



THURBER ENGINEERING LTD.

MEMORANDUM

To: Christopher Schueler, P.Eng.
AECOM

Date: January 5, 2016

From: Alastair Gorman, P.Eng.
(Reviewed by P.K. Chatterji, P.Eng.)

File: 19-4406-20

PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN MADOC TOWNSHIP CULVERT (SITE 11-242/C)

1 INTRODUCTION

This memo presents a brief summary of the factual findings from a foundation review carried out for the existing Madoc Township Culvert on Highway 7 in the geographic township of Madoc – Municipality of Hastings, Ontario. It also presents preliminary geotechnical recommendations for use in assessment of the existing foundations at the site. It is noted that the proposed structural alternatives are not yet defined.

The recommendations provided in this memorandum are for planning, structure evaluation and preliminary design purposes only. Additional investigation and analysis may be required in any subsequent detail design phase of the project.

The following reference numbers apply to this site:

- Current W.P. 4017-13-01
- Site No. 11-242/C
- GEOCRES No. N/A
- Historic W.P. 922-61

2 SITE DESCRIPTION

The site is located on Highway 7 approximately 4.5 km east of Highway 62 in the Geographic Township of Madoc – Municipality of Hastings. Based on the RFP information, the existing culvert consists of a cast-in-place, rigid frame, open-footing culvert with a span of 6.1 m and a length of 16 m (please see Section 5 for clarification). It accommodates 2 lanes of traffic on Highway 7. The road grade on the culvert is approximately 5.5 m above the adjacent ground level.

The natural terrain in the vicinity of the culvert is generally rough to gently rolling with cobbles and boulders exposed on the ground surface. Bedrock outcrops are present approximately 50 m west and 300 m east of the site. The archive culvert design drawing indicates that the original grade in the vicinity of the culvert was near elevation 161.0 m. Highway 7 was constructed to approximate elevation 166.4.



3 SUBSURFACE CONDITIONS

The site is located within the physiographic region known as the Dummer Moraines, an area of rough stoney land bordering the Canadian Shield. The moraines are characterized by angular fragments and blocks of limestone as well as some Precambrian rocks. Geologic maps indicate that the underlying bedrock generally consists of siliceous clastic metasedimentary rocks of the Grenville Supergroup.

GEOCREST information is not available for this site. The archive "General Plan and Retaining Walls" and "Culvert & Wingwalls" drawings for the existing culvert indicate that bedrock is very close to the ground surface. The drawings for the existing culvert are attached in Appendix A.

4 SITE OBSERVATIONS

Foundations engineering staff from Thurber visited the site to observe conditions related to the geotechnical performance.

No obvious signs of settlement or distress of the existing culvert and headwalls were observed. The approach embankments appeared to be stable, with no obvious signs of instability, bulging or erosion.

Photographs of the structure and the approaches are attached in Appendix B.

5 EXISTING FOUNDATIONS

The RFP information indicates that the existing culvert has an overall length of 16 m. However, the archive design drawings show an overall culvert length of 26.8 m, constructed in two stages of 10.5 m (south end, first stage) and 16.3 m (north end, second stage). Site observation confirms the length of 26.8 m.

The south end of the culvert was to be supported on 1.4 m wide spread footings "to be poured against undisturbed ground" at a minimum depth of 1.2 m. The remainder of the culvert was to be supported on 0.86 m wide footings founded on bedrock with 19 mm dowels drilled and grouted 600 mm into rock.

6 ASSESSMENT OF EXISTING FOUNDATIONS

The archive information indicates that the majority of the existing culvert is founded on bedrock. The founding material for the south end of the culvert is not defined on the design drawings, however it is likely that this section was also founded on bedrock. The foundations appear to be performing satisfactorily, and it can be assumed that the foundations will continue to perform satisfactorily under similar loading in the future.

The RFP document suggests that the required rehabilitation work will consist of concrete repair to the culvert barrel. In this case, there will be no appreciable increase in the loading.



If a significant (greater than 10%) increase in loading or replacement of the culvert is subsequently planned, it will be necessary to carry out further assessment and possibly site investigation and field testing to support the preparation of foundation design recommendations.

