

MEMORANDUM

13-65-263.

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

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

Attention: Mr. S. McCombie

DATE: June 30, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For:

A Proposed Structure at W.-E. 401  
over W.B. Collector Rd. & Hwy. No.401  
(Islington Interchange) District No.6

W.J. 64-F-37

--

W.P. 442-64

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 you require additional information,  
please do not hesitate to contact our Office.

KYL/MdeF  
Attach.

cc: Messrs. A. M. Toye  
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

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# FOUNDATION INVESTIGATION REPORT

For

A Proposed Structure at W.-E. 401  
over W.B. Collector Rd. & Hwy. No. 401  
(Islington Interchange) District No. 6  
W.J. 64-F-37      --      W.P. 442-64

## 1. INTRODUCTION:

A request by Mr. J. B. Curtis, Regional Bridge Location Engineer of the Bridge Design Division, to perform a foundation investigation at the above-noted site was received by this Section on April 28, 1964. A field investigation was carried out by this Section during the period from May 22, 1964 to May 26, 1964, to determine the subsoil conditions at the site of the proposed structure, which is one of the five structures to be constructed at a new interchange at the intersection of Hwy. #401 and Islington Avenue in Metropolitan Toronto.

This report contains the field investigation findings, laboratory test results and recommendations pertaining to the type of foundations to support the proposed new structure.

## 2. DESCRIPTION OF THE SITE:

The site is located on the W.-E. Ramp of the proposed Belfield Pk. to the widened Hwy. 401, District No. 6. It is about half a mile east of Islington Avenue. The area on both sides of the embankment of the existing Hwy. 401 is fairly flat and grassy.

cont'd. /2 ...

### 3. FIELD AND LABORATORY WORK:

Field work consisting of five boreholes and two dynamic cone penetration tests was carried out by means of a Pennsylvania type drillrig machine. Samples were recovered at required depths by means of a 2" O.D. split-spoon sampler. The dimensions of this sampler and the energy used to drive it, conform to the requirements of the Standard Penetration Test. Dynamic cone penetration tests were carried out adjacent to boreholes #2 and #5. Driving energy to advance the 2-inch cone was 350 ft.-lbs. per blow.

The locations and elevations of all the boreholes are shown on Drawing #64-F-37A, attached to this report.

Samples were visually examined and identified in the field as well as in the laboratory. Atterberg limits and moisture contents for a selection of representative soil samples were determined in the laboratory.

### 4. SUBSOIL CONDITIONS:

Subsoil was found to consist of a deposit of glacial till consisting of clayey silt, sand and fine gravel with occasional thin sand seams. The consistency of the material is in general, very hard. The upper zone of this deposit, 15 to 20 ft., approximately, is brown, oxidized and partially desiccated. Underlying this oxidized zone, the clayey silt till is grey and hard.

The laboratory results for this deposit are summarized as follows:

Moisture content	-----	9%	to	11%
Plastic limit	-----	11%	to	15%
Liquid limit	-----	20%	to	25%

cont'd. /3 ...

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

According to the Unified Soils Classification System, this material is classified as clayey silt (inorganic).

In B.H. #3, which was located at the top of the existing embankment of Hwy. #401, a layer of fill consisting of clayey silt with sand and gravel 16 to 18 ft. approx. in thickness, was found. The consistency of this material is in general, firm to stiff.

5. GROUND WATER CONDITIONS:

No attempt was made to establish an accurate ground water level by means of piezometers. Observations carried out a week after the field investigation, indicate that the ground water level is approximately 2 to 4 ft. below the existing ground. The exact water levels observed are shown in the borehole logs (Appendix I).

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a four-span bridge on the W.-E. ramp of the proposed Belfield Road to the widened Hwy. #401.

Subsoil at the site consists of a deposit of hard clayey silt with sand and fine gravel (glacial till).

