FOUNDATION TECHNICAL MEMORANDUM

For

MEDWAY CREEK BRANCH BRIDGE (BIRR)
MTO WEST REGION 59 STRUCTURE REHABILITATIONS
HIGHWAY 4, SITE 19-160, CONTRACT 5
GWP 3062-11-00
GEOGRAPHIC TOWNSHIP OF LONDON
MIDDLESEX COUNTY, ONTARIO

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June 17, 2015

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Peto MacCallum Ltd.
CONSULTING ENGINEERS

FOUNDATION TECHNICAL MEMORANDUM
For
Medway Creek Branch Bridge (Birr)
MTO West Region 59 Structure Rehabilitations
Highway 4, Site 19-160, Contract 5, GWP 3062-11-00
Geographic Township of London
Middlesex County, Ontario

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1. INTRODUCTION

The Foundation Engineering Services for the present project involve the detail foundation investigation and design for the rehabilitation of 59 structures in MTO West Region along Highways 4, 6, 401, 402 and 403. Ten (10) Group Work Projects (GWP's) are contemplated to be completed between 2014 and 2020.

This technical memorandum summarizes the factual results of geotechnical data based on the review and compilation of existing subsurface information from relevant reports in the MTO GEOCRES Library for the Medway Creek Branch Bridge (Birr) on Highway 4. The Foundation Engineering recommendations from the initial bridge foundation reports are summarized with reference to the "Canadian Highway Bridge Design Code" (CHBDC) and follow in general the "Guidelines for Professional Engineers providing Geotechnical Engineering Services".

From the Minutes of Meeting Report, dated January 23, 2015, it is understood that rehabilitation of the bridge structure will be completed in two stages with the use of temporary portable signals to maintain one lane of traffic.

The purpose of the Technical Memorandum is to summarize the subsurface and groundwater conditions and foundation recommendations based on available reports at the bridge location for the design project team's reference.

The elevations in this report are expressed in meters, unless otherwise noted.

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BARRIE, HAMILTON, KITCHENER, TORONTO

2. PROJECT SITE BACKGROUND AND GEOLOGY

The Medway Creek Branch Bridge (Birr) on Highway 4 is located about 16 km (10 miles) north of London in the Geographic Township of London, Middlesex County, Ontario. A key plan is shown in the Figure 1.

The existing structure is a single span reinforced concrete rigid frame structure that carries two lanes of traffic. The surrounding areas adjacent to the bridge location are generally flat cultivated field lands. The creek flows from east to west at the bridge location.

Physiographically, the site is located in the region known as the Lucan Moraine. The topography of the region is undulating with a broad valley through which the Medway Creek meanders. The geology of the subsoil is mainly moraine till of glacial origin. In the Geographic Township of London the drift thickness exceeds 46 m, and in some areas 61 m, and is underlain by bedrock of the Dundee Formation, a light brown, medium-grained limestone with some chert (Aggregate Resources Inventory of London Township, Middlesex County, Southern Ontario by Ontario Geological Survey, dated 1983).

3. SOURCE OF INFORMATION

The following report was available for review and information for the Medway Creek Branch Bridge (Birr).

1. Foundation Investigation for Medway Creek proposed crossing Highway # 4, Township of London, County of Middlesex, Dist. No. 2, W.J F-59-9, W.P. 150-59, Material and Research Division (foundation Office), Department of Highways Ontario, dated July 20, 1961. GEOCREC 40P03-003. (Reference 1)

2. General Arrangement, Drawing No. D-5014-1, Medway Creek Bridge, 3.7 miles south of Highway No. 7, King's Highway No. 4, Dist. No 2, Lot 16 and 17, Con. XII, Township London, County of Middlesex, W.P 150-59, TWP. 93-160-1 by Department of Highways Ontario - Bridge Division, dated March 1962. (Reference 2)

4. SITE RECONNAISSANCE

As part of the current foundation engineering assessment study, a site reconnaissance of the Medway Creek Branch Bridge (Birr) was carried out on July 24, 2014. A photographic record of the site visit is attached in Appendix B.

The slopes adjacent to the abutments were vegetated (Photographs 2, 3, 5 and 6). Rocks placed on slope faces and at the toes were observed to protect against erosion and scouring of exposed earth soils. The slopes were visibly in stable condition. Slight scouring was observed at the slope toes. No obvious major cracks were observed on the abutment walls except for some surficial cracks (Photographs 1 and 4). The effect of erosion or scouring at the abutment walls could not be established below the creek water level. No weep holes or drainage systems were observed in the abutment walls or adjacent slopes.

At the time of the site reconnaissance the creek water was up to 0.5 m deep.

5. PREVIOUS FOUNDATION INVESTIGATION AND SUBSURFACE CONDITIONS

The site is located on Highway 4 in the Geographic Township of London, Ontario. The general subsurface conditions presented in this section are based on the Foundation Investigation Report, GEOCRES 40P03-003, dated July 20, 1961 (Reference 1).

The foundation report includes the borehole location plan (Drawing No.F59-9A), Record of Borehole sheets (1 to 4), and Summary of the Field and Laboratory tests.

The purpose of the previous investigation was to replace the original concrete single span bridge structure, 14.6 m (48 ft.) long and 12.2 m (40 ft.) wide, with a new bridge at the same location with the same geometry but with a raised grade of approximately 0.6 m (2 ft.). The centre line of the structure was to remain unchanged.

The investigation comprised four boreholes which were drilled from February 11 to 28, 1959 and were drilled to depths of 7.8 to 9.6 m (25.5 to 31.5 ft.), elevation 274.5 to 276.0 (900.5 to 905.5 ft.).

Dynamic cone penetration tests (DCPTs) that were conducted directly adjacent to the location of the four boreholes. The DCPTs met penetration refusal at depths of 3.0 to 4.9 m (10 to 16 ft.), elevation 278.3 to 280.7 (913 to 921 ft.).

The boreholes were drilled using a core drill machine adapted for soil sampling. In granular soils, samples were obtained by utilizing a 50 mm (2 in.) O.D. split barrelled spoon. The dimensions of the spoon sampler and the energy used in driving it conformed to the requirements of the Standard Penetration test.

The samples obtained were visually examined in the field and representative samples were brought to the laboratory for further testing.

Generally, about a 3.0 m layer of loose to dense fine to coarse sand, silt and gravel occasionally blended with very stiff to hard clayey silt was underlain by a deep deposit of generally hard silty clay till.

Sand and Gravel

A 2.7 and 3.0 m (9.0 and 10.0 ft.) thick surficial compact to very dense sand and gravel layer was encountered in boreholes 1 and 4 which extended to elevation 280.7 and 280.1 (921.0 and 919.0 ft.), respectively. N values of 28 to 80 were recorded for the sand and gravel layer. Moisture content determination ranged from 2.7 to 10.2%.

Clayey Silt

A 2.6 and 3.5 m (8.5 and 11.5 ft.) thick surficial very stiff to hard clayey silt was encountered in boreholes 2 and 3 and extended to elevation 281.3 and 280.3 (923.0 and 919.5 ft.), respectively. Layers of sandy silt and gravelly sand were encountered within the clayey silt. A shear strength of 56.5 kPa (1180 psf) was measured in the clayey silt layer.

A 0.6 m thick layer of loose sandy silt layer was encountered within the clayey silt in borehole 2 from 0.9 to 1.5 m (3 to 5 ft.), elevation 282.4 to 283.0 (926.5 to 928.5 ft.). One N value of 4 with a corresponding moisture content of 23.1% was obtained for the sandy silt layer.

