THURBER ENGINEERING LTD.

DESKTOP STUDY REPORT
PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN
REPLACEMEMT OF HIGHWAY 401 UNDERPASS
AT HIGHWAY 62
SITE NO. 11-160
HIGHWAY 401 WIDENING
BELLVILLE, ONTARIO
G.W.P. 4193-15-00

GEOCRES Number: 31C-294

Report

to

WSP

Date: December 11, 2020
File: 11566

103, 2010 Winston Park Drive, Oakville, ON L6H 5R7 T: 905 829 8666 F: 905 829 1166
thurber.ca

THURBER

TABLE OF CONTENTS

THURBER

DESKTOP STUDY REPORT
PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN
REPLACEMENT OF HIGHWAY 401 UNDERPASS
AT HIGHWAY 62
SITE NO. 11-160
HIGHWAY 401 WIDENING
BELLVILLE, ONTARIO
G.W.P. 4193-15-00

GEOCRES Number: 31C-294

PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents a summary of the factual subsurface information for the existing Highway 401 underpass at Highway 62 at the City of Belleville, Ontario.

The purpose of this desktop study report is to summarize currently available subsurface information pertinent to the foundation aspects of the proposed widening of Highway 401 from 4 lanes to 6 lanes at this site. The information includes a previous foundation report from the Geocres, soil design reports for pavements, general arrangement drawings, geological maps, and a site reconnaissance visit. The latest design strategy provided by WSP indicates that consideration is being given to replacing the existing rigid frame structure to the west side.

Thurber carried out this desktop study as a sub-consultant to WSP under the MTO Consultant Assignment Number 4015-E-0036.

2 SITE DESCRIPTION

2.1 General

The Highway 401 and Highway 62 interchange is located in Belleville approximately 400 m west of Moira River. At this location, the existing underpass consists of a single span, rigid frame reinforced concrete structure that has a total span length of about 34 m perpendicular

to Highway 401 and a width of about 17 m. The structure was originally constructed in 1956. The last rehabilitation of the Highway 62 underpass was completed in 2015. This rehabilitation included soffit, girder and substructure work.

The structure accommodates 4 traffic lanes (2 northbound and 2 southbound) and carries Highway 62 over 4 traffic lanes on Highway 401. Select photographs of the structure are included in Appendix C.

2.2 Geology

The project area is situated within the physiographic region known as the Napanee Plain. The Napanee Plain is characterized by a thin veneer of glacial till underlain at relatively shallow depths by limestone bedrock of the Trenton Group. Thick glacial sediments are present in the deep river and stream valleys in the region. There are a few scattered drumlins in this area.

2.3 Topography and Land Use

The Highway 401 corridor addressed in this project generally runs in an east to west orientation along relatively flat terrain. There are commercial and institutional developments in the vicinity of the interchange. Further north of the interchange the lands are predominantly of agricultural usage and the City of Belleville is located to the south of the interchange.

3 STUDY PROCEDURES

The desktop study is based on geotechnical data gathered from available sources with no borehole drilling and sampling in this phase of the work.

Information on existing surface and subsurface conditions relevant to the foundations of the existing structures and embankments have been collected from the following sources:

- Review of an existing foundation investigation and design report for the structure available from the MTO GEOCRES system, and selected information from archived contract files.
- Review of General Arrangement drawings

- Review of published geological information for the study area.
- Site reconnaissance visit by Thurber project personnel to observe and document the performance of existing structure foundations, cuts, embankments and any visible geological/geotechnical features.

Imperial units in the archived files and drawings have been converted to metric units.

3.1 MTO GEOCRES Files

Existing foundation/geotechnical information relevant to the subject site has been obtained from the MTO GEOCRES library. The document used for the desktop study is provided under GEOCRES File 31C00-028 listed below and is included in Appendix A.

31C00-028: Foundation Investigation, Thurlow Township, Bridge No. 2. Report No. S-500-501/55/T-61-1. prepared by Racey, MacCallum and Associates for the Department of Highways Ontario (DHO) dated March 17, 1955.

3.2 General Arrangement Drawing

A General Arrangement (GA) Drawing from April 1955 prepared by T. O. Lazarides, Lount and Partners was used to estimate the foundation depths and type for each foundation element. No as-built drawings were available. The GA drawing is included in Appendix B.

3.3 Other Foundation Investigations

A Foundation Investigation Report and a Foundation Memorandum were prepared by Golder Associates for the Highway 62 Widening From Highway 401 to Foxboro-Stirling Road. The two documents listed below contained borehole information for locations within 400 m of the Highway 62 Overpass.

- Proposed Watermain Between Stations 10+433 and 12+280, Highway 62 Widening from Highway 401 to Foxboro-Stirling Road, Belleville, Ontario, G.W.P No 731-93-00. Report Number 06-1111-010-3 dated November 2010 (Reference 1).

- Stormwater Management Pond, Highway 62 Widening from Highway 401 to Foxboro-Stirling Road, Belleville, Ontario, G.W.P. No. 731-93-00 dated May 31, 2007 (Reference 2).

3.4 Inspection Reports

Biannual Inspections were completed by the Ontario Bridge Management System in 2013 and 2015 to assess the condition of the existing structure through visual inspection. In 2015 the bridge was reportedly in good condition overall, although some concrete spalling and exposed rebar was observed on the northeast retaining wall and some transverse cracks were observed at the approach slabs.

3.5 Site Reconnaissance Visit

A site reconnaissance visit was carried out by Thurber's project personnel during the preparation of this report on April 30, 2018. The site was visited and documented for visible geological/geotechnical features and for assessing structure, cut and embankment performance.

