

## MEMORANDUM

To: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Division.

Attention: Mr. S. McComble

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

DATE: April 22, 1966

IN REPLY TO

OUR FILE REF.

APR 27 1966

SUBJECT:

## FOUNDATION INVESTIGATION REPORT

At

The Proposed Site of Hwy #401 and  
Tilbury West, Rochester Twp. Line  
Rd. Underpass, District #1 (Chatham).

W.J. 66-F-23 -- W.P. 123-64

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

We believe that 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.

AGS/MdeF

Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
A. Gater  
F. C. Brown  
J. Roy  
A. Watt

Foundations Office  
Gen. Files ✓

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

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FOUNDATION INVESTIGATION REPORT  
At  
The Proposed Site of Hwy. #401 and  
Tilbury West, Rochester Twp. Line  
Rd. Underpass, District #1 (Chatham).  
W.J. 66-F-23    --    W.F. 123-64

1. INTRODUCTION:

A request dated November 29, 1965, to carry out a foundation investigation at the proposed site of Hwy. #401 and Tilbury West, Rochester Twp. Line Rd. underpass, was received from the Regional Bridge Location Engineer.

Accordingly, a field and laboratory investigation was undertaken by the Foundation Section.

Presented in this report are the results of the investigation, together with recommendations regarding the foundations.

2. DESCRIPTION OF THE SITE:

The site is located in Essex County, some 2.5 miles west of Hwy. #77 along Hwy. #401. The vicinity is generally flat farmland.

Physiographically, the area belongs to the "Essex Clay Plain" sub-region. It is essentially a till plain bevelled by shallow deposits of lacustrine clay which settled in the depressions, while the knolls were being lowered by wave action.

3. FIELD INVESTIGATION PROCEDURE:

Five sampled boreholes and 10 dynamic cone penetration tests were carried out during the course of the field investigation. A conventional diamond drill rig, adapted for soil sampling purposes, was used. Thin-walled Shelby Tube samplers were pushed manually into the soils in order to recover "undisturbed samples", while split-spoon sampling was undertaken for the disturbed samples.

3. FIELD INVESTIGATION PROCEDURE: (cont'd.) ...

Standard and cone penetration tests were performed, using a driving energy of 350 ft. lbs. The number of blows required to advance the split-spoon sampler one ft. into the soil were registered as penetration "N" values. In B.H. #6 several field vane shear tests were carried out by means of a standard D.H.O. vane apparatus, in order to determine the in-situ undrained shear strength of the stratum.

Locations and elevations of the boreholes and cone penetrations are plotted on Drawing #66-F-23A, accompanying this report.

4. SUBSOIL CONDITIONS:

4.1) General:

After visual examination of the soil samples, laboratory tests were performed on representative soil specimens in order to define moisture contents, Atterberg limits, bulk densities, unconsolidated undrained shear and consolidation characteristics.

The results of the field and laboratory tests are compiled on the borelog sheets under Appendix I. The estimated soil profile on Drawing #66-F-23A was based on these borelogs.

A brief description of the subsoil follows:

4.2) Silty Clay to Clayey Silt:

Under an approximately 4-ft. deep sand and gravel road fill, a silty clay to clayey silt stratum was revealed by the borings at each location, extending to the lower limits of the explorations, the deepest of which was terminated at El. 483.4 ft., some 119 ft. below ground. The greyish-brown coloured soils exhibited somewhat varied consistencies. They were found to be "hard" at approx. 10 ft. below ground level, indicated by Standard penetration 'N' values of 50 - 90 blows/ft. The consistency gradually decreases with depth, becoming "very stiff" and finally "firm" at around El. 570 - 550 ft.,

cont'd. /3 .....

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

4.2) Silty Clay to Clayey Silt: (cont'd.) ...

some 30 - 50 ft. below ground, where "N" values in the order of 7 - 8 blows/ft. were recorded. Below El. 550 ft. a slight improvement of the consistency was observed, with "N" values of 10 - 15 blows/ft., corresponding to a "stiff" material.