A layer of 1.5 m thick dense gravelly sand was encountered within the clayey silt material in borehole 3 from 1.8 to 3.3 m (6 to 11 ft.), elevation 280.4 to 281.9 (920.0 to 925.0 ft.). Two N values recorded were 31 and 45. One moisture content of 6.8% was measured for a gravelly sand sample.

Boulders were encountered in the clayey silt layer at 1.8 to 2.4 m (6.0 to 8.0 ft.), elevation 281.5 to 282.1 (923.5 to 925.5 ft.) in borehole 2 and at 2.1 to 3.3 m (7.0 to 11.0 ft.), elevation 280.4 to 281.6 (920.0 to 924.0 ft.) in borehole 3.

Silty Clay Till

A silty clay till layer was encountered below the sand and gravel at 2.1 and 3.0 m (7.0 to 10.0 ft.), elevation 280.7 and 280.1 (921.0 and 919.0 ft.) and extended to boreholes 1 and 4 termination depth at 8.5 and 8.1 m (28.0 and 26.5 ft.), elevation 274.9 and 275.1 (902.0 and 902.5 ft.), respectively.

The clayey silt layer in boreholes 2 and 3 was underlain by a hard stratum of silty clay till which was encountered at 2.6 and 3.5 m (8.5 and 11.5 ft.), elevation 281.3 and 280.3 (923.0 and 919.5 ft.), respectively, in boreholes 2 and 3 and extended to borehole termination depth at 9.4 and 7.8 m (31.0 and 25.5 ft.), elevation 274.5 and 276.0 (900.5 and 905.5 ft.), respectively.

N values recorded were between 40 and 109. Laboratory shear measured for silty clay till ranged from 81.4 to 263.3 kPa (1700 to 5500 psf). The Atterberg liquid limits ranged from about 19.6 to 24.4 and plastic limits from 10.8 to 13.4 for the silty clay samples. The plasticity index ranged from 8.3 to 11.0. Further, the unit weight of the silty clay till samples varied between 21.8 and 23.9 kN/m^3 (138.5 to 152.2 pcf). Moisture content determinations ranged approximately from 9.7 to 15.9%.

Groundwater

Groundwater was encountered during the site investigation in boreholes 2 to 4 at 0.8 to 1.7 m (2.0 to 5.5 ft.), elevation 282.1 to 283.2 (925.5 to 929 ft.).

6. FOUNDATION

6.1 Previous Foundation Recommendations

The foundation report stated that based on the subsoil conditions encountered, spread footings would be favourable for founding the new bridge structure. The report suggested that proposed footings be placed at or below elevation 281.9 (925.0 ft.). A safe bearing pressure of 335 kPa (3.5 tsf) for 1.8 m (6.0 ft.) wide footings was recommended with a safety factor of 3 incorporated. The safe bearing pressure recommended included safeguard against settlement of more than 25 mm (1.0 in.) of the structure.

During the investigation, groundwater encountered varied between 0.8 to 1.7 m (2.0 to 5.5 ft.), elevation 282.1 to 283.2 (925.5 to 929 ft.). Due to the creek water level fluctuation, protection of footings against scour was recommended. It was anticipated that dewatering of the excavation during footing construction would be required. Further, sheet piles driven approximately 0.3 m (1.0 ft.) below the lower footing level and into the dense till stratum, was suggested for this purpose.

Based on the General Arrangement Drawing (Reference 2), the proposed bridge was to be constructed as one rigid frame structure. The spread footings were to be placed at elevation 279.8 (918.0 ft.). The approach embankments were to be raised up to approximately 3.0 m (10 ft.) from the original ground. On the slope faces, 0.3 to 0.6 m (1 to 2 ft.) thick hand-laid to random rip-rap was to be placed to protect against erosion. The slopes were to be cut back at 1.5H:1V.

6.2 Assessment of Foundation Parameters

Based on the previous investigation and subsurface conditions encountered, the following table summarizes the foundation design parameters that were recommended in the previous report and the updated geotechnical reaction at SLS and factored geotechnical resistance at ULS are provided.

FOUNDATION DESIGN PARAMETERS

Foundation and Type	Elevation of Footings (m)	Previous Safe Bearing Resistance (tsf)[1]	Previous Equivalent Limit State Design Values		Limit State Design Values Updated to current industry practices[2]	
			SLS Geotechnical Reaction (kPa)	Factored ULS Geotechnical Resistance (kPa)	SLS Geotechnical Reaction (kPa)	Factored ULS Geotechnical Resistance (kPa)
East Abutment on Spread Footing	279.8 (918 ft.)	3.5	335	502	450	675
West Abutment on Spread Footing						

Notes: 1. Working stress design values. The Ultimate Limit State design values are based on the working stress. No field verifications were made.
2. Resistance Factor = 0.5 for shallow foundation (CFEM 4th edition)
Assumed Factor of Safety is 3 (CFEM 4th edition)

The seismic site coefficient for the conditions at this site is 1.0 (soil profile Type 1, Canadian Highway Bridge Design Code (CHBDC) 2006 Edition, clause 4.4.6). The bearing resistance for inclined loads should be reduced in accordance with the requirements of clause 6.7.4 of the CHBDC. The foundation frost penetration depth at the site is 1.2 m according to OPSD 3090.101.

7. DISCUSSION

From a geotechnical point of view, at the present time, foundation work for the Medway Creek Branch Bridge (Birr) structure is not expected provided that the total dead load on the bridge does not increase or decrease by more than 10%.

It is understood that rehabilitation of the bridge structure is anticipated and that rehabilitation will be completed in two stages with the use of temporary signals to maintain one lane of traffic.

No weep holes or drainage systems were observed in the abutment walls or adjacent slopes.

8. CLOSURE

This technical memorandum was prepared by Mr. Nazibur Rahman, P.Eng with the assistance of Mr. Mansoor Khorsand, EIT and was reviewed by Mr. Robert Ng, PhD, P.Eng., Senior Project Engineer. Mr. Brian R. Gray, MEng, P.Eng., MTO Designated Principal Contact conducted an independent review of the report.

We trust this memo is sufficient for your immediate needs. Please, do not hesitate to contact us if you have any inquiries and/or comments. Yours very truly,

Yours truly,

Peto MacCallum Ltd.