Based on the site observations, Highway 62 is constructed on an embankment that reaches approximately 7 m above the original ground surface. No bedrock exposures were noted at this site. There was no visible evidence of settlement, lateral movement or other problems associated with the performance of the existing structure foundations. Similarly, the immediate approach embankments and retaining walls at all four quadrants appeared to be performing satisfactorily. Water was seen flowing out of the Bell utility at the toe of the northwest approach embankment.

4 SUBSURFACE CONDITIONS

Four boreholes were drilled using a diamond core drill in February 1955 near the proposed bridge location. At the borehole locations, 0.9 m to 1.8 m of sandy clay with gravel was found underlain by "grey, fossiliferous, argillaceous" limestone bedrock which contained "calcareous, shaly claystone" interbeds of various thicknesses. The reported core recovery typically ranged from 50 percent to 100 percent with some zones in the 0 to 33 percent range. The rock core was described as "hard" and "sound and solid". The top of bedrock was reported to range between Elevations 93.4 and 92.6 m.

Several boreholes were drilled approximately 400 m north of the Highway 62 underpass by Golder Associates (Reference 1). The recovered rock core samples have been described as slightly weathered to fresh limestone of the Trenton Group. The Rock Quality

Designation (RQD) reportedly ranged from 0 to 93 percent indicating that the rock was of very poor to excellent quality. Measured Unconfined Compressive Strength (UCS) values of the limestone with shale interbeds ranged between 11 and 116 MPa indicating a weak to very strong rock.

The groundwater table was found to range from 0.6 m to 1.2 m below the ground surface (Elevations 93.3 to 93.8 m) at the time of drilling.

THURBER

PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

This part of the report presents an interpretation of the factual information outlined in Part 1. Based on the existing information, preliminary foundation recommendations are provided for use in the assessment of the existing foundations and for the preliminary design of the replacement structure to the west of the existing structure. It is understood that the details of the works are yet to be decided at this time. Additional investigation and analysis will be required in any subsequent detail design phase of the project.

5 EXISTING FOUNDATIONS

Based on the historical General Arrangement (GA) drawing for the Highway 62 bridge (then Thurlow Township Bridge No. 2, Highway 14) over Highway 401 dated April 1955, both abutments of this rigid frame structure were designed to be supported on spread footings founded on the limestone bedrock. The forward slopes and adjacent approach side slopes were designed to have inclinations of 2H to 1V. The lower portion of the two forward slopes were designed to be retained by a wall with an approximate height of 3 m (10 ft). Based on the cross-sections on the GA drawing, the footings are estimated to be founded at approximate Elevation 92.6 m on or within bedrock.

The GA drawing does not show design geotechnical resistances for the footings.

The 1955 31C00-028 report concluded that since the rock formation at the site was “sound and solid”, there would be “no problem regarding the bearing capacity” for the then proposed bridge structure. It also advised that sub-excavation to a depth of at least about two feet into the rock to avoid the more fractured superficial rock layers of bedrock and to increase the lateral resistance against shear.

6 ASSESSMENT OF EXISTING FOUNDATIONS

Based on information provided by the historical GA drawing and the GEOCRES report, a factored geotechnical resistance at ULS of 2,000 kPa for footings founded on limestone bedrock has been assessed in accordance with the requirements of the CHBDC 2014. The SLS condition does not govern footing design on sound bedrock. In addition, for sliding

resistance at the footing and limestone interface, an ultimate coefficient of friction, tan δ, of 0.6 may be used for evaluation.

It is noted that there is no construction records available to confirm whether the existing footings are founded on bedrock or not.

Structural inspection was carried out periodically by others as part of the Ontario Bridge Management System (OBMS). The available reports for the 2013 and 2015 inspections indicate that the bridge was generally in good structural condition apart from some spalling around the drainage basin, transverse cracks on the Highway 62 bridge approaches, and shrinkage cracks and exposed rebar on some of the retaining walls. These records are generally consistent with Thurber's observations during our recent site visit.

There is no documented record of the foundations having experienced any movement and the approach embankments appear to be performing well.

Given that the rigid frame structure is to be replaced by a larger bridge, it is anticipated the existing structure will be demolished and its footings will not be re-used.

7 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS FOR REPLACEMENT BRIDGE

7.1 Abutments and piers

Based on the existing information, abutments and piers of the replacement structures may be supported on spread footings founded on bedrock. For preliminary design of spread footings founded on the limestone bedrock at or below approximate Elevation 92.5 m, a factored geotechnical resistance at ULS of 2,000 kPa may be used. The SLS condition does not govern footing design on bedrock. For sliding resistance at the footing and limestone interface, an ultimate coefficient of friction, tan δ, of 0.6 may be used for evaluation. Minor sub-excavation at the bedrock surface may be required to remove the more fractured surficial rock and to create a more level subgrade surface. Mass concrete may be required to raise the subgrade level at some locations. Footings constructed on limestone bedrock do not require frost protection.

THURBER

7.2 Lateral Earth Pressure

Earth pressures acting on new abutment walls may be assumed to be triangular and to be governed by the characteristics of the abutment backfill. For a fully drained condition, the pressures should be computed in accordance with the CHBDC 2014 but are generally given by the expression:

$$p_h = K(\gamma h + q)$$

where: p_h = horizontal pressure on the wall at depth h (kPa)
K = earth pressure coefficient (see Table 7.1)
γ = unit weight of retained soil (see Table 7.1)
h = depth below top of fill where pressure is computed (m)
q = value of any surcharge (kPa).