The results of the field vane and laboratory unconsolidated undrained shear tests appear to agree closely, (see B.H. #6). In the upper 25 - 30 ft. crust portion of the soil, values of shear strength in the order of 1200 - 2000 p.s.f. were measured. Between El. 570 and 540 ft. the average shear strength may be taken to be 800 p.s.f.; below El. 540 ft. the average value increases to 1200 p.s.f. The observed low values of liquidity indices and sensitivities (less than 3), indicate that the subsoils belong to the glacial till deposits of the Essex region, as was reported by Soderman et al., (11th Canadian Soil Mech. Conf., 1960).

No bedrock was encountered within the zone of the soil investigation, but it is believed to be between 120 - 200 ft. below ground.

4.3) Ground Water Conditions:

The ground water level in the boreholes was found to be between El. 595 and 596 ft., some 6 - 7 ft. below ground surface.

5. DISCUSSION AND RECOMMENDATIONS:

It is proposed to erect an underpass structure at the crossing of Hwy. #401 and the Tilbury West Rochester Twp. line road.

It is felt that the upper portion of desiccated crust exhibits adequate strength to support the structure on spread footings at shallow depths. Placing the footings at the approximate elevation of 593.0 ft., the allowable design load may be taken to be 2.5 t.s.f. The ground water level - as observed in the boreholes - will be some 2 - 3 ft. above the bottom of the footing excavations; however, no

cont'd. /4 .....

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

dewatering problems are foreseen, due to the very low permeability of the subsoil. Any seepage inflow might be handled by low-capacity pumps.

In the case of perched abutments for the proposed structure, piled foundations should be used. For the latter, concrete or steel displacement piles are recommended, driven to, but not below El. 590.0 ft. Taking 12" diam. displacement piles, it is estimated that a design load of 30 T/pile can be achieved at the above elevation. It is recommended that the working load on the piles be checked during pile driving, according to the Hiley Formula, (D.H.O. Standards DD-1218 & 1219).

Settlement analyses, based on laboratory consolidation tests, indicate that differential settlements between the abutments (assuming they are supported on piles) and the centre pier, will likely be in the order of  $1\frac{1}{2}$  to 2 inches over a long-term period.

No stability problem is anticipated for the approach fills, provided they are built with slopes of 2 horizontal to 1 vertical.

6. SUMMARY:

A foundation investigation for the proposed underpass crossing of Hwy. #401 and the Tilbury West Rochester Twp. line road is reported. The silty clay to clayey silt subsoil displays adequate strength to support the structure on spread footings. 2.5 t.s.f. allowable load is recommended for the spread footings founded at El. 593.0 $\pm$ . Perched abutments may be supported on steel or concrete displacement piles. For 12" diam. displacement piles driven to, but not below elevation 590.0 ft., a design load of 30 T/pile may be employed.

Differential settlements in the order of  $1\frac{1}{2}$  - 2 inches are likely to occur between abutments and the centre pier over a long-term period.

cont'd. /5 .....

7. MISCELLANEOUS:

The field work, carried out during the period March 4 - 11, 1966, was supervised by Mr. W. W. Kulmattickas, Project Foundation Engineer. Equipment used was owned and operated by Canadian Longyear Co. Ltd.

This report was prepared by Mr. A. K. Barsvary, Project Foundation Engineer. The general supervision was by Mr. K. G. Selby, Supervising Foundation Engineer.

April 1966

## APPENDIX I





DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-23LOCATION Gravel Rd. Sta. 16+05, 17' Lt. of EORIGINATED BY W.W.K.W.P. 123-64BORING DATE Feb. 26, 1966COMPILED BY A.K.B.DATUM GeodeticBOREHOLE TYPE Dynamic Cone PenetrationCHECKED BY K.G.S. *ll*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT — WL	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	PLASTIC LIMIT — WP		
601.6	Groundlevel				600	20 40 60 80 100	WP — WL	WATER CONTENT %	
0.0					590				
					580				

REL. 585.6' Hammer Bouncing.