In view of the high strength of the subsoil, it is recommended that the structure be supported on spread footing type foundations. A safe bearing pressure of 3 T.S.F. may be used for design purposes for footings located 6 ft. below the original ground surface so that they have adequate frost protection. In the case of the piers which will be located at the median and the

cont'd. /4 ...

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

south edge of the existing highway embankment, it is necessary to excavate the embankment fill, estimated 16 to 18 ft. in thickness. The footings may be located at elev. 510 approximately. If this is uneconomical, these two particular piers may be supported on end-bearing piles driven to practical refusal into the hard glacial till stratum. For estimating purposes, steel H-piles (14 BP 73) driven some 10 ft. below the original ground surface (approx. tip elev. 504.0), can provide a safe design load of 70 tons/pile. However, the final choice should be decided upon the economical considerations.

Because of the low permeable nature of the glacial till material, no major dewatering problems are anticipated. However, care should be taken to prevent softening of the foundation material immediately after excavation by surface runoff.

The approach embankment should be constructed with standard side slopes 2 horizontal to 1 vertical to ensure the overall and surficial stability of the slope.

7. SUMMARY:

The site is underlain by a deposit of hard clayey silt with sand and fine gravels (glacial till).

It is recommended that the proposed structure be founded on spread footings. A design load of 3 T.S.F. may be used. As an alternative, the centre and the south piers may be supported on end-bearing steel H-piles driven to the glacial till stratum. A design load of 70 tons/pile may be used.

cont'd. /5 ...

7. SUMMARY: (cont'd.) ...

No major dewatering problems will be encountered.

Side slope of the approach embankment should be constructed with standard side slopes 2 horizontal to 1 vertical.

8. MISCELLANEOUS:

The field work, performed during the period from May 22, 1964 to May 26, 1964, was undertaken by Mr. T. Chan, Project Foundation Engineer, who also wrote this report. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

June 1964.

APPENDIX 1



MEMORANDUM

MURPHY

APRIL 29, 1964.

64-F-31

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

FROM: Bridge Division,  
Downsview, Ontario.

Atten: Mr. M. Devata,  
Senior Foundation Engineer.

DATE: April 28, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: Islington Ave. Interchange-Hwy. 401,  
Bridge Site #38-187 [W.P. #238-60] 64-F-34  
C.N.R. O'head West of Islington, Hwy. 401.  
Bridge Site #38-186 [W.P. 239-60] 64-F-31  
Basket Weave East of Islington, Hwy. 401,  
64-F-35 [W.P. # 243-63,] Structure on [N-W Ramp Islington] 64-F-36  
to 401, De Leuw Drawing # C-163-184,  
Structure on [W-E Ramp Belfield Rd. to 401.] 64-F-37  
District # 6 Highway # 401.

This is to request site investigations necessary for the design of the above structures. The approximate footing locations are shown in red on the drawing delivered to your office.

Profiles of the Islington interchange area will be forwarded to you as soon as possible.

There should be no problem involved in trespassing on private property, however if there is any doubt, please contact Ross Walker of De Leuw Cather Company Limited.

JWC/kd

J.W. Carter,  
for J.B. Curtis,  
Regional Bridge Location Engineer.

Inform Mr. Stermac and Regional Engineer by phone

Devata  
Feb 1-27-64

Re: W.P. 442 64 Ramp WE 401 Structure No. 2 over Highway 401  
W.P. 85 59-5 Ramp WE 401 Eastbound from Kipling Ave. to CNR

MINUTES OF A MEETING HELD AT THE OFFICES  
OF DE LEUW, CATHER & COMPANY OF CANADA  
LIMITED ON DECEMBER 22nd, 1964 AT 10:30 A.M.

Present:

Department of Highways of Ontario

W. C. Friedmann	B. Davis
J. B. Curtis	M. Gvildys
B. Richardson	

De Leuw, Cather & Company of Canada

R. J. Walker	R. J. Barr
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Purpose

The meeting was called to decide (a) the type of structure to be built over Highway 401; (b) the treatment of the ramp between the South limit of Structure No. 2 and the CNR Structure No. 1.