7 EXCAVATION AND ROADWAY PROTECTION

If the selected rehabilitation strategy requires excavation in the approach fills adjacent to the culvert, it is recommended that site investigation and field testing be carried out in each approach fill in order to characterize the fill and bedrock, and to select parameters for the design of roadway protection. Since the bedrock is at shallow depth, two boreholes should be drilled within each approach fill. The boreholes should extend to sufficient depth to delineate the bedrock surface or to twice the depth of excavation, whichever is the lesser. It should be noted that the archive drawing shows a rock fill embankment, though this was not confirmed by inspection.

8 CLOSURE

The subsurface information used in the preparation of this memorandum was taken from the archive design drawings "General Plan & Retaining Walls" and "Culvert & Wingwalls" dated February 1963. GEOCRETS information was not available.

The memorandum was prepared by Mr. Murray Anderson, P.Eng., Senior Foundations Engineer and was reviewed by Mr. Alastair Gorman, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.

Murray Anderson, P.Eng.
Associate, Senior Foundation Engineer

Alastair Gorman, P.Eng.
Associate, Senior Foundation Engineer

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

Attachments

Client: AECOM

File No.: 19-4406-20

E file: h:\19\4406\20 eastern rehab 18 structures\reports and memos\group 2\madoc township culvert\site 11-242c madoc township culvert draft memo.docx

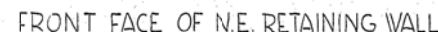
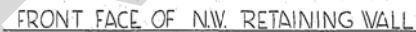
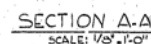
Date: January 5, 2016

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Appendix A
Archive Drawings

DRAFT



KEY PLAN
SCALE: 1 IN. = 1 MI.

LIST OF DRAWINGS	
D-5213-1	GENERAL PLAN & RETAINING WALLS
2	CULVERT & WINGWALLS
3	REINFORCING STEEL SCHEDULE

1. BUILD SOUTH PORTION OF NEW CULVERT.
2. DEMOLISH AND REMOVE OLD CULVERT.
3. BUILD NORTH PORTION OF NEW CULVERT.

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 N° 9
AND THE SPECIAL PROVISIONS, EXTRA COPIES OF WHICH
MAY BE OBTAINED FROM THE DISTRICT ENGINEER.

MIN. STRENGTH OF CONCRETE @ 28 DAYS : 3000 P.S.I.
APPROVED ADMIXTURES SUPPLIED BY THE CONTRACTOR W
BE ADDED TO ALL CONCRETE AS SPECIFIED BY THE ENGINE
CLEAR COVER ON REINFORCING STEEL

CONSTRUCTION NOTES
ALL EXPOSED EDGES TO BE CHAMFERED 1/4" EXCEPT AS NOTED
ALL CONSTRUCTION JOINTS MUST BE APPROVED BY THE
BRIDGE ENGINEER.

FOOTINGS TO BE POURED AGAINST UNDISTURBED GROUND.

REVISIONS	DATE	BY	DESCRIPTION
	4/14/23/07	A.E.S	REVISED AS-CONSTRUCTED.
	23.VI.64	M.H.	△ NORTH PORTION OF CULVERT REV.
	10.3.03	J.G.G.	△ GENERAL NOTES REV. SECTION A-A REV.