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 66-F-23

W. P. 123-64

DATUM Geodetic

## RECORD OF BOREHOLE NO. 3

LOCATION Gravel Rd. Sta. 15+83, 17' Rt. of C

BORING DATE Feb. 26, 1966.

BOREHOLE TYPE Dynamic Cone Penetration

FOUNDATION SECTION

ORIGINATED BY W.W.K.

COMPILED BY A.K.B.

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT ——— WL	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	PLASTIC LIMIT ——— WP		
						SHEAR STRENGTH P.S.F.		WATER CONTENT ——— W		
								WP ——— W ——— WL WATER CONTENT %		
602.8	Groundlevel									
0.0						600				
						590				
						580				
							@El. 588.8' Hammer Bouncing.			

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 66-F-23

LOCATION Gravel Rd. Sta. 15+64, 17' Lt. of E

ORIGINATED BY W.W.K.

W.P. 123-64

BORING DATE Feb. 26, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, EA Casing.

CHECKED BY K.G.S. *JK*

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		BLOWS / FOOT				WATER CONTENT %					
							20	40	60	80	100	WP	W			WL
SHEAR STRENGTH P.S.F.																
602.9	Groundlevel															
598.9	Sand and gravel. Fill					600										
4.0	Hard		1	SS	18											
			2	SS	67											
			3	SS	31											
	Brown Very stiff Silty clay Very stiff		4	SS	20											
			5	SS	12											
	Stiff															
561.3			6	SS	11											
41.6	End of borehole.					560										
						550										

@El. 586.9' Hammer Bouncing.

W.L.  
@El 595.9'

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 66-F-23

LOCATION Gravel Rd. Sta. 15410, 17' Rt. of C

ORIGINATED BY W.W.K.

W.P. 123-64

BORING DATE March 3, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone Penetration

CHECKED BY K.G.S. 

SOIL PROFILE			SAMPLES					DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY $\rho_{\text{bulk}}$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WP	WL	WATER CONTENT %		
603.1 0.0	Groundlevel											P.C.F.	
						600							
						590							
								@ El. 589.1' Hammer Bouncing.					
						580							

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 66-F-23

LOCATION Gravel Rd. Sta. 14/90, 17' It. of E

ORIGINATED BY W.W.K.