Nazibur Rahman, P.Eng.
Project Engineer, Geotechnical Services

Robert Ng, MBA, PhD, P.Eng.
Senior Project Engineer

Brian R. Gray, MEng, P.Eng.
MTO Designated Principal Contact

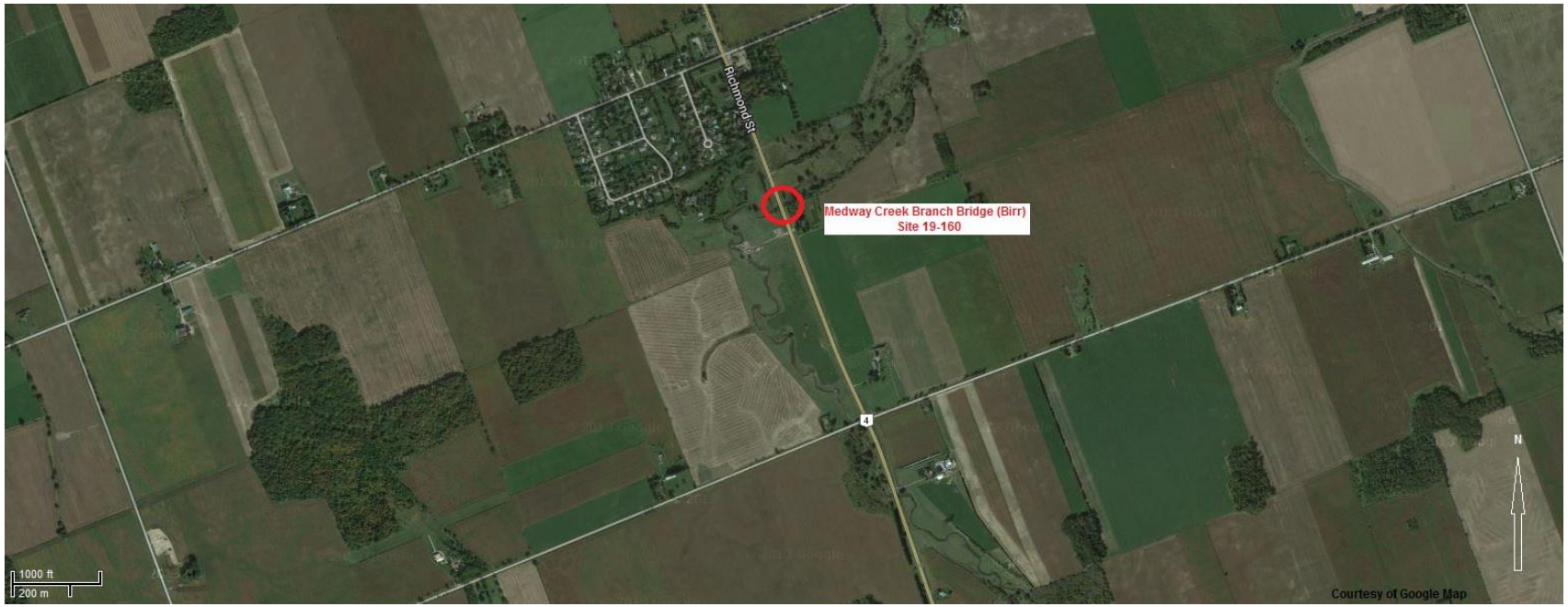
NR/RN/BRG:nr-mi-jk

TABLE 1

LIST OF STANDARD SPECIFICATIONS REFERENCED IN REPORT

DOCUMENT	TITLE
OPSD 3090.101	Foundation Frost Depth for Southern Ontario

Figure 1 – Key Plan

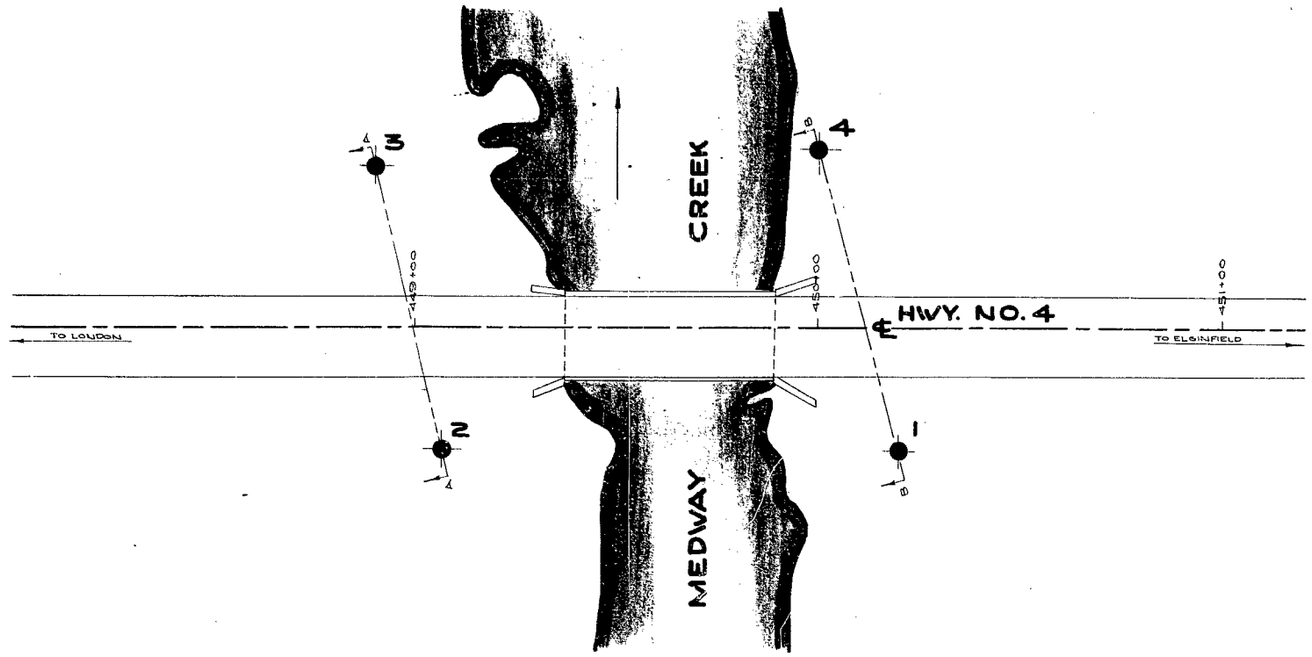


APPENDIX A

Foundation Investigation Report (GEOCRES 40P03-003)

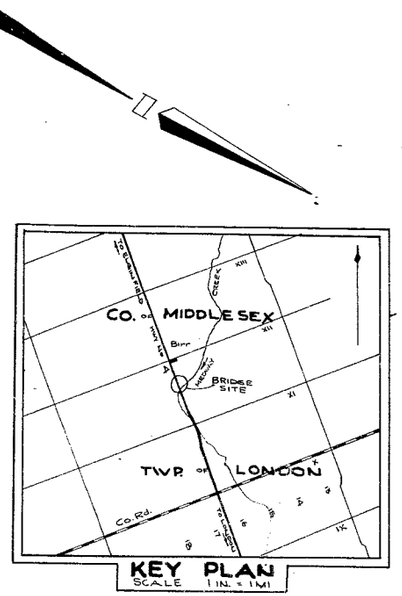
General Arrangement, Medway Creek Bridge (Dated March, 1962)

59-F-9
W.P. # 150-59
Hwy. # 4
CROSSING
MEDWAY CREEK
LONDON TWP.