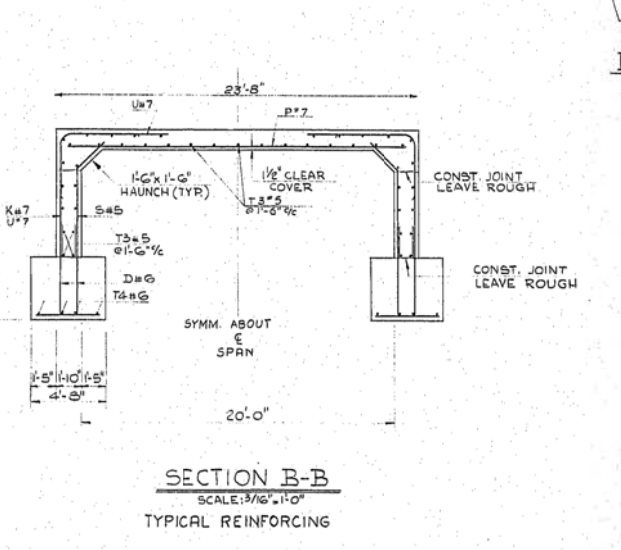
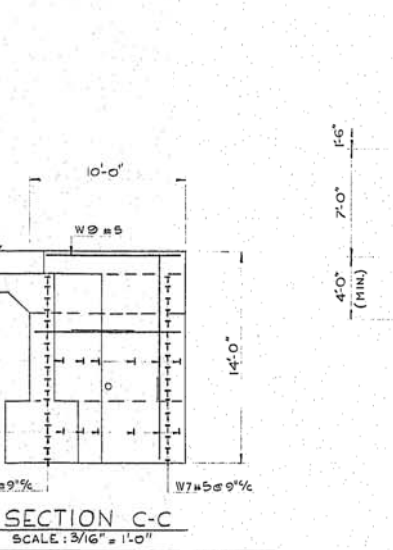
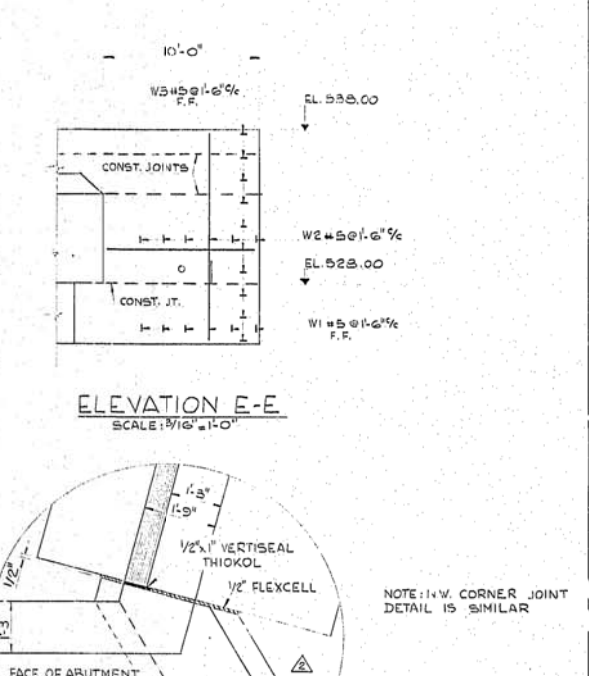