W.P. 123-64

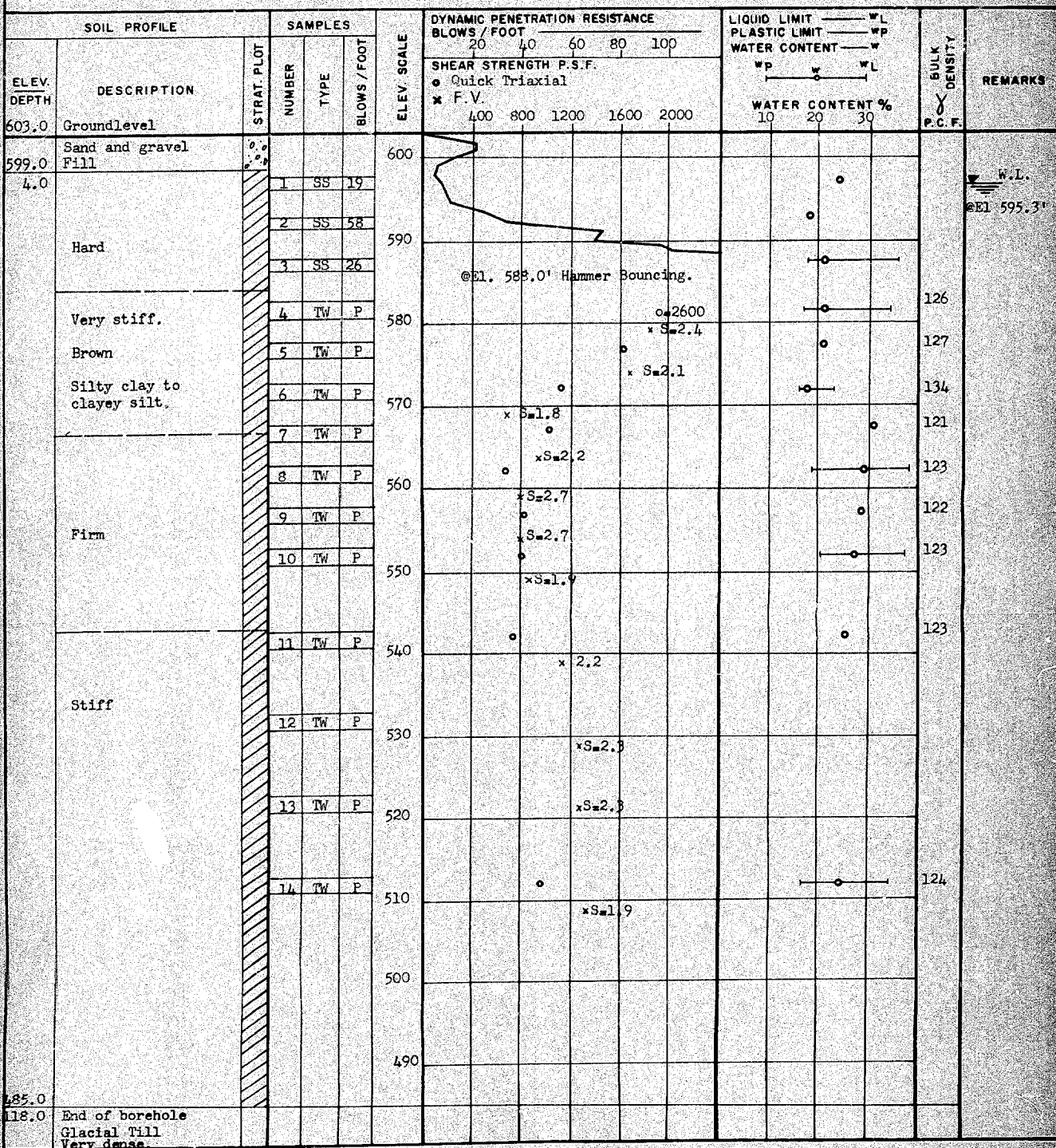
BORING DATE March 2, 1966.

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing.

CHECKED BY K.G.S.



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 66-F-23

W. P. 123-64

DATUM Geodetic

LOCATION Gravel Rd. Sta. 14-38, 17<sup>th</sup> Rt. of E

BORING DATE Feb. 28, 1965BOREHOLE TYPE Dynamic Cone Penetration

FOUNDATION SECTION

ORIGINATED BY W.W.K.

COMPILED BY A.K.B.

CHECKED BY K.G.S.

## SOIL PROFILE

## SAMPLES

## DYNAMIC PENETRATION RESISTANCE

LIQUID LIMIT \_\_\_\_\_ W<sub>L</sub>

PLASTIC LIMIT ——— WP

## WATER CONTENT — %

取 金

WATER CONTENT %

P.C. #	BOX	BULK	DENSITY
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
43	43	43	43
44	44	44	44
45	45	45	45
46	46	46	46
47	47	47	47
48	48	48	48
49	49	49	49
50	50	50	50
51	51	51	51
52	52	52	52
53	53	53	53
54	54	54	54
55	55	55	55
56	56	56	56
57	57	57	57
58	58	58	58
59	59	59	59
60	60	60	60
61	61	61	61
62	62	62	62
63	63	63	63
64	64	64	64
65	65	65	65
66	66	66	66
67	67	67	67
68	68	68	68
69	69	69	69
70	70	70	70
71	71	71	71
72	72	72	72
73	73	73	73
74	74	74	74
75	75	75	75
76	76	76	76
77	77	77	77
78	78	78	78
79	79	79	79
80	80	80	80
81	81	81	81
82	82	82	82
83	83	83	83
84	84	84	84
85	85	85	85
86	86	86	86
87	87	87	87
88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