1. Five alternate schemes were reviewed as prepared by the Bridge Department following the alternatives outlined in Item 5 of December 11, 1964 meeting. The schemes were all comparable in price. Scheme (a) 2 (a four span structure which provides for the westbound collector to be either taken through parallel or tapered back to the centre core) was found to be the most flexible arrangement. It was decided to adopt this design as it provided better aesthetics, and greater flexibility for relatively little difference in cost.
2. De Leuw, Cather pointed out that the sight distance would be restricted in the left lane on Bridge No. 2 due to the 80° curvature and the 3.5 foot lateral clearance to the parapet and recommended that 2.5 feet extra be provided to bring the lateral clearance to 6 feet. It was decided that as similar cases now exist on other Highway 401 bridges that this suggestion would not be adopted.
3. Several Schemes were reviewed for the Section of Ramp WE-401 between structures 2 and CNR Bridge No. 1 as prepared by De Leuw Cather as per Item 1 of December 16, 1964 Meeting.

It was decided to adopt a scheme in which retaining walls extend from the South abutment of Bridge 2 with CNR Bridge No. 1 as one continuous structure with the following conditions:

- (a) That the south retaining wall be extended to cross to the East side of the CNR Bridge No. 1.
- (b) That De Leuw, Cather design the portion of the South Retaining wall which is attached to the CNR Structure including a cantilevered section 10 - 15 ft. west (limit to be set by De Leuw, Cather) and the Bridge Office design the remainder of the wall to connect to Bridge 2.
- (c) That the north Retaining wall which will be designed by the Bridge Department be extended east to a point where a 4:1 grading fill slope can be obtained (to be set by contour design by De Leuw Cather).
- (d) That the Bridge Office will determine the limit of the Abutments of Bridge 2.
- (e) That no slope paving will be used under the south abutment of Bridge 2. This will allow for easier maintenance of grassed slopes.

RJAB/feh

c.c.	W. F. Friedmann	16	G.G. Stewart	S. Cummings
	B. Davis	3	W E. Carroll	H.J.A. Barr
	J. Thatcher	1	C. M. Bishop	M.R. Retly
	R. Strain	1		R. J. Walker

APPENDIX I.