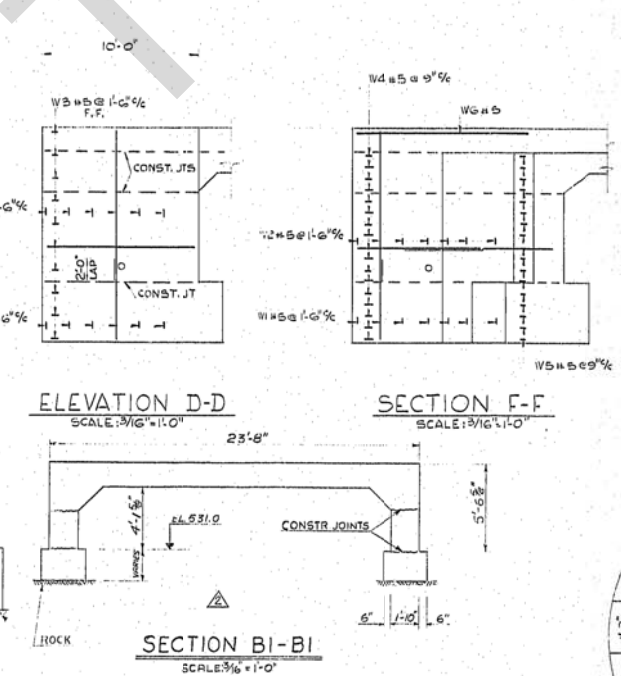
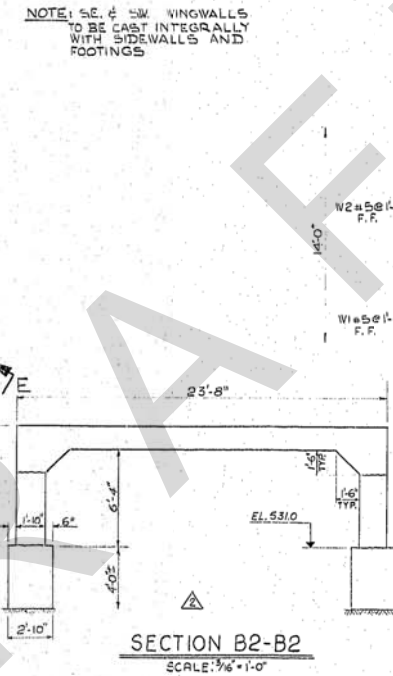
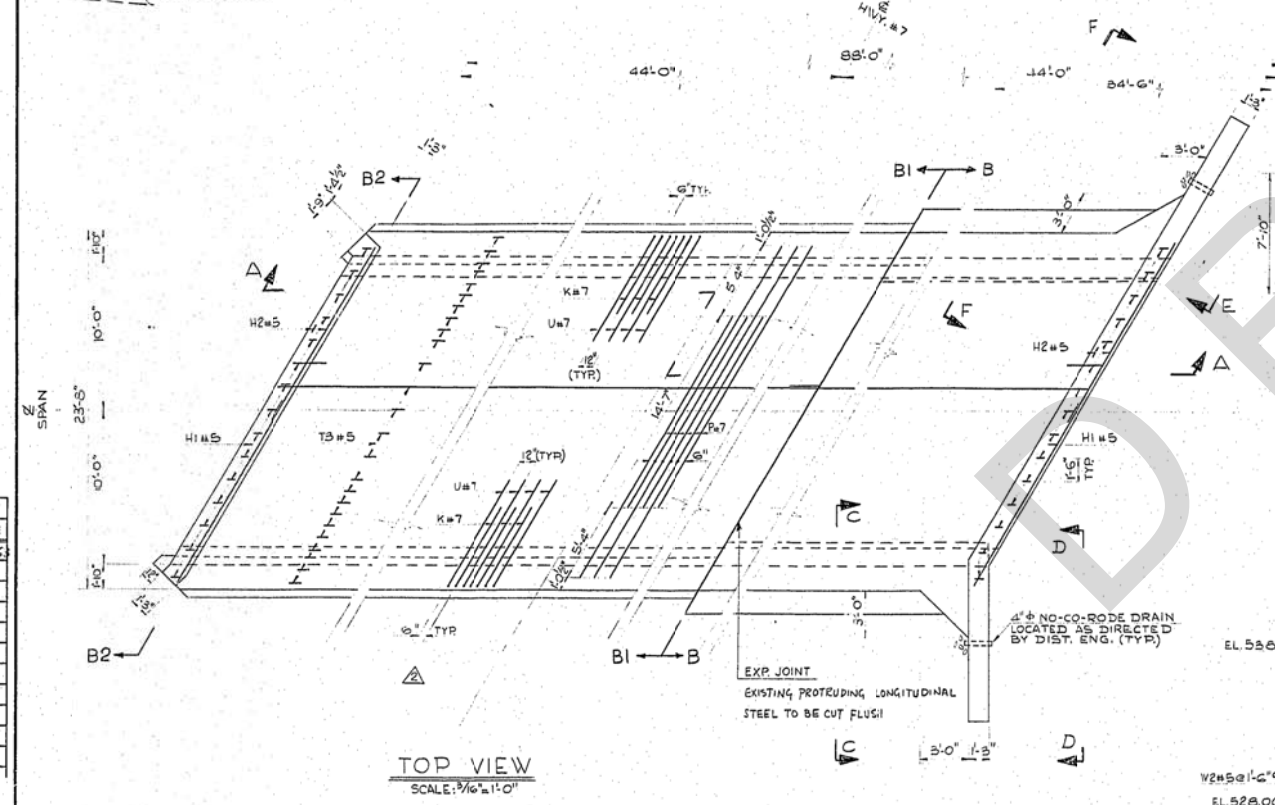