## REMARKS

ELEV.		DEPTH	
1	10	1	10
2	20	2	20
3	30	3	30
4	40	4	40
5	50	5	50
6	60	6	60
7	70	7	70
8	80	8	80
9	90	9	90
10	100	10	100
11	110	11	110
12	120	12	120
13	130	13	130
14	140	14	140
15	150	15	150
16	160	16	160
17	170	17	170
18	180	18	180
19	190	19	190
20	200	20	200
21	210	21	210
22	220	22	220
23	230	23	230
24	240	24	240
25	250	25	250
26	260	26	260
27	270	27	270
28	280	28	280
29	290	29	290
30	300	30	300
31	310	31	310
32	320	32	320
33	330	33	330
34	340	34	340
35	350	35	350
36	360	36	360
37	370	37	370
38	380	38	380
39	390	39	390
40	400	40	400
41	410	41	410
42	420	42	420
43	430	43	430
44	440	44	440
45	450	45	450
46	460	46	460
47	470	47	470
48	480	48	480
49	490	49	490
50	500	50	500
51	510	51	510
52	520	52	520
53	530	53	530
54	540	54	540
55	550	55	550
56	560	56	560
57	570	57	570
58	580	58	580
59	590	59	590
60	600	60	600
61	610	61	610
62	620	62	620
63	630	63	630
64	640	64	640
65	650	65	650
66	660	66	660
67	670	67	670
68	680	68	680
69	690	69	690
70	700	70	700
71	710	71	710
72	720	72	720
73	730	73	730
74	740	74	740
75	750	75	750
76	760	76	760
77	770	77	770
78	780	78	780
79	790	79	790
80	800	80	800
81	810	81	810
82	820	82	820
83	830	83	830
84	840	84	840
85	850	85	850
86	860	86	860
87	870	87	870
88	880	88	880
89	890	89	890
90	900	90	900
91	910	91	910
92	920	92	920
93	930	93	930
94	940	94	940
95	950	95	950
96	960	96	960
97	970	97	970
98	980	98	980
99	990	99	990
100	1000	100	

DESCRIPTION

## STRAT. PLOT

NUMBER

TYPE

GLOWS / FOOT

ELEV. SCALE

BLOWS / FOOT

20	40	60	80	100
----	----	----	----	-----

SHEAR STRENGTH P.S.F.

取 金

WATER CONTENT %

P.C. #	BOX	BULK	DENSITY
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
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73	73	73	73
74	74	74	74
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76	76	76	76
77	77	77	77
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80	80	80	80
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82	82	82	82
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84	84	84	84
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86	86	86	86
87	87	87	87
88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

REMARKS

1602.8

Groundlevel

0.0

600

590

580

570

CE1. 587.8" Hammer Bouncing.



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

JOB 66-F-23LOCATION Gravel Rd. Sta. 14+19, 17' Lt. of EORIGINATED BY W.W.K.W.P. 123-64

BORING DATE \_\_\_\_\_

COMPILED BY A.K.B.DATUM GeodeticBOREHOLE TYPE Washboring, EA Caving.CHECKED BY K.G.S. *AK*

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	WATER CONTENT — W	WP	WL		
602.6	Groundlevel															
598.6	Sand and gravel. Fill					600										
4.0	Hard		1	SS	20											
			2	SS	70	590										
	Very stiff.		3	SS	22											
	Brown		4	SS	17	580										
	Silty Clay															
	Firm		5	SS	7	570										
561.1	Very stiff		6	SS	24											
41.5	End of borehole.					560										

@El. 585.8' Hammer Bouncing.

W.L.

@El. 595.9'



DEPARTMENT OF HIGHWAYS - ONTARIO

# RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-23 LOCATION Gravel Rd. Sta. 13497, 17' Rt. of E ORIGINATED BY W.W.K.  
W.P. 123-64 BORING DATE Feb. 28, 1966. COMPILED BY A.K.B.  
DATUM Geodetic BOREHOLE TYPE Washboring, BX Casing. CHECKED BY K.G.S.