Earth pressure coefficients for backfill to the abutment walls are dependent on the material used as backfill. Typical values are shown in Table 7.1.

Table 7.1 – Earth Pressure Coefficients

Wall Condition	Earth Pressure Coefficient (K)			
	OPSS Granular A or OPSS Granular B Type II $\phi = 35°$, $\gamma = 22.8$ kN/m^3		OPSS Granular B Type I $\phi = 32°$, $\gamma = 21.2$ kN/m^3	
	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)
Active (Unrestrained Wall)	0.27	0.40	0.31	0.48
At rest (Restrained Wall)	0.43	-	0.47	-
Passive (Movement Towards Soil Mass)	3.7	-	3.3	-

In conventional design, the use of a material with a high friction angle and low active pressure coefficient (e.g. Granular A, Granular B Type II) should be preferred as it results in lower earth pressures acting on the wall.

7.3 Approach Fills or Cuts

It is recommended that new forward slopes and approach sideslopes, which would consist of up to 7 m fill or cut, be designed to have inclinations not steeper than 2H : 1V.

No stability or settlement issues are anticipated at this site given the dense soils and the shallow depth to bedrock.

7.4 Excavation and Roadway Protection

It is anticipated that some of the replacement works may require roadway protection. Should this be the case, it is recommended that site investigation and field testing be carried out through the approach embankments in order to characterize the soils and to select parameters for geotechnical design of the roadway protection.

The design of roadway protection (temporary shoring) systems should be the responsibility of the Contractor. All shoring systems must be designed by a Professional Engineer experienced in such designs.

7.5 Groundwater Control

Groundwater control during footing construction is expected to be handled by sumps and pumps. Surface runoff should be diverted away from the excavations at all times and subgrade surfaces should be protected from precipitation.

8 ADDITIONAL SITE INVESTIGATION

The existing GEOCRES information was obtained and reported in the 1950's. The subsurface conditions depicted by this information is insufficient and incomplete to be used for design of new works. It will be necessary to carry out additional site investigation and field testing to support the preparation of foundation design recommendations for the bridge replacement.

For detail design, it is recommended that Guidelines for MTO Foundation Engineering Services (Version 2.0 October 2020) be followed. For this bridge replacement, the minimum requirements are summarized as follows:

- 2 BHs at each foundation element advancing to a minimum of 3 m below refusal.
- If bedrock is encountered, a minimum of 50 percent of the boreholes shall be cored for a minimum depth of 3 m.
- 1 BH at each bridge approach embankment within 20 m of the abutment, advancing to 3 m into a competent stratum or 10 m below the base of the fill. If bedrock is encountered, no coring is required.

9 CLOSURE

Dr. Nancy Berg, E.I.T. and Dr. Sydney Pang, P.Eng. prepared the Desktop Foundation Investigation Report. Dr. P.K. Chatterji, P.Eng. a Designated Principal Contact for MTO Foundations projects, reviewed the report.

THURBER ENGINEERING LTD.

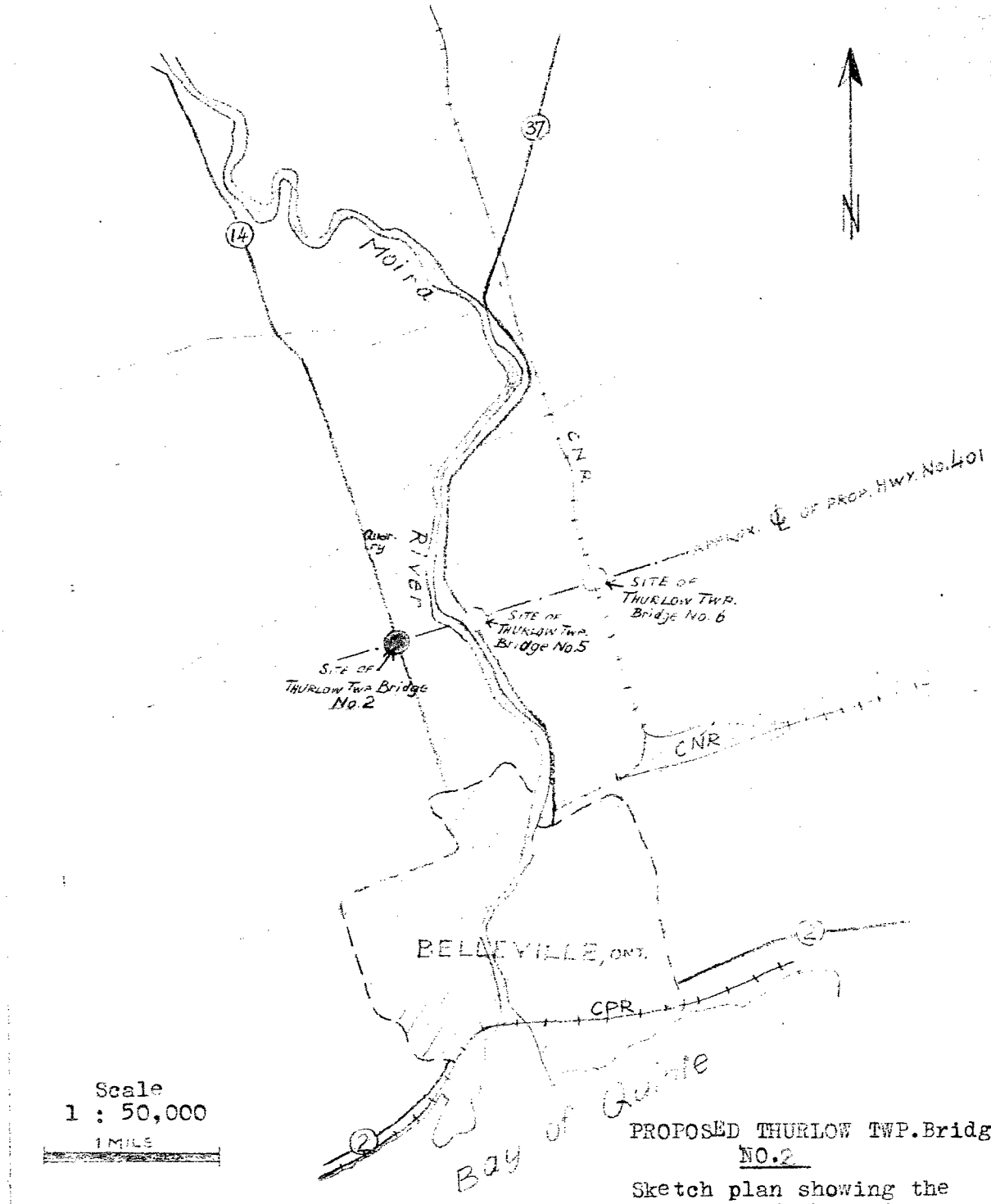
Sydney Pang, P.Eng.
Associate, Senior Foundation Engineer

