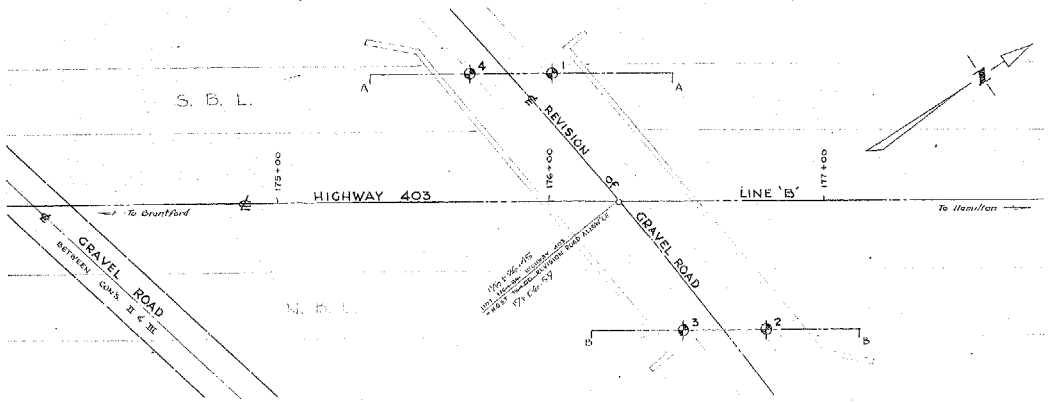
MDS/MdeP

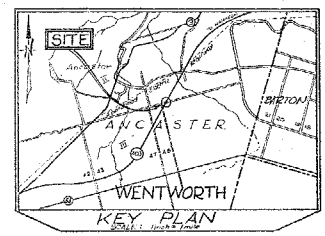
cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
I. Campbell
R. D. Richardson
T. J. Kovich

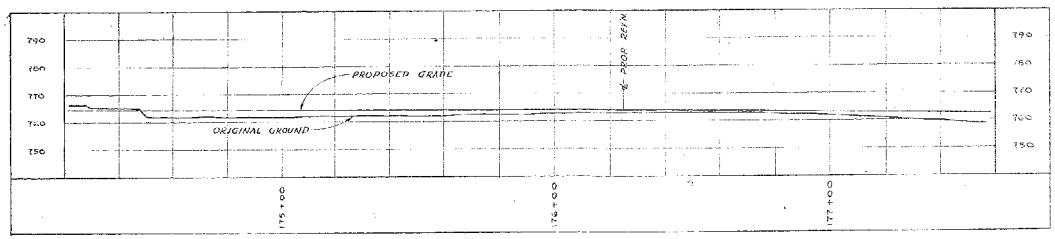
Foundations Office
Gen. Files.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.
Per:

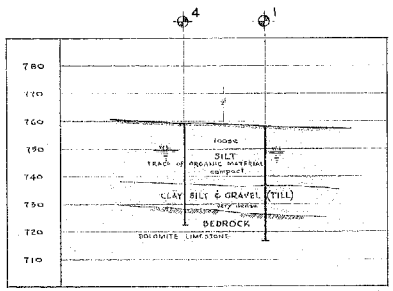
(R. D. Smith)

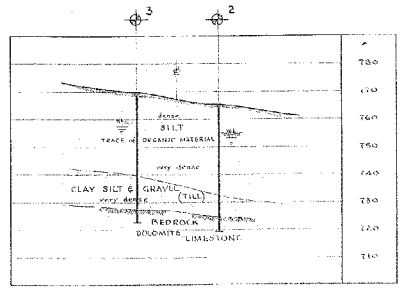






LEGEND			
BORE & PENETRATION HOLE			
HOLE	ELEVATION	STATION	DISTANCE FROM ℄
1	758.20	176+01	46' LT.
2	768.00	176+49	46' RT.
3	769.70	176+19	46' RT.
4	759.50	175+71	46' LT.





- NOTE -

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

GRAVEL ROAD REVISION
BETWEEN CON'S. II & III

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 403 DISTRICT 4 COUNTY WENTWORTH
TOWNSHIP ANCASTER LOT 49 CON. II & III
LOCATION 3 MILES S.W. of HAMILTON
DRAWN BY A.D.R. CHECKED BY [illegible] W.P. 200-58
DATE 16 JULY 1960 APPROVED BY [illegible] DRAWING NO. 60-F-56 A
SCALE 1 inch = 20 feet