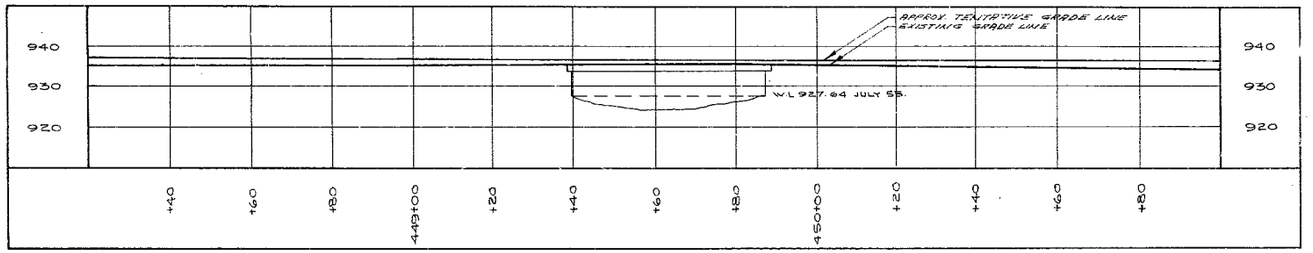
PLAN

63045-1 2-3
GB-95



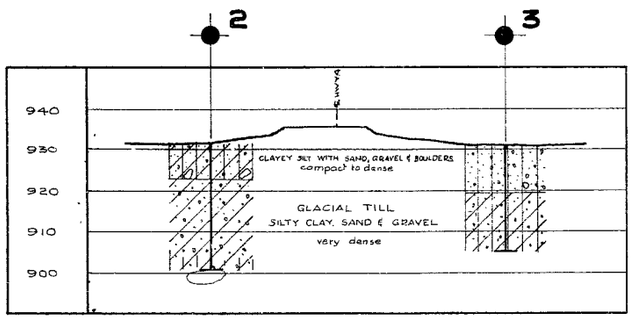
LEGEND	
BORE HOLE	●
PENETRATION HOLE	⊕
BORE & PENETRATION HOLE	◒

HOLE NO.	ELEVATION	STATION	DISTANCE FROM ℄
1	930.0'	450+20	35'RT
2	931.5'	449+07	30'RT
3	931.0'	448+90	40'LT
4	929.0'	450+00	44'LT.

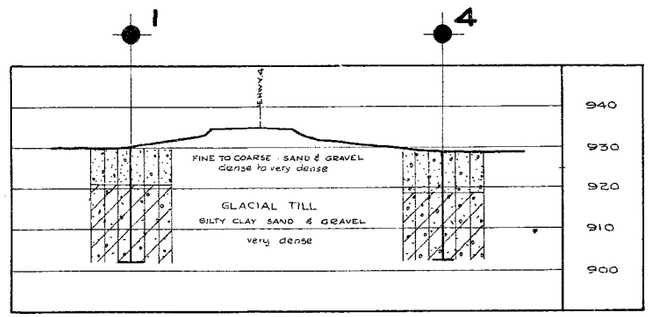


PROFILE

CIIIB-2
4A-18



A-A



B-B

- 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.

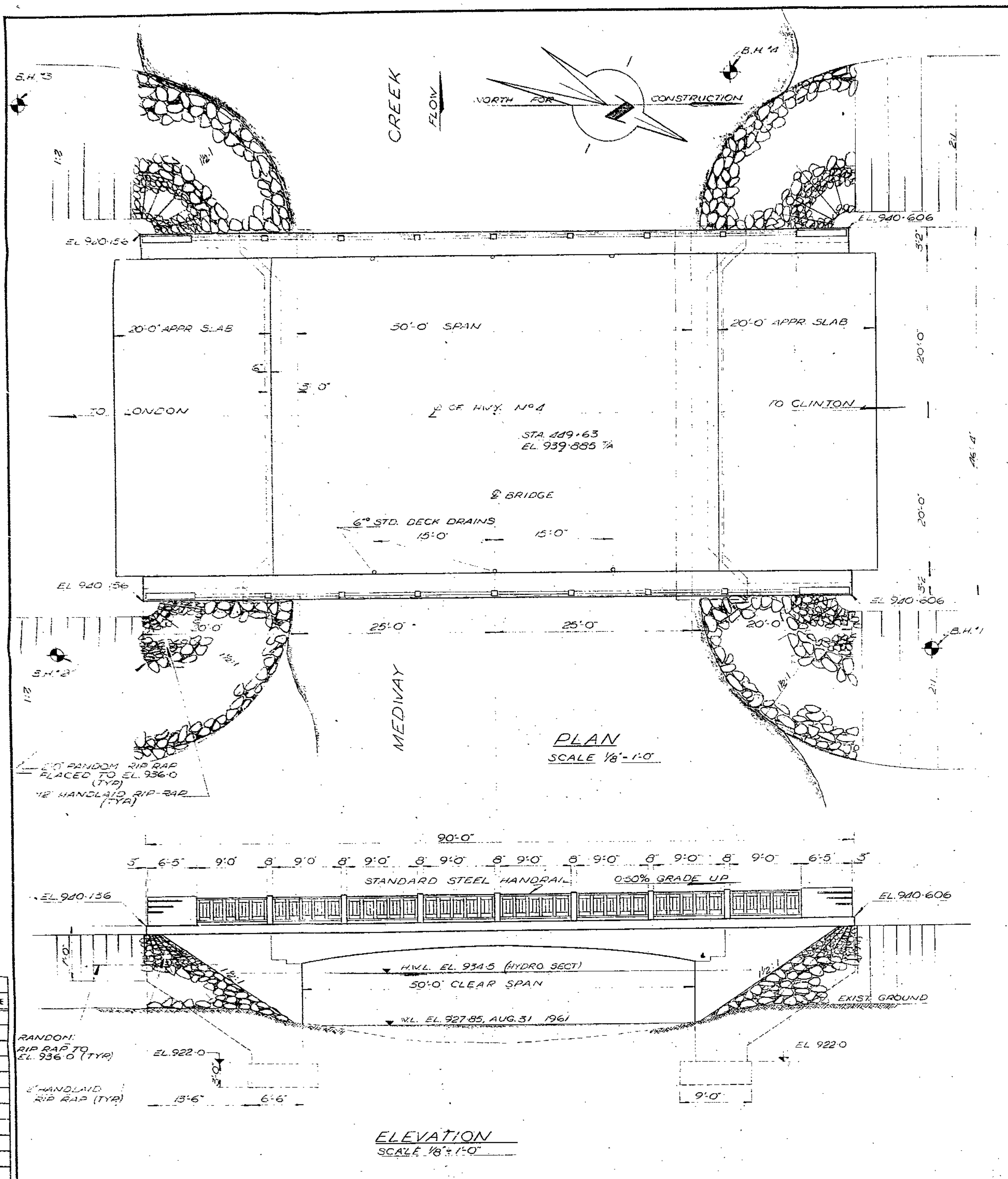
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