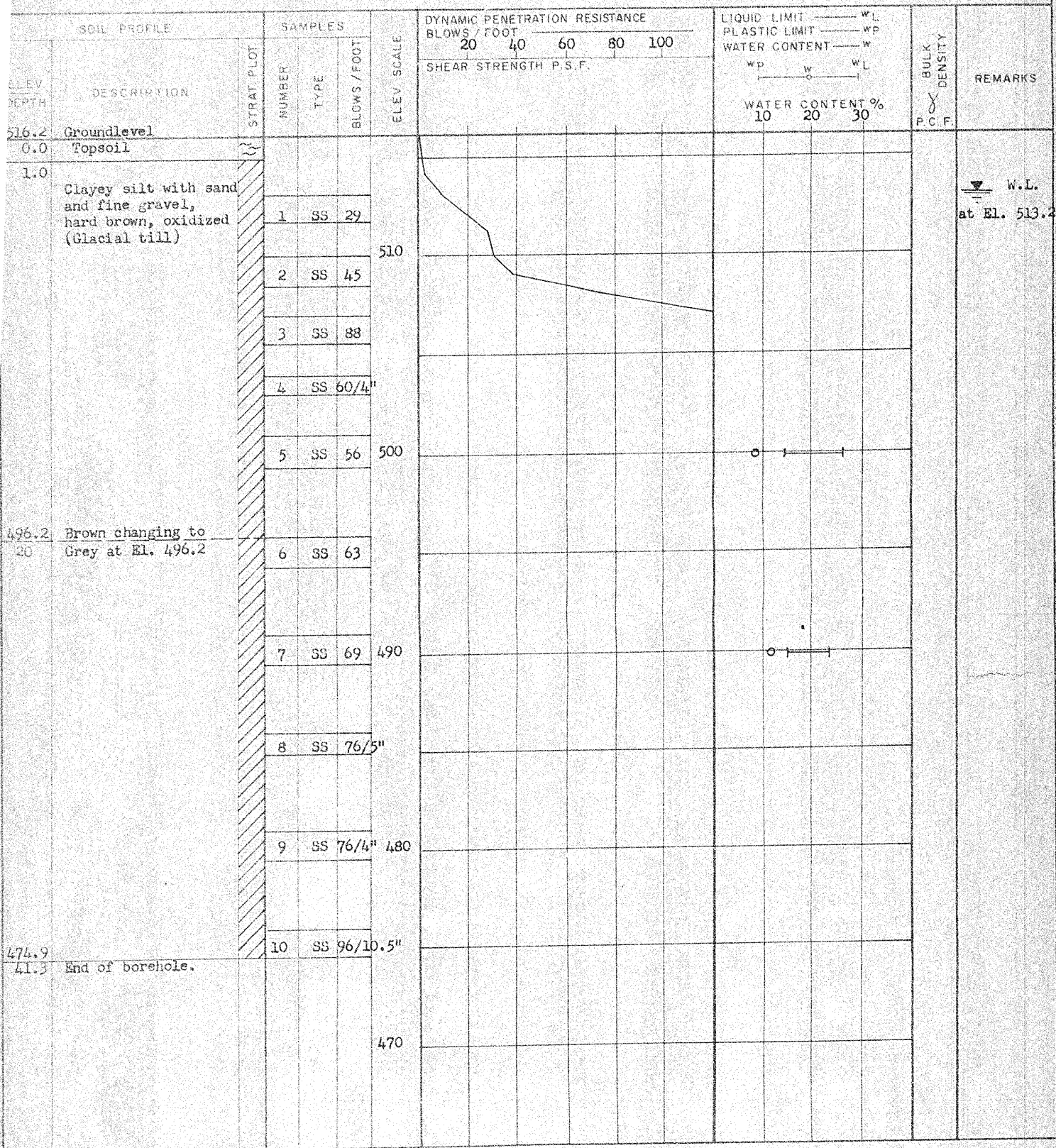
ORIGINATED BY T.C.

COMPILED BY T.C.

CHECKED BY M.D.

W.L. at  
El. 511.6

FOR 64-F-37 LOCATION Hwy. 401, Sta. 445+99, 128' Rt. ORIGINATED BY T.C.  
W.P. 442-64 BORING DATE May 22, 1964. COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Pennsylvania Type Auger. CHECKED BY M.D.











JOB 64-F-37 LOCATION Hwy. 401, Sta. 443+32, 137' Lt. ORIGINATED BY T.C.  
W.P. 442-64 BORING DATE May 25, 1964. COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Pennsylvania Type Auger CHECKED BY M.D.

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	BLOWS / FOOT	20	40	60	80	100	Wp			Wo
515.9	Groundlevel															
0.0	Topsoil					515										
	Clayey silt with sand and fine gravel, hard, brown, oxidized. (Glacial till)		1	SS	32											
			2	SS	41											
	Dense sand seam (1") at El. 503.7 approx.		3	SS	107	505										
501.9			4	SS	62/3"											
14.0	Brown changing to grey at El. 501.9 approx.		5	SS	53											
			6	SS	66	495										
			7	SS	50											
485.2			8	SS	57/2"	485										
30.7	End of borehole.															

W.L.  
At El. 512.5

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W.P. 85-59-5 Ramp WE 401 Eastbound from Kipling Ave. to CNR

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	R. Strain	1		R. J. Walker

#64-F-37

W.P. # 442-64

HWY. # 401

PROP. STRUCTURE

at W.-E. 401

OVER W.B.

COLLECTOR RD.