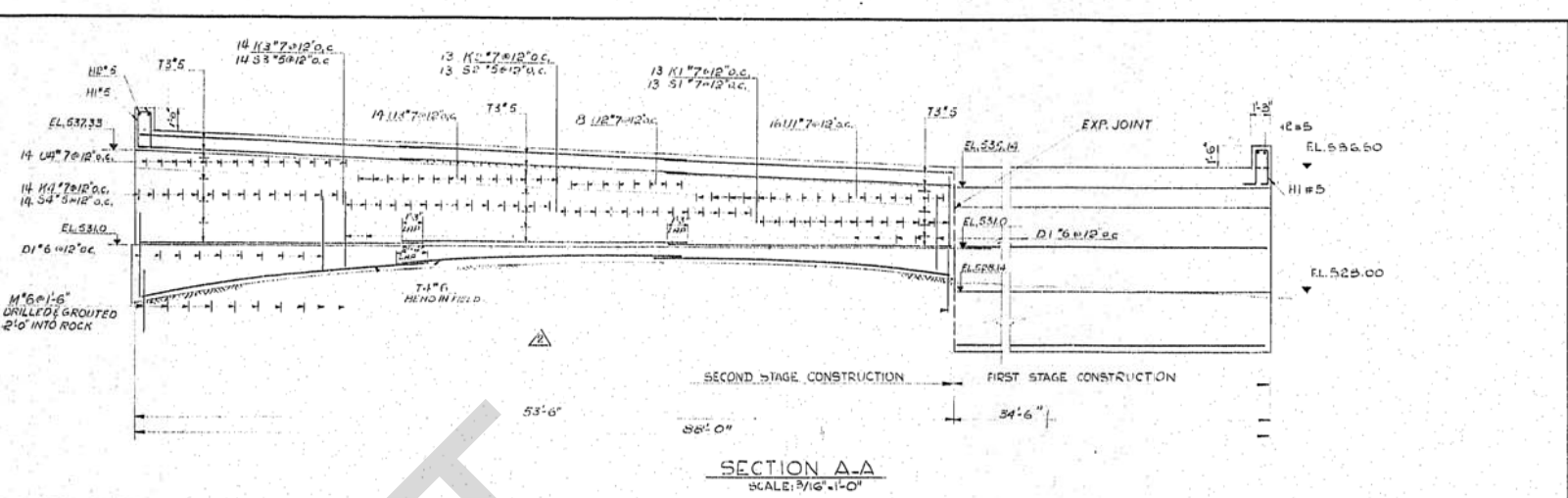
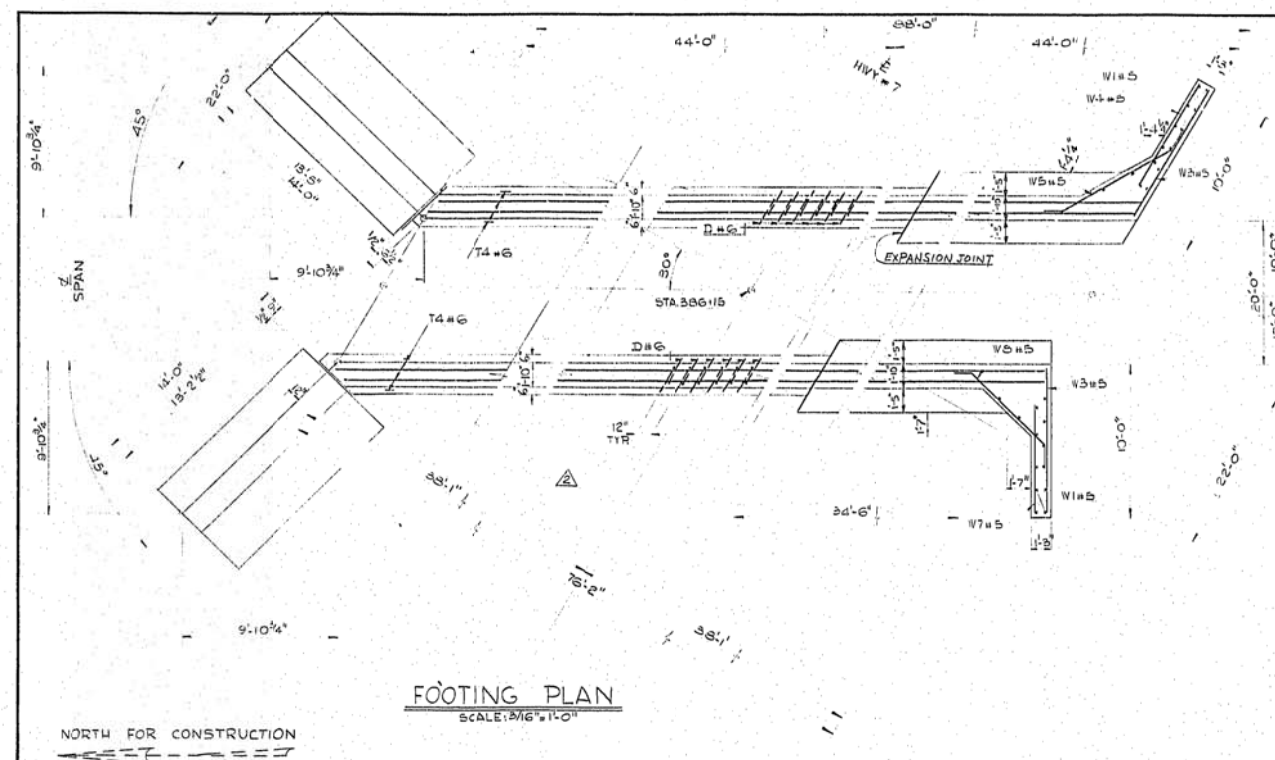
20'x7' RIGID FRAME CULVERT