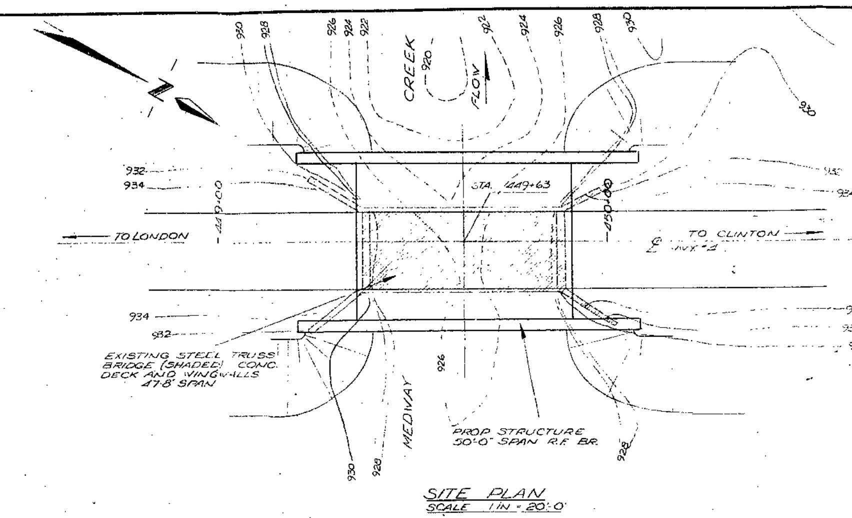
MEDWAY CREEK PROPOSED CROSSING

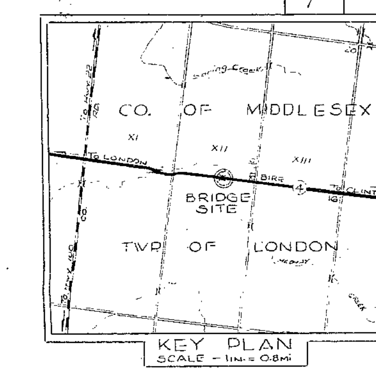
SHOWING POSITIONS & ELEVATIONS OF HOLES

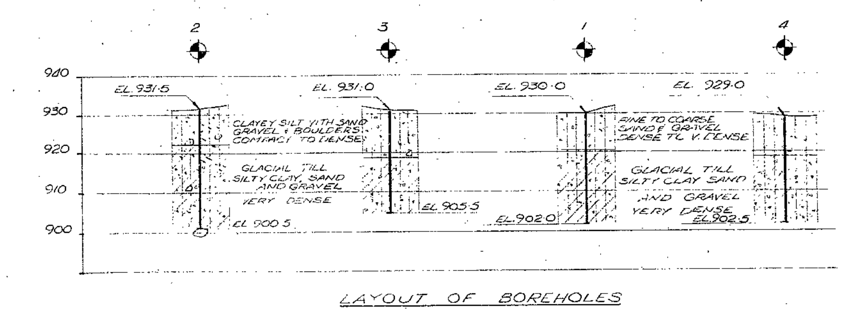
HWY. 4 DISTRICT 2 COUNTY MIDDLESEX
TOWNSHIP LONDON LOT 16 & 17 CON. XII
LOCATION APP 10 MI. N. OF LONDON
DRAWN BY: T. MELLORS CHECKED BY: W.P. 150-59
DATE 4 JUNE 1959. APPROVED BY:
SCALE 1 IN = 20 FT. DRAWING NO. F59-9A

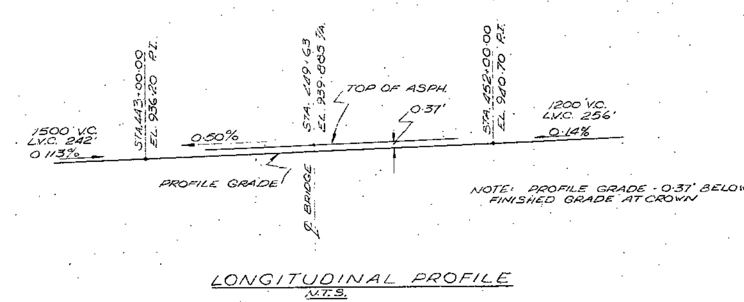
SHEET No.	TOTAL SHEETS
1	











G.B.M. Nº 176-F LONDON ELEV. 791·678
CONC. BENCH MARK PIER AT SOUTHEAST CORNER OF RICHMOND ST. AND ROAD BETWEEN CONS. III AND IV. TWP. OF LONDON, 10 FT. WEST OF EASTERLY LIMIT OF RICHMOND ST. 23 FT. EAST OF EDGE OF PAVEMENT ON SAME AND 5 FT. NORTH OF SOUTHERLY LIMIT OF CONCESSION ROAD. BOLT SET VERTICALLY IN TOP OF PIER, BURIED ABOUT 1 FT. BELOW ROAD SURFACE

59-F-9

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

REFERENCE PLANS
E 4047-1
F-4029
C-1118-2
BA 1235
BW 290

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

MEDWAY CREEK BRIDGE
3·7 MILES SOUTH OF HWY. Nº7

KING'S HIGHWAY No. 4 DIST. No. 2
CO. MIDDLESEX
TWP. LONDON LOT 16 & 17 CON. XII

PRELIMINARY PLAN

APPROVED ___ BRIDGE ENGINEER				SITE No.	W.P. No. 150-59
DESIGN	A.P.	CHECK	M.M.	CONTRACT Nos.	
DRAWING	M.J.O.	CHECK	M.M.		
DATE	JAN 1962	LOADING	H20 S16	DRAWING No.	D-5014-P1

cc: Foundations Office

23-62-823

Mr. A. M. Foye,

Bridge Engineer.

Materials & Research Section,

(Foundations Office).

July 20, 1961.

D.H.C. FOUNDATION INVESTIGATION REPORT.

W.J. 59-9-9 -- W.P. 150-59.

Attention: Mr. B. McCombie.

Re: Proposed Crossing - Medway Creek - Hwy. #4, Twp. of London, Co. of Middlesex, Dist. #2.

Accompanying this memo, is our detailed foundation report on the subsoil conditions existing at the above site.

We believe the conclusions and recommendations contained therein, should prove adequate for your future design work.

If we can be of further assistance in connection with this project, please do not hesitate to contact our office.

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

A. G. Stermac

(A. G. Stermac,
SUPERVISING FOUNDATION ENGR.)

AGS/Mef
Attach.
cc: Messrs. A. M. Foye (2)
M. A. Tregaskiss
H. D. MacMillan
A. Cater
W. L. Fraser
J. Roy
T. J. Kovich
J. C. Gruspier
C. R. Saint
F. Forman
A. Watt
Foundations Office
Gen. Files.

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FOUNDATION INVESTIGATION

For

Medway Creek
Proposed Crossing - Hwy. #4,
Twp. of London, Co. of Middlesex, Dist. #2,
W.J. F-59-9 -- W.P. 150-59.

1. INTRODUCTION:

This report contains the detailed results of field soil investigation and laboratory findings, together with recommendations for the foundations for the proposed new bridge at Hwy. #4 and Medway Creek.

The site is located about 10 miles North of London in Lots #16 & #17 (Con. XII), Twp. of London. The existing structure is a single span (48') concrete bridge 40' in width. It is proposed to construct a new bridge at the same location with the same span, but with a raise in grade of approximately 2.0'. The centre-line of the structure will remain unchanged.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site is in the physiographic region of "Lucan Moraine". The topography is undulating with a broad valley through which the Medway Creek meanders.

During the recession of the glaciers at certain sections, the ice lobes re-advanced, overriding the recently deposited drift, and at the terminus of each advance, moraines were formed. During this process, the drainage of the melting ice formed spillways which deposited the sand and gravel released from the melting ice.

Medway Creek was the drainage channel of the "Lucan Moraine".

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:

The investigations were carried out by means of a core drill machine adapted for soil sampling. The work comprised of four sampled boreholes.

In granular soils, samples were taken by means of a 2" O.D. split barrelled spoon. The dimensions of the spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test.

The split spoon samples were visually examined in the field and representative samples were brought to the laboratory for further testing.

The logs of the boreholes and their locations are shown on Drawing No. P-59-9A, attached under Appendix I.

4. SOIL TYPES ENCOUNTERED:

The investigations at the site revealed the following subsoil conditions:

The top material, about 10 ft., is a granular deposit of silty sand and gravel. Underlying this top material is a layer of dense silty, sandy clay till with pebbles.

4.1) Silty Sand and Gravel:

This top deposit is made up of granular material and varies in depth from 9' to 12'. The grain size distribution curve indicates that the material is made up of particles ranging in size from silt to gravel. Below 4 ft., this deposit is in a dense state of compaction.

cont'd. /3 ...