P.K. Chatterji, P.Eng.
Principal, Designated MTO Contact

Appendix A

GEOCRES Information

S-500-501/55/T-61
PREP & DRAWN: K.T.

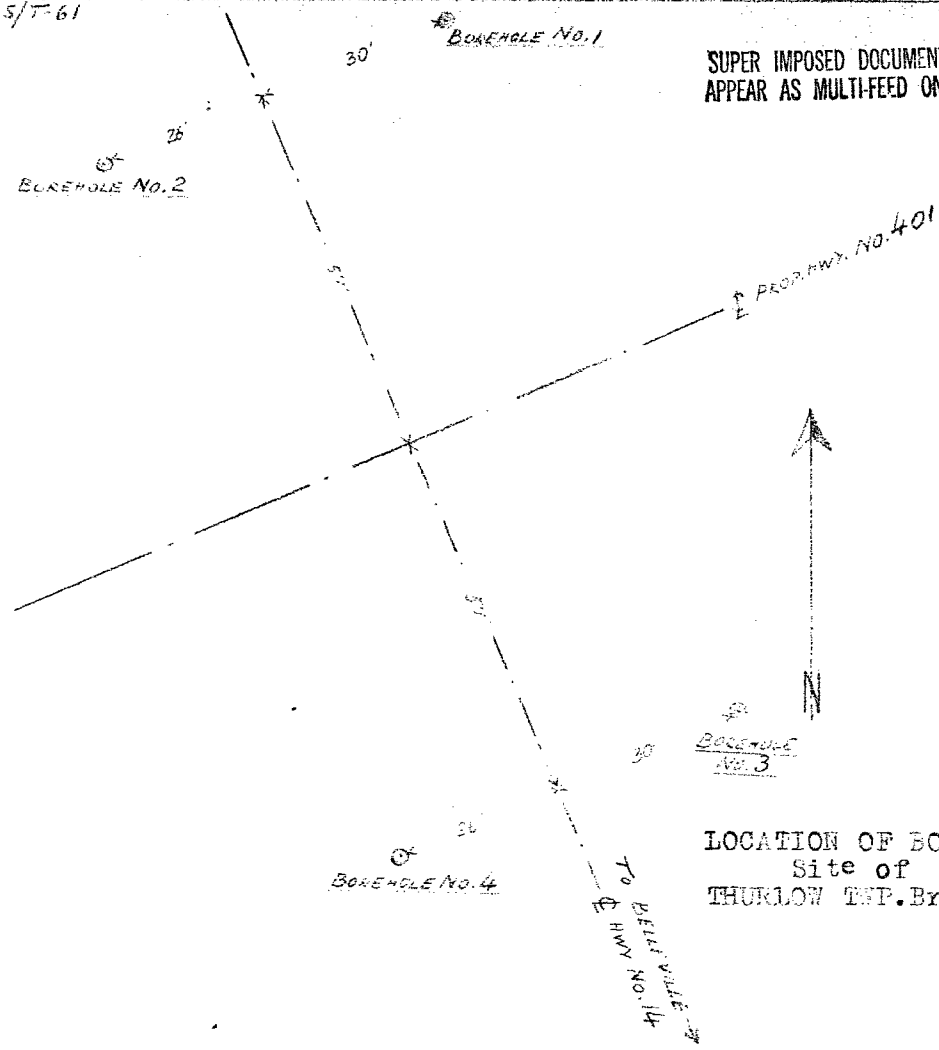


PROPOSED THURLOW TWP. Bridge NO. 2

Sketch plan showing the location of the site.

RACEY, MacCALLUM & ASSOCIATES, Ltd.

S-500-501/55/T-61



LOCATION OF BOREHOLES
Site of
THURLOW TWP. Bridge No.2

Bedding of Bedrock shown in wall of an abandoned quarry, about 1/2 mile north of the bridge site.

RACEY, MacCALLUM & ASSOCIATES, Ltd.