KING'S HIGHWAY No. 7 T.C.H. DIST. No. 8
CO. HASTING STA. 386 + 15
TWP. MADOC LOT 2 & 3 CON. IX

GENERAL PLAN & RETAINING WALLS

APPROVED <i>Carl E. [Signature]</i>				SITE No. 12-242		W.P. No. 922	
BRIDGE ENGINEER							
DESIGN	G. P.	CHECK	W.T.H.	CONTRACT No.		PLAN No.	
DRAWING	G. P.	CHECK	W.T.H.			63	
DATE	FEB. 1963		LOADING	H20-S16	DRAWING No.	D-5243-1	

[illegible]



DETAIL OF N.E. CORNER JOINT

SCALE: 1/2" = 1'-0"

REVISIONS	DATE	BY	DESCRIPTION
1	11-23-64	A.E.S.	REV. AS-CONSTRUCTED.
2	5-27-64	W.H.R.	W. NORTH PORTION OF CULVERT REVISED. SECTION 81-81 ; 82-82 ADDED

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION									
<u>20'x7' RIGID FRAME CULVERT</u>									
KING'S HIGHWAY No. 7 I.C.H.						DIST. No. 8			
CO. HASTING						STA. 386+15			
TWP. MADOC						LOT 243		CON. 1X	
CULVERT & WINGWALLS									
APPROVED <u>Chris L.</u> BRIDGE ENGINEER						SITE No. 12-242		W.P. No. 922-61	
DESIGN	GP	CHECK	W.T.H.	CONTRACT				C. 2233-114	
DRAWING	GP	CHECK	W.T.H.	Nos.				63-114	
DATE	FEB. 1963		LOADING	420-516	DRAWING No.		D-5213-2		



Appendix B
Site Photographs



South End of Madoc Township Culvert, looking northwest



South Side of Highway 7 over Culvert, looking east



North End of Madoc Township Culvert, looking east



North End of Madoc Township Culvert, looking southwest



North Side of Highway 7 over Culvert, looking west



Highway 7 Pavement over Culvert, looking north