

COLLINS ENGINEERS^{INC}

UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 108B00041N

KY-2885 OVER SIMPSON CREEK

SPENCER COUNTY, KY

DISTRICT 5

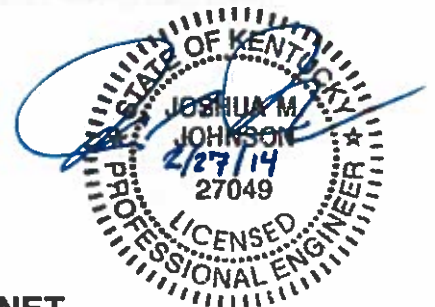


JULY 2013

PREPARED FOR THE



KENTUCKY TRANSPORTATION CABINET



UNDERWATER INSPECTION SUMMARY

GENERAL:

Inspection Date: July 10, 2013
Inspection Team Leader: Joshua M. Johnson, P.E.
Support-Divers: Adam R. Davis, P.E.; Allen D. Cantrell, E.I.T.
Inspection Method: Surface Supplied Air

BRIDGE INFORMATION:

Superstructure Type: Single Simple Span of Precast Prestressed Concrete Box Beam
Substructure Type: Reinforced Concrete Abutments
SSUs in Water: Abutments 1 and 2
Year Constructed: 1981

GENERAL CONDITIONS:

Water Visibility:	2 feet	Water Velocity:	< 1 ft/s
Water Temperature:	65 °F	Weather:	Overcast – 90 °F
Waterline Elevation:	97.0 feet	Approx. HW Mark:	N/A

Waterline Reference: Bottom of the Deck at the Downstream End of Abutment 1
Maximum Depth at SSU: 9.3 feet – Downstream End of Abutment 2
Shoreline Conditions: Moderately Vegetated Embankments with Minor Erosion

SUBSTRUCTURE CONDITIONS:

Abutment 1: Concrete surfaces exhibited light scaling from the waterline to the channel bottom. Vertical cracking and spalling was noted in areas of previous repair. See Figure 4 in Appendix A for detailed inspection notes.
Abutment 2: Concrete surfaces exhibited light scaling from the waterline to the channel bottom. The footing along the south face was undermined and shear cracks were noted on both wingwalls. Construction joints were separated on both wingwalls. Spalling was noted in areas of previous repair. See Figure 5 in Appendix A for detailed inspection notes.

RECOMMENDATIONS:

Replace structure.
 Perform load rating analysis and impose load restrictions on this structure based on results.
 Perform structural repairs to Abutment 2 until a replacement bridge can be constructed.

UNDERWATER INSPECTION CODING:

NBI Ratings:

Item	Description	Coding	Condition
60	Substructure	2 – Critical Condition	Advanced Deterioration & Undermining
61	Channel	7 – Good Condition	Minor Erosion
92B	UW Insp. Frequency	12 Months	Inspector Recommended
93B	Insp. Date	07 10 13	
113	Scour Critical Bridges	3 – Scour Critical	Unstable (Inspector Recommended)

AASHTO Element (CoRe) Ratings:

Element #	Description	Units	Total	Condition State			
				1	2	3	4
215	Abutment	LF	38	0	0	19	19

Note: Ratings were developed using the FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges. The recommended ratings consider inspected elements located within the waterway and conditions existing below the water surface only. Additional consideration is necessary for the assignment of overall condition ratings for this bridge.



 Joshua M. Johnson, P.E

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION.....	1
1.1 Purpose and Scope	1
1.2 General Description of the Structure	1
1.3 Method of Investigation	1
2.0 EXISTING CONDITIONS	2
2.1 General Conditions.....	2
2.2 Substructure Conditions	3
3.0 EVALUATION AND RECOMMENDATIONS.....	3

APPENDIX

APPENDIX A - FIGURES

APPENDIX B - PHOTOGRAPHS

1.0 INTRODUCTION

1.1 Purpose and Scope

This report consists of the results of a detailed underwater investigation performed at the KY-2885 Bridge over Simpson Creek in Spencer County, KY. Collins Engineers, Inc. (Collins) conducted the underwater investigation for the Kentucky Transportation Cabinet (KYTC) on July 10, 2013. The primary purpose of the investigation was as follows:

- Determine the condition of the substructure components located in the water at the time of the inspection from the waterline to the channel bottom.
- Obtain channel bottom depth measurements along the bridge fascias, upstream and downstream of the bridge, and around the submerged substructure units.
- Determine the condition of the shorelines in the vicinity of the structure.
- Obtain photographs of the bridge and any significant defects.