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 20 40 60 80 100	SHEAR STRENGTH P.S.F.	WP	W		
602.4	Groundlevel										
597.9	Sand & gravel. Fill				600						
4.5	Hard		1	SS 21							
			2	SS 90	590						
			3	SS 31							
	Very stiff		4	SS 17	580						
			5	SS 7	570						
	Firm		6	SS 8	560						
	Brown silty Clay										
			7	SS 9	550						
					540						
	Stiff		8	SS 11	530						
					520						
			9	SS 11	510						
					500						
			10	SS 15	490						
			11	SS 15							
483.4											
119.0	End of borehole. Glacial Till										
	Very dense.										

W.L.  
@El. 595.9'

@ El. 586.4' Hammer Bouncing.

MATERIALS &amp; TESTING DIVISION

## FOUNDATION SECTION

ORIGINATED BY W.W.K.

COMPILED BY A.K.B.

CHECKED BY K.G.S. *AK*

[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.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

$\gamma$	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 SHEAR $\%$ RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_i$	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
$\sigma'$	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
$K_0$	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
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

## MEMORANDUM

E.B.D. 120.1 1002

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

FROM: Bridge Division,  
Downsview, Ontario.

DATE: November 29, 1965.

OUR FILE REF.

IN REPLY TO

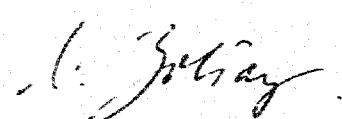
SUBJECT: W.P. 123-64, Site 6-250,  
Tilbury West,  
Rochester Twp. Line Road Underpass,  
2.5 miles west of Hwy. 77,  
Hwy. 401, District #1.

66-23

We are sending to you herewith two prints of Bridge Site Plan E 4363-1 on which we have marked in red the proposed location of the above structure.

The bridge site is readily accessible. It is 2.5 miles west of Hwy. 77.

Please make the necessary arrangements for foundation soils investigation. We will be pleased to have your report in due course.



NZ/ag  
c.c. S. McCombie  
G. Scott  
N. D. Smith

N. Zoltay,  
for G. Scott,  
Regional Bridge Location Engineer.

Mr. A. P. Watt,  
Regional Bridge Location Engr.,  
London, Ontario.

Foundation Section,  
Materials & Testing Division.

August 4, 1966.

Tilbury W. Rochester Twp. Line Rd. U'Pass,  
2.5 Miles West of Hwy. #77, Hwy. #401,  
W.P. 123-64, District #1, Chatham.

With reference to your letter of July 15, 1966  
regarding the above structure we wish to inform you that  
we find the drawing D-5951-P1 satisfactory and have no  
comments to make.

AGS/tt  
cc: Mr. S. McCombie

  
A. G. Stermac,  
Principal Foundation Engr.

Foundation Files  
General Files

MEMORANDUM

To: Mr. A. G. Stermac  
Principal Foundation Engineer  
Lab Building  
D O W N S V I E W

FROM: A. P. Watt

DATE: July 15, 1966

OUR FILE REF.

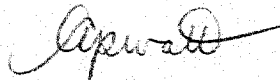
IN REPLY TO:

SUBJECT:

WP 123-64, Bridge Site 6-250,  
Tilbury W. Rochester Twp. Line Rd. Underpass,  
2.5 miles west of Hwy. No. 77,  
Highway No. 401,  
District 1, Chatham.

Attached please find one copy of the preliminary  
plan D-5951-P1 for the above structure.

Would you kindly review the bridge foundations  
proposed and inform me if they are satisfactory.



A. P. WATT  
REGIONAL BRIDGE LOCATION ENGINEER

APW:gf  
Encl.

c.c. Mr. S. McCombie

~~CONSTRUCTION DATE~~

# 66-F-23  
W.P. # 123-64  
Hwy. # 401  
GRAVEL RD.  
BETWEEN  
TILBURY W. &  
ROCHESTER  
TWP. RDS.