4. SOIL TYPES ENCOUNTERED: (cont'd.) ...

4.2) Silty Clay with Sand and Gravel (Glacial Till):

This material immediately underlies the upper layer of sand and gravel and was observed in all boreholes. The lower contact was not penetrated. The grain size distribution curve indicates a range of particle sizes varying from clay silt to pebbles. The matrix is mainly silty clay. The material in the layer has been reworked and has a grey colour. The boreholes were advanced about 20 ft. into the layer and the Standard Penetration Test results indicate that the consistency of the matrix may be classified as hard.

5. DISCUSSION AND RECOMMENDATIONS:

The subsoil at the site consists of a granular deposit overlying a dense till layer. Conditions are favourable for founding the new bridge on spread footings.

The Standard Penetration Test results indicate that below elevation 925 ft., the subsoil is in a very dense state (average 58 blows per foot). Calculated on this basis, the subsoil's safe bearing pressure for 6 ft. wide footings is about 3.5 T.S.F. This value incorporates a safety factor of 3 and safeguards against more than one inch settlement of the structure.

It is recommended to found the footings at or below elevation 925 ft. with a safe bearing pressure of 3.5 T.S.F.

At times of high water level, the existing footings are partly submerged by water and a slight scouring action at the corners

cont'd. /4 ...

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

can be observed. This indicates the necessity for some form of scour protection.

During the investigation the ground water level was found in the boreholes to vary from elev. 925.5' in B.H. #3 to elev. 929.0' in B.H. #2. As the recommended footing level is below elev. 925.0' dewatering of the excavations will most probably be necessary. Sheet piling driven approximately 12" below the lower footing level and into the dense till stratum, should prove suitable for this purpose; however, other methods may be used. The choice of the dewatering procedure (if at all necessary) will depend on the ground water level during actual construction.

6. SUMMARY:

The subsoil at the site consists of granular top material underlain by a dense glacial till layer.

It is recommended to found the new structure on spread footings at or below elevation 925.0'. A safe bearing pressure of 3.5 Tons/sq.ft. can be used for design purposes. Protection of footings against scour has to be carried out. Dewatering of the excavation during footing construction will most probably be necessary.

7. MISCELLANEOUS:

The field work was carried out during February 11 to 28, 1959, under the supervision of Project Foundation Engineer, V. Korlu. All the lab. testing was done by the Materials & Research Section.

July 1961. REPORT PREPARED BY: V. Korlu, Project Foundation Engr.

REPORT APPROVED BY: A. C. Stermac, Supervising Fdn. Engr.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 59-9
W.P. 150-59

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'	Fine to coarse sand and gravel.	45	8.1	-	-	-	-	
	S2	6'-7.5'	" " " "	80	-	-	-	-	-	
	S3	8'-9.5'	" " " "	37	7.8	-	-	-	-	
	S4	10'-11.5'	Silty clay, sand, and gravel (Till)	58	11.0	10.8	19.6	-	148.5	
	S5	18'-19.5'	" " " "	55	15.2	13.4	24.4	1700	144.2	
	T6	24'-26'	" " " "	63	14.6	-	-	4520	139.0	
2	T1	3'-5'	Sandy silt some fine fine gravel.	4	23.1	-	-	-	141.7	
	T2	6'-8'	Clayey silt, sand and gravel.	44	15.8	-	-	-	123.5	
	S3	9'-10.5'	Silty clay, sand, and gravel (Till)	40	11.5	12.5	20.8	-	146.5	
	S4	14'-15.5'	" " " "	74	14.6	-	-	-	142.0	
	S5	18'-19.5'	" " " "	87	14.7	-	-	-	138.5	
	S6	25'-26.5'	" " " "	50	10.2	-	-	-	152.2	
	S7	30'-31'	" " " "	54	11.6	-	-	-	-	
3	T1	3'-5'	Clayey silt sand and gravel	23	27.4	-	-	1180	125.0	
	T2	6'-8'	Gravelly sand, some silt.	31	6.8	-	-	-	132.0	
	T3	9'-11'	Gravelly sand, some silt.	45	-	-	-	-	-	
	S4	14'-15.5'	Silty clay sand and gravel (Till)	47	10.9	-	-	-	148.5	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 59-9
W.P. 150-59

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
3	S5	20'-21.5'	Silty clay sand and gravel.	57	14.0	-	-	-	144.8	
	S6	25'-26.5'	" " "	109	10.6	12.3	-	5500	149.5	
4	T1	3'-5'	Fine to coarse sand and gravel.	28	5.7	-	-	-	-	
	T2	6'-8'	" " " " "	42	2.7	-	-	-	-	
	S3	9'-10.5'	" " " " "	44	10.2	-	-	-	-	
	S4	14'-15.5'	Silty clay, sand and gravel (Till)	81	10.3	-	-	-	146.0	
	S5	20'-21.5'	" " " " "	39	15.9	-	-	-	-	
	S6	25'-26.5'	" " " " "	102	9.7	-	-	-	150.0	

T Denotes thin walled shelby tube.

S Denotes split spoon.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 150-59 BORE HOLE NO. 1

JOB F-59-9 STATION 450/20 (35' Rt.)

DATUM Geodetic COMPILED BY B.K.

BORING DATE Feb. 11/59 CHECKED BY V.K.

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 LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	SAMPLE	NATURAL UNIT WT. P.C.F.
	Groundlevel	930.0			
	Fine to coarse sand and gravel well graded, dense to very dense.	921.0		SS1	-
				SS2	-
				SS3	-
	Silty clay, sand and gravel mixture, very dense. (Glacial Till)			SS4	148.5
				SS5	144.2
		902.0		TW6	139.0
	End of borehole. Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.				

STRENGTH AND PENETRATION RESISTANCE
P.S.F. 2000 4000 6000 8000
BLOWS/FT. 50 100 150 200
10 20 30 40
Penetration ends at elev. 916.0'

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

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 150-59 BORE HOLE NO. 2

JOB F-59-9 STATION 449+07 (30' Rt.)

DATUM Geodetic COMPILED BY B.K.

BORING DATE Feb. 7/59 CHECKED BY V.K.

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

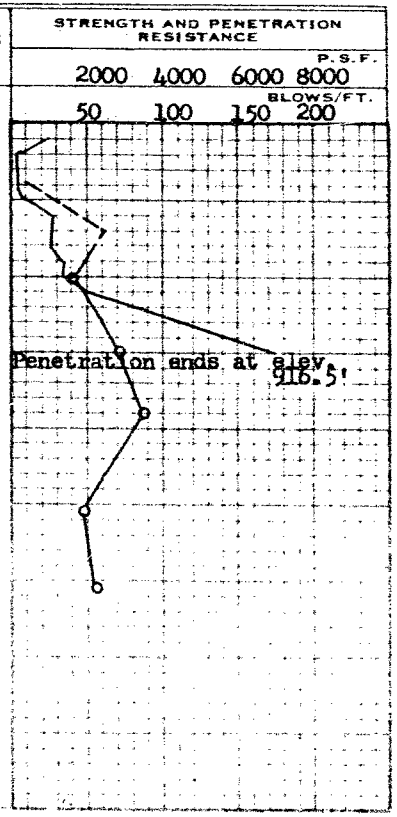
LEGEND

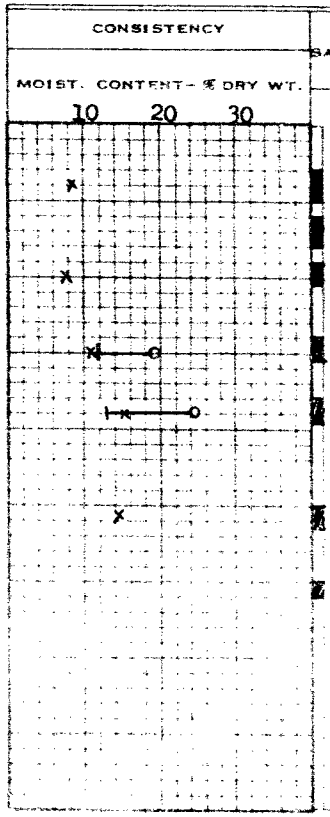
1/2 UNCONFINED COMPRESSION (Qu) ○
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT ⊸
PLASTIC LIMIT ⊢