In addition, a brief inspection was made of areas that could be submerged during periods of high water. The following report includes a description of the structure, the method of investigation, a description of existing conditions, an evaluation and recommendations based on the conditions, inspection figures, and photographs.

1.2 General Description of the Structure

Structure No. 108B00041N spans 22 feet, carrying KY-2885 over Simpson Creek and is approximately 18 feet wide. The bridge superstructure is constructed of one precast prestressed concrete box beam span. The roadway orientation of the longitudinal axis of the bridge is south to north. The substructure units are labeled as Abutments 1 and 2. Existing design drawings were not available at the time of the inspection. Refer to Figure 1 in Appendix A for a Location Map of the bridge. Refer to Photographs 1 and 2 Appendix B for overall views of the bridge.

1.3 Method of Investigation

A detailed field inspection was conducted to determine the physical condition of the submerged bridge substructure units from the waterline to the channel bottom. A brief visual examination of the substructure units above the waterline was also made.

A three-person team consisting of two professional engineer-divers and team leader (Joshua M. Johnson, P.E. and Adam R. Davis, P.E.) and an engineer-diver (Allen D. Cantrell, E.I.T.) conducted the underwater inspection. The inspection was conducted using surface supplied air diving equipment. During the inspection, the divers worked from the shore and a note taker on the shore recorded the inspection notes.

The underwater inspection consisted of a visual and tactile examination of the accessible surfaces of the substructure units from the waterline to the channel bottom with particular attention given to any observed areas of deterioration or apparent distress. Approximately 10 percent of the total area on the underwater surfaces of the substructure units was cleaned so that the substrate condition could be more closely examined. Photographs were taken to document the general conditions and observed deficiencies. The type of channel bottom material, the presence or extent of scour, the presence or extent of riprap, the presence or extent of drift and debris, and the location of any foundation exposure or undermining were noted.

The channel bottom was sounded utilizing a digital fathometer and telescoping survey rod. Soundings were taken along both fascias and approximately 50 feet upstream and downstream of the bridge. Soundings were also taken along the pier faces and noses, between the piers along the structure centerline, and the waterline was referenced to a known elevation on the bridge. A sounding plan was developed using the soundings and mapping of the shoreline. Refer to Figures 2 and 3 in Appendix A for the sounding plan and channel cross sections that show the channel limits and water depths around the structure.

2.0 EXISTING CONDITIONS

2.1 General Conditions

At the time of the inspection, the waterline of Simpson Creek was located approximately 3.0 feet below the bottom of deck at the west face of Abutment 1, which corresponds to an assumed waterline elevation of 97.0 feet. During the inspection the waterway was flowing less than 1 foot per second. There were indications of localized scour on the south face of Abutment 2. The shorelines adjacent to the bridge consisted of medium dense clay and riprap and exhibited minor erosion. Refer to Figures 2 through 5 in Appendix A for detailed inspection notes on the substructure units. Refer to Photographs 3 through 6 in Appendix B for views of the shorelines

Based on the critical findings at Abutment 2, it is recommended that the submerged substructure units of Structure No. 108B00041N be next inspected underwater at an interval not to exceed 12 months. Topside inspections are currently being conducted by the District after each major rain event.

Respectfully submitted,

COLLINS ENGINEERS, INC.

Joshua M. Johnson, P.E.
Field Team Leader

Originated By:
Allen D. Cantrell, E.I.T.

near the structure. The channel bottom material around the abutments consisted of bedrock with no probe rod penetration.

2.2 Substructure Conditions

Abutment 1

The concrete below the water surface on Abutment 1 exhibited light scaling with up to 1/8 inch of section loss. The footing is socketed into bedrock and no undermining was observed. Vertical cracking up to 1/16 inch wide from 18 inches below the waterline to the bottom of the deck was noted in areas of previous repair. Spalling up to 2 feet by 2 feet with 8 inches of penetration and exposed reinforcement was also observed in areas of previous repair. Refer to Photographs 7 through 10 in Appendix B for views of Abutment 1.

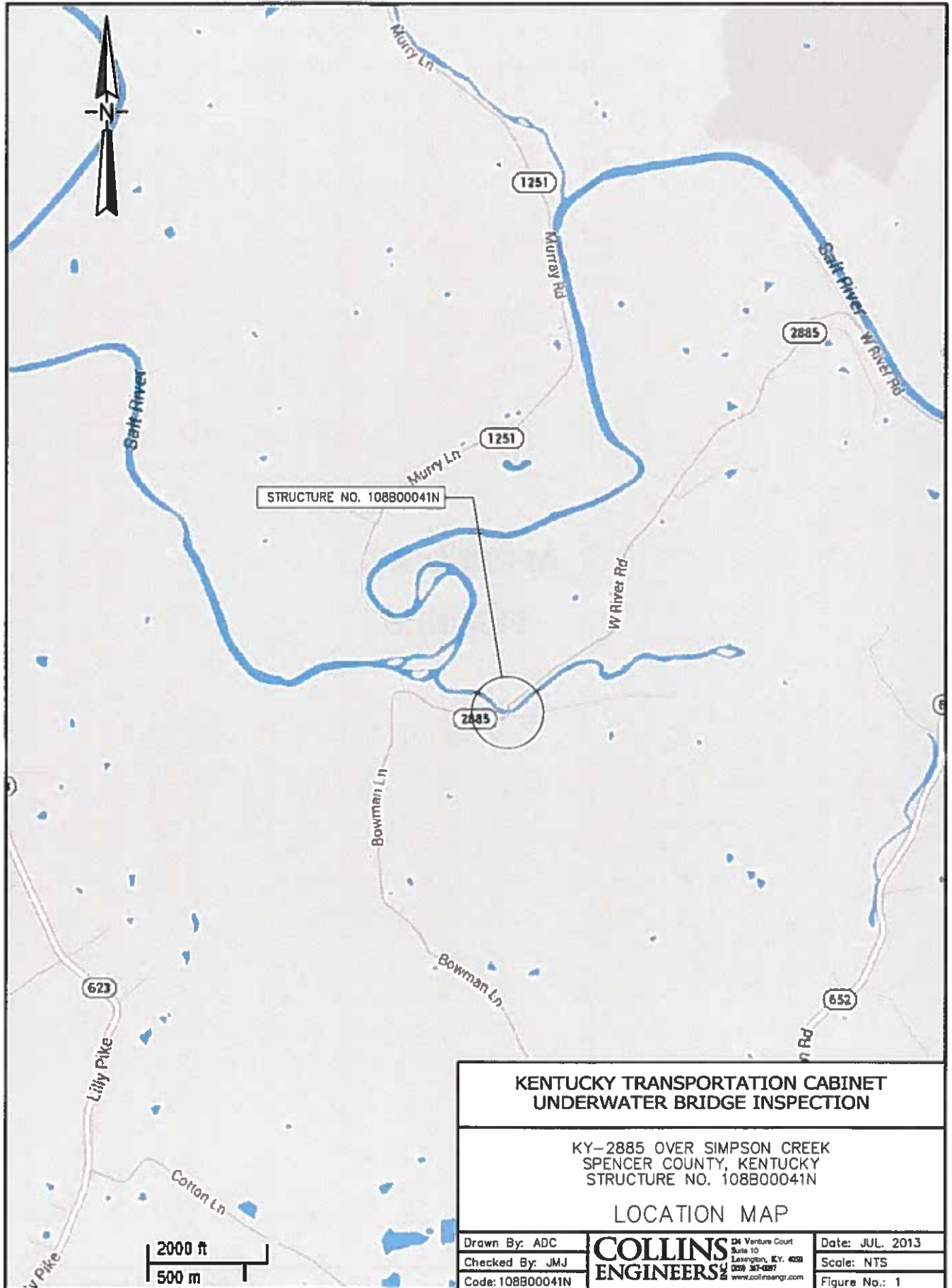
Abutment 2

The concrete below the water surface on Abutment 2 exhibited light scaling with up to 1/8 inch of section loss. The footing is socketed into bedrock, however the rock socket is oversized and the backfill material is eroding during high flow events. Undermining was observed on the south face with a vertical exposure of 2 feet and up to 3 feet of penetration. The backfill material consists of stiff clay with 6 inches of penetration. Shear cracking up to 1/2 inch wide from bottom of footing to the bottom of the deck was noted on both wingwalls. Construction joints on both wingwalls were separating with observed dimensions of up to 1/2 inch wide. Spalling up to 6 feet by 3 feet with 3 inches of penetration and exposed reinforcement was also observed in areas of previous repair. Refer to Photographs 11 through 18 in Appendix B for views of Abutment 2.

3.0 EVALUATION AND RECOMMENDATIONS

The inspected substructure units of Structure No. 108B00041N were in critical condition due to contraction scour at Abutment 2. **A load rating should be performed and load restrictions should be placed on this structure based on those results. This bridge should be replaced on a priority basis. Structural repairs to Abutment 2 should be implemented until a replacement bridge can be constructed.**

**APPENDIX A:
FIGURES**



**KENTUCKY TRANSPORTATION CABINET
UNDERWATER BRIDGE INSPECTION**

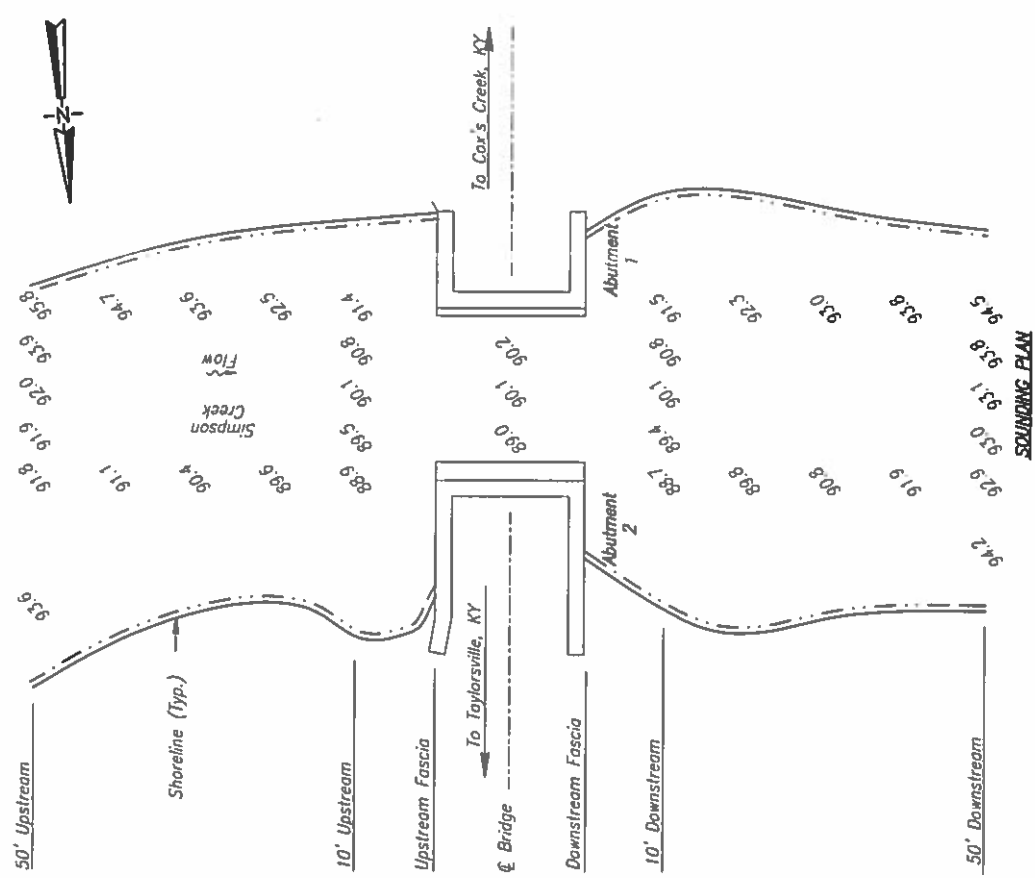
KY-2885 OVER SIMPSON CREEK
SPENCER COUNTY, KENTUCKY
STRUCTURE NO. 108B00041N

LOCATION MAP

Drawn By: ADC
Checked By: JMJ
Code: 108B00041N

COLLINS ENGINEERS
24 Venture Court
Suite 10
Lexington, KY 40509
606-357-0287
www.collinsengr.com

Date: JUL. 2013
Scale: NTS
Figure No.: 1



GENERAL NOTES:

1. Abutments 1 and 2 were inspected underwater.
2. At the time of inspection on July 10, 2013, the waterline was located approximately 3.0 feet below the bottom of deck (assumed EL. +100.0 feet) on the west face of Abutment 1. This corresponds with an assumed waterline elevation of +97.0 feet.
3. Soundings indicate the water depth at the time of inspection and are measured in feet.
4. Soundings were taken parallel to the bridge at 10 feet and 50 feet upstream and downstream of the fascias, at 1/4 point intervals between the substructure units, and at 10 feet intervals in-line with the abutments upstream and downstream.