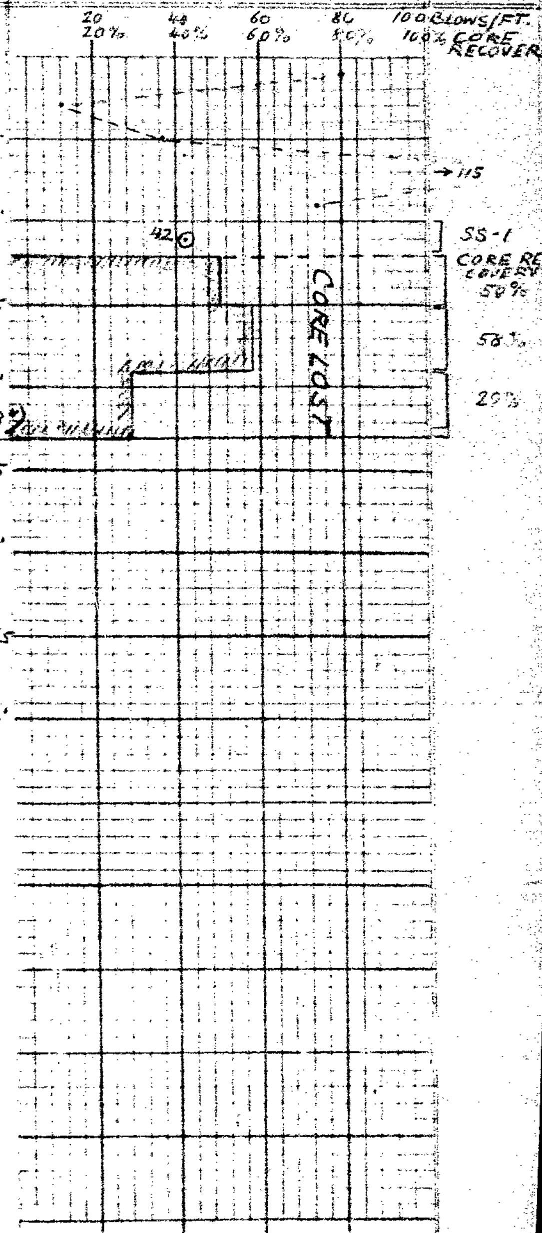
LOCATION OF BOREHOLES
Site of
THURLOW T.T.Bridge No.2

Bedding of bedrock shown in wall of an abandoned quarry, about 1/2 mile north of the bridge site.

Order No. S-500-50H/55/T-61 RACEY, MacCALLUM AND ASSOCIATES — A. McCABDEN, Driller
Limited
Dated ________ (Day Month Year)
Foundation Engineering Division
Hole Begun 7/2/55 — D. McCURDY, Helper
Hole Ended 9/2/55
Engineering Data Sheet for Borehole: 1

Job Name: THURLOW BRIDGE NO. 2 — K. TUBBESING, Checked by
Job Located: INTERSECTION OF HWY. NO. 14 AND PROP. HWY. NO. 401, ~2 MILES NNW OF BELLEVILLE, ONT.
Hole Located: AS SHOWN ON ATTACHED SKETCH PLAN.
Hole Elevation: 309.7 Datum: M.S.L.
15/2/55 (Day Month Year)

Depth	El.	Thickness	W	Symbol	Narrative
-0	309.7				GROUND SURFACE FROZEN GROUND
-2' -2.4	307.7 307.3		▽		WATER LEVEL IN PIPE BEFORE START OF WORK, 8/2/55, AND 9/2/55 (2.4')
					SANDY CLAY WITH GRAVEL (OF GLACIAL ORIGIN)
-6'	303.7				REFUSAL (BEDROCK)
					FOSSILIFEROUS, ARGILLACEOUS LIMESTONE, INTERBEDDED WITH LAYERS OF DARK GREY CLAY SHALE (HARD) BEDS OF VARYING THICKNESS (UP TO ~8")
-11.5'	298.2				END OF BOREHOLE



ABBREVIATIONS
W: WATER ... SATURATED ... HUMID

Order No.: S-500-501/55/T-61 RACEY, MacCALLUM AND ASSOCIATES Limited — A. McCABDEN, Driller

Dated: Day Month Year — Foundation Engineering Division

Hole Began: 10/2/55

Hole Ended: 15/2/55 — Engineering Data Sheet for Borehole: 2 — D. McCURDY, Helper

Job Name: THURLOW BRIDGE NO. 2 — K. TUBBESING, Checked by

Job Located: INTERSECTION OF HWY. No. 14 AND PROP. HWY. No. 401; ~2 MILES NNW OF BELLEVILLE, ONT.

Hole Located: AS SHOWN ON ATTACHED SKETCH PLAN

Hole Elevation: 309.8 Datum: M.S.L.

15/2/55 (Day Month Year)

Depth	El.	Thickness	W.	Symbol	Narrative
0	309.8				GROUND SURFACE
					FROZEN GROUND
					SANDY CLAY WITH GRAVEL
-3.75'	306.0				WATER LEVEL BEFORE START OF WORK ON 14/2/55 (HOLE 9' DEEP) AND 15/2/55 (HOLE 11.2' DEEP)
-5'	304.8				REFUSAL (BEDROCK). PIPE DRIVEN AFTER DRILLING WITH AXT DIAMOND BIT.
					FOSSILIFEROUS AND ARGILLACEOUS LIMESTONE, INTERBEDDED WITH DARK GREY CLAY SHALES (HARD)
					BEDS OF VARYING THICKNESS, UP TO ~ 8".
					BEDDING CLOSE TO THE HORIZONTAL.
-16'	293.8				END OF BOREHOLE

Tabular Values: 20 20% | 40 40% | 60 60% | 80 80% | 100 100% CORE RECOVERY

Sampling: Blows/Ft.

0 — 2.5 — 5 — 7.5 — 10' — 12.5 — 15' — 17.5

118

CORE LOST

CORE LOST

CORE RECOVERY:	Blows/Ft.
50%	121
100%	160
50%	178
66%	294
50%	
25%	
33%	
0%	
100%	
100%	
100%	

ABBREVIATIONS

Dated Day Month Year — A. McCADDEN, Driller

Limited
Foundation Engineering Division

Hole Begun: 16/2/55
Hole Ended: 17/2/55

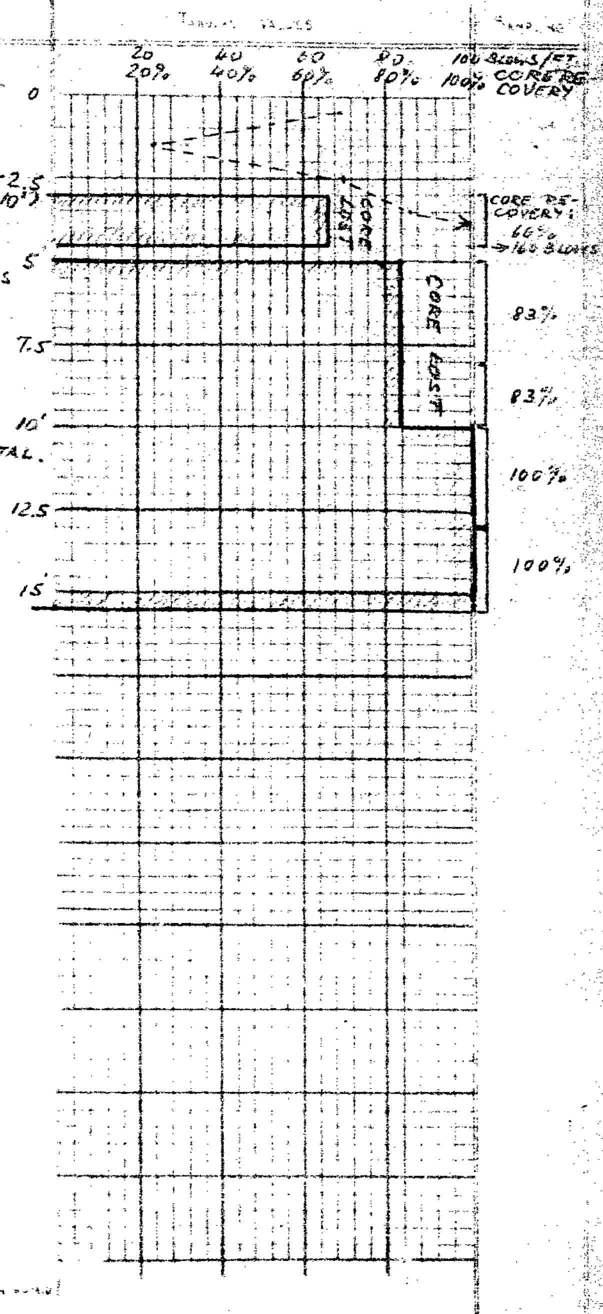
Engineering Data Sheet for Borehole: 3

D. McCURDY, Helper

Job Name: THURLOW BRIDGE NO. 2
Job Located: INTERSECTION OF HWY. NO. 14 AND PROP. HWY. NO. 401; ~ 2 MILES NNW OF BELLEVILLE, ONT.
Hole Located: AS SHOWN ON ATTACHED SKETCH PLAN.
Hole Elevation: 309.3 Datum: M.S.L.

K. TUBBESING, Checked by
20/2/55 Day Month Year

Depth	El.	Thickness	W	Symbol	Narrative
— 0	309.3				GROUND SURFACE
					FROZEN GROUND SANDY CLAY
— 2.2'	307.1		▽		WATER LEVEL IN PIPE BEFORE START OF WORK ON THE 17/2/55 (HOLE AT 10')
— 3'	306.3				REFUSAL (BEDROCK)
					FOSSILIFEROUS AND ARGILLACEOUS LIMESTONE, INTERBEDDED WITH DARK GREY CLAY SHALE (HARD)
					BEDS UP TO 8" THICK. BEDDING CLOSE TO THE HORIZONTAL.
— 15.5'	293.8				END OF BOREHOLE



Abbreviations
W: [illegible] SATURATED, [illegible]
D: DRY

Order No: 5500-501/55/T-61 RACEY, MacCALLUM AND ASSOCIATES Limited
Foundation Engineering Division

Date: Day Month Year

Hole Begun: 9/2/55
Hole Ended: 10/2/55

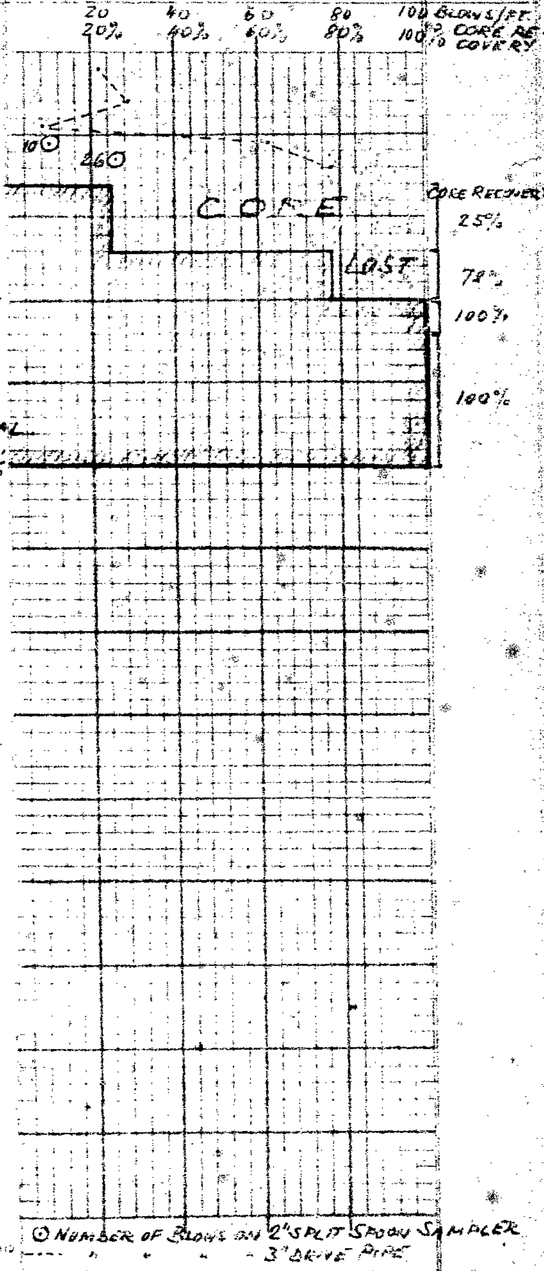
Engineering Data Sheet for Borehole: 4

A. MacCASLEN — Driller
D. McCURDY — Helper

Job Name: THURLOW BRIDGE No. 2
Job Located: INTERSECTION OF HWY. No. 14 AND PROP. HWY. No. 401; ~2 MILES NNW OF BELLEVILLE, ONT.
Hole Located: AS SHOWN ON ATTACHED SKETCH PLAN.
Hole Elevation: 310.0 Datum: M.S.L.

K. TUBBESING — Checked by
20/2/55 (Day Month Year)

Depth	El.	Narrative	
0	310.0	GROUND SURFACE	0
		SANDY GREY CLAY AND GRAVEL (OF GLACIAL ORIGIN)	2.5
4'	306.0	REFUSAL (BEDROCK)	5'
		FOSSILIFEROUS, ARGILLACEOUS LIMESTONE, INTERBEDDED WITH DARK GREY CLAY SHALE (HARD) BEDS UP TO 8" THICK. BEDDING CLOSE TO THE HORIZONTAL	7.5, 10'
12.5'	297.5	END OF BOREHOLE	12.5



Abbreviations

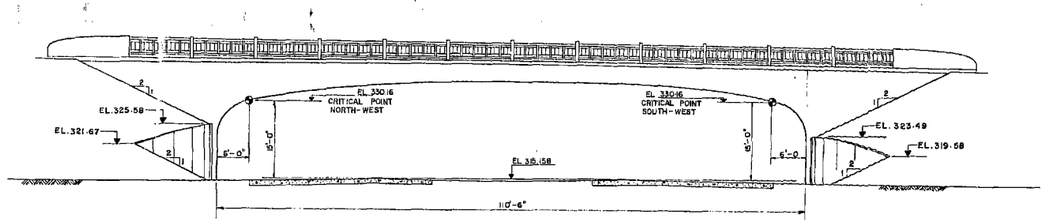
⊙ NUMBER OF BLOWS ON 2" SPLIT SPOON SAMPLER
" " " " 3" DRIVE PIPE

THURBER

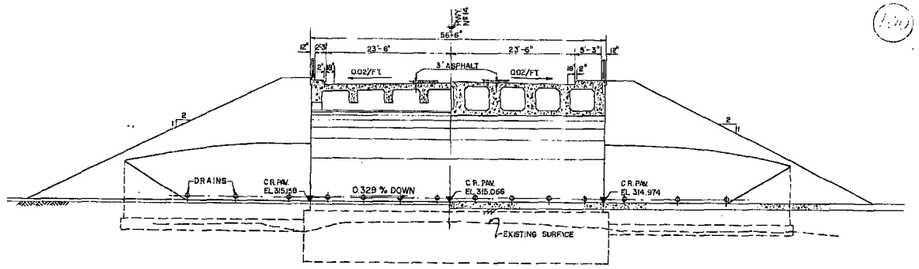
Appendix B

Archived Drawings

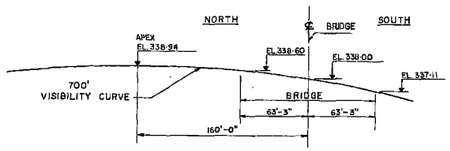
site 11-160



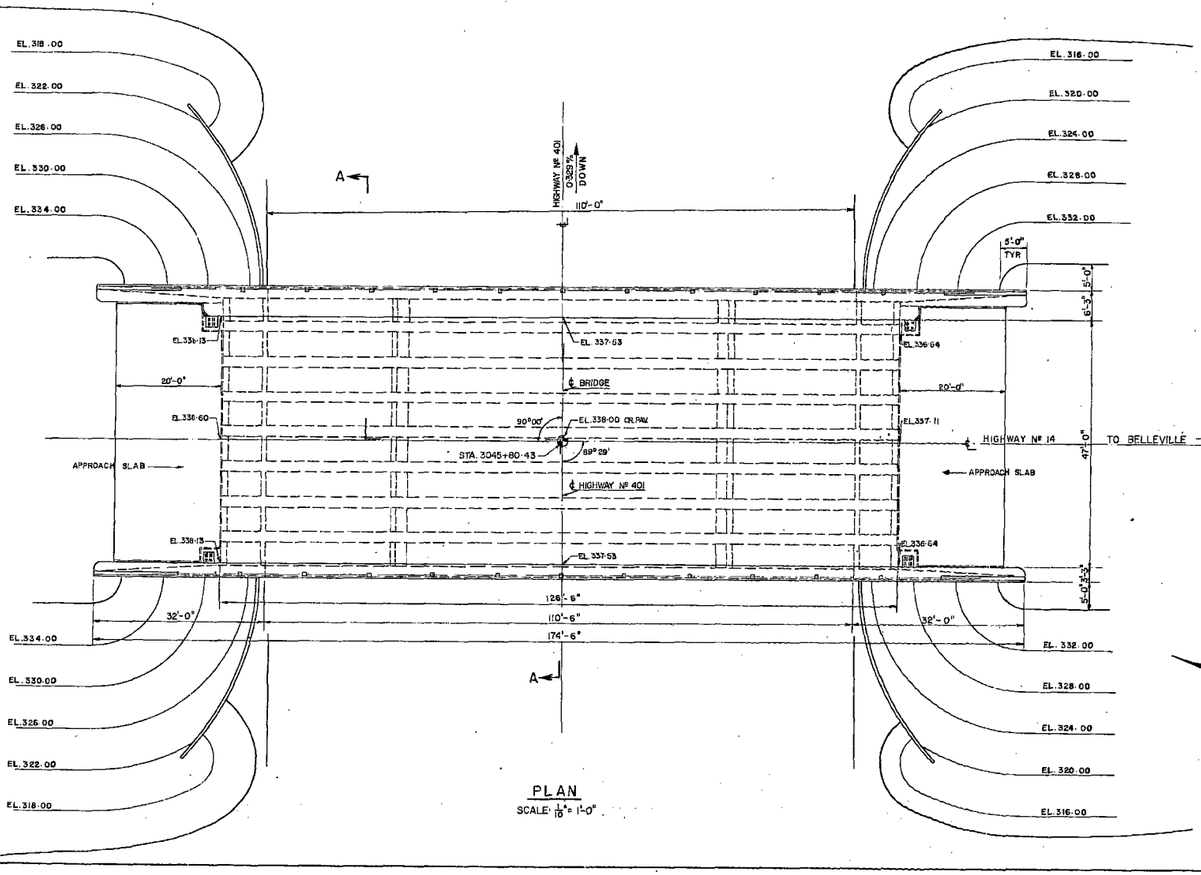
ELEVATION
SCALE: $\frac{1}{10}$ = 1'-0"



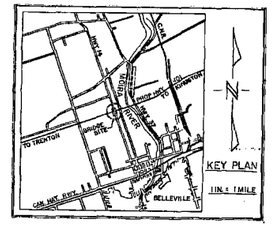
SECTION A-A
SCALE: $\frac{1}{10}$ = 1'-0"



PROFILE ℄ HIGHWAY Nº 14
FINISHED ELEVATION SHOWN
SCALE: $\frac{1}{4}$" = 1'-0" VERTICAL
1" = 50'-0" HORIZONTAL



PLAN
SCALE: $\frac{1}{10}$" = 1'-0"



NOTES:

- SKEW ANGLE OF BRIDGE = 0°00'00"
- FOR DIVISION ENGINEER: CONCRETE WORK ON THIS STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE DIVISION ENGINEER
- FOR GENERAL CONTRACTOR: STRUCTURE TO BE IN ACCORDANCE WITH THE GENERAL SPECIFICATIONS FOR HIGHWAY BRIDGES, ONTARIO, 1935, FORMS NO. 9, AND THE SPECIAL SPECIFICATIONS ATTACHED TO THE 'INFORMATION TO BIDDERS' SHEET, EXTRA COPIES OF WHICH MAY BE OBTAINED FROM THE DIVISION ENGINEER

PRINT RECORD

NO.	ITEM	DATE
1	REVISED	NOV.4/57
2	REVISED	NOV.25/57
3	SUBMITTED	FEB 9/58
4	REVISED	MAY 7/58

T.O. LAZARIDES, LOUNT & PARTNERS
STRUCTURAL CONSULTANTS
TORONTO MONTREAL VANCOUVER

DEPARTMENT OF HIGHWAYS: ONTARIO
BRIDGE OFFICE: TORONTO

THURLOW TOWNSHIP BRIDGE Nº 2
HIGHWAY 14 OVER HIGHWAY 401

THE KING'S HIGHWAY No. 401, 14 DIV. No. 8
CO. HASTINGS
TWP. THURLOW LOT 3 CON. II

GENERAL ARRANGEMENT

APPROVED
CHIEF BRIDGE ENGINEER
11-160
3552
1 to 19
CHIEF ENGINEER

DESIGN	H	CHKD	J.K.	CONTRACT NUMBERS	GENERAL
DRAWING	J.K.	CHKD	H.		55-216
TRACING	R.R.	CHKD	J.M-C	LOCATION	
DATE	22nd APRIL 1958			120-516 DRAWING NUMBER	D3552-1

REVISIONS

DATE	BY	DESCRIPTION

THIS PRINT SUPERSEDES ALL PRINTS BEARING A PREVIOUS LETTER

Twp 14-160-1-A

14-18-1

THURBER

Appendix C

Site Photographs

Figure 1 : Northeast approach embankment and retaining wall – April 30, 2018

Figure 2: Northwest approach embankment – April 30, 2018

Figure 3: Northwest retaining wall – April 30, 2018

Figure 4: Southeast approach embankment – April 30, 2018

Figure 5: Southeast Retaining Wall – April 30, 2018

Figure 6: Southwest approach embankment – April 30, 2018

Figure 7: Southwest Retaining Wall – April 30, 2018

Figure 8: North Abutment – April 30, 2018

Figure 9: North Approach – April 30, 2018

Figure 10: South Abutment – April 30, 2018