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	931.5	
	Clayey silt containing varying amounts of sand and gravel compact to dense boulders at 6' to 8'.	923.0	10
	Silty clay, sand and gravel mixture (Glacial Till) Very dense.	900.5	20
	End of borehole.		30

Note: Stopped when encountering a boulder.

Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.





SAMPLE	NATURAL UNIT WT. P.C.F.
TW1	141.7
TW2	123.5
SS3	146.5
SS4	142.0
SS5	138.5
SS6	152.2
SS7	-

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 150-59 BORE HOLE NO. 3

JOB P-59-9 STATION 448/90 (40' Lt.)

DATUM Geodetic COMPILED BY B.K.

BORING DATE Feb. 24/59 CHECKED BY V.K.

LEGEND

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

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
	↓ Groundlevel	931.0	
	Clayey silt with sand and gravel to gravelly sand with silt - Dense. Boulders from 7.0' to 11.0'. w.l. ▽	925.5	
		919.5	
	Silty clay, sand and gravel mixture (Glacial Till).		
		905.5	

Hole completed.

Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE

Shear strength P.S.F. 2000 4000 6000 8000

BLOWS/FT. 50 100 150 200

10 20 30 40

Penetration ends at elev. 921.0'

CONSISTENCY

MOIST. CONTENT - % DRY WT. 10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
TW1	125.0
TW2	132.0
TW3	-
SS4	148.5
SS5	144.5
SS6	149.5

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 150-59 BORE HOLE NO. 4

JOB F-59-9 STATION 450+00 (44' Lt.)

DATUM Geodetic COMPILED BY B.K.

BORING DATE Feb. 25/59 CHECKED BY V.K.

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

LEGEND

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

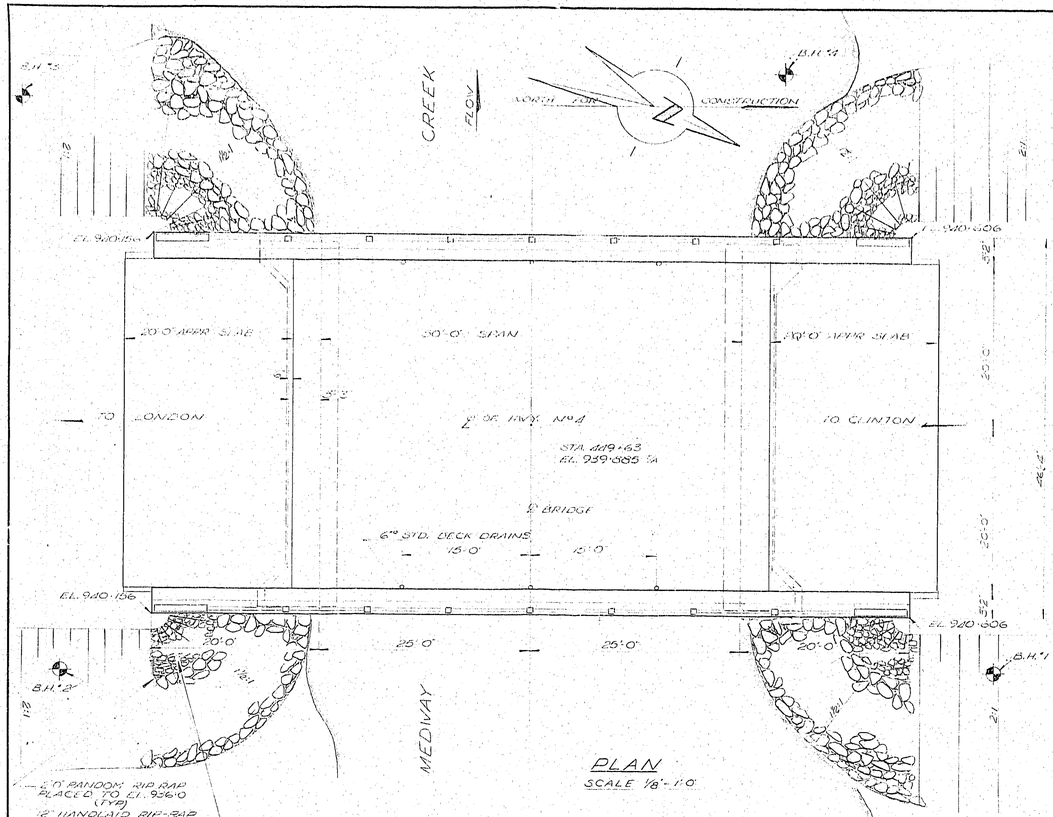
SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	929.0	0
	Fine to coarse sand and gravel, well graded, dense to very dense. W.L. ▽	927.0	
		919.0	10
	Silty clay, sand and gravel mixture. (Glacial Till) Very dense.		20
		902.5	
	End of borehole.		30
	Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		40

STRENGTH AND PENETRATION RESISTANCE
P.S.F. 2000 4000 6000 8000
BLOWS/FT. 50 100 150 200

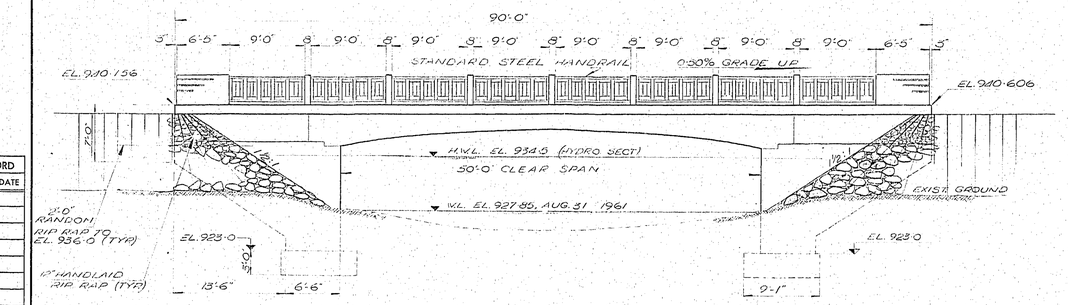
Penetration ends at elev. 913.0'

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

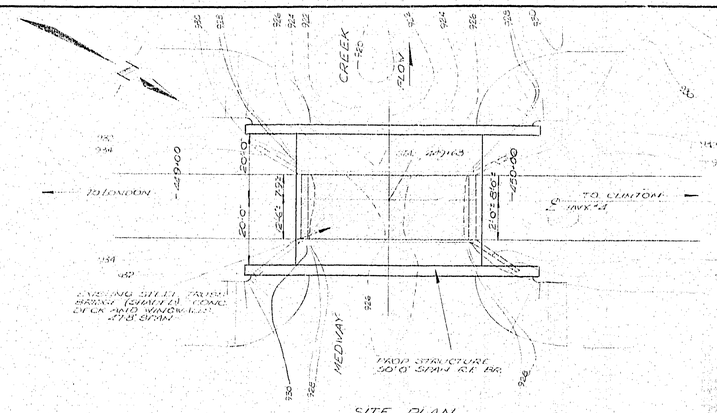
SAMPLE	NATURAL UNIT WT. P.C.F.
TW1	-
TW2	-
SS3	-
SS4	146.0
SS5	-
SS6	150.0



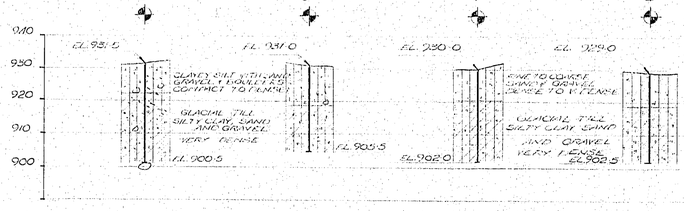
PLAN
SCALE 1/8" = 1'-0"



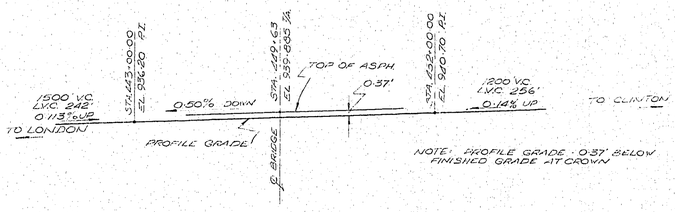
ELEVATION
SCALE 1/8" = 1'-0"



SITE PLAN
SCALE 1 IN. = 20'-0"



LAYOUT OF BOREHOLES



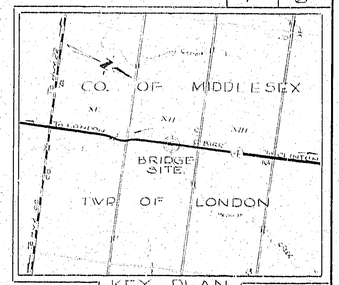
NOTE: PROFILE GRADE 0·37' BELOW FINISHED GRADE AT CROWN

LONGITUDINAL PROFILE
N.T.S.

LIST OF DRAWINGS	
D-5014-1	GENERAL ARRANGEMENT
" -2	FOOTINGS & RIGID FRAME
" -3	WINGWALLS, APPR. SLABS & CURBS
" -4	HANDRAIL DETAILS
" -5	REINF. STEEL SCHEDULE
" -6	" " "

REFERENCE PLANS
C 4047-1
C-4029
C-1118-2
BA 1235
SN 290

SHEET No.	TOTAL SHEETS
1	6



NOTES

TO DISTRICT ENGINEER

CONCRETE WORK ON THIS STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE DISTRICT ENGINEER.

TO CONTRACTOR

STRUCTURE TO BE BUILT IN ACCORDANCE WITH FORM No 9 AND THE SPECIAL PROVISIONS, EXTRA COPIES OF WHICH MAY BE OBTAINED FROM THE DISTRICT ENGINEER.

CONCRETE MIX

MIN. CONC. STRENGTH @ 28 DAYS 3000 p.s.i. THROUGHOUT
MAX. SIZE AGGREGATE ¾"

APPROVED ADMIXTURES SUPPLIED BY THE CONTRACTOR WILL BE ADDED TO ALL CONCRETE AS SPECIFIED BY THE ENGINEER.

BORING DATA

THE COMPLETE SOIL INVESTIGATION REPORT BA 1235 MAY BE EXAMINED AT THE BRIDGE OFFICE, DOWNSVIEW. THE DEPARTMENT DOES NOT GUARANTEE THE ACCURACY OF THIS REPORT OR THE ABRIDGED VERSION SHOWN ON THESE PLANS.

CLEAR COVER ON REINFORCING STEEL

FOOTINGS	ABUTMENTS	DECK	HANDRAILS
3"	3"	1½"	

APPR. SLAB 2" END POSTS 1"

CONSTRUCTION NOTES

ALL EXPOSED EDGES TO BE CHAMFERED 1"x1" EXCEPT AS NOTED.
ALL CONSTRUCTION JOINTS MUST BE APPROVED BY THE BRIDGE ENGINEER.
STRUCTURE TO BE BACKFILLED WITH FREE DRAINING GRANULAR
FALSEWORK SUPPORTING DECK MUST NOT BE REMOVED UNTIL THE GRANULAR BACKFILLING BEHIND THE ABUTMENTS HAS BEEN PLACED ⚠

G.B.M. No 176-F LONDON ELEV. 791·678
CONC. BENCH MARK INCISED AT SOUTHEAST CORNER OF RICHMOND ST. AND ROAD BETWEEN CONS. III AND IV, TWP OF LONDON. 10 FT. WEST OF EASTERLY LIMIT OF RICHMOND ST., 23 FT. EAST OF EDGE OF PAVEMENT ON SAME AND 5 FT. NORTH OF SOUTHERLY LIMIT OF CONCESSION ROAD. BOLT SET VERTICALLY IN TOP OF PIER, BURIED ABOUT 1 FT. BELOW ROAD SURFACE

REVISIONS		
1-3-62	T.G.	⚠ REMOVED CHANGED TO PLACED.
DATE	BY	DESCRIPTION

PRINT RECORD		
No.	FOR	DATE

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

MEDWAY CREEK BRIDGE
3·7 MILES SOUTH OF HWY. No 7

KING'S HIGHWAY No. 4 DIST. No. 2
CO. MIDDLESEX
TWP. LONDON LOT 16 & 17 CON. XII -

GENERAL ARRANGEMENT

APPROVED _____ BRIDGE ENGINEER
SITE No.
W.P. No. 150-59

DESIGN	A.P.	CHECK	A.R.B.	CONTRACT Nos.	62-723
DRAWING	M.J.O.	CHECK	A.R.B.		
DATE	MARCH 1962	LOADING	1120 S16	DRAWING No.	D-5014-1

TWP. 93-160-1

APPENDIX B

Site Photographs

Photograph 1: Looking at the north abutment from the southeast corner of the bridge site. No obvious cracks were observed on concrete. Scouring effect below the water could not be established. (July 24, 2014)

Photograph 2: Looking north at the east adjacent slope. The slope was covered with grass and bushes. Rock pieces were observed at the slope toe to protect from scouring effects. (July 24, 2014)

Photograph 3: Looking north at the adjacent west slope of the north abutment. The slope was covered by bushes. Rocks were observed at the toe of the slope to prevent further scouring. (July 24, 2014)

Photograph 4: Looking at the south abutment wall from the northeast corner of the bridge site. No obvious cracks were observed except for some surface cracks. Scouring effect below the water could not be established. (July 24, 2014)

Photograph 5: Looking south at the east slope adjacent to the south abutment. Rocks were placed at the toe and face of the slope to prevent erosion and scour. (July 24, 2014)

Photograph 6: Looking south at the west slope adjacent to the south abutment wall. Rocks were placed at the toe and face of the slope to prevent erosion and scouring. (July 24, 2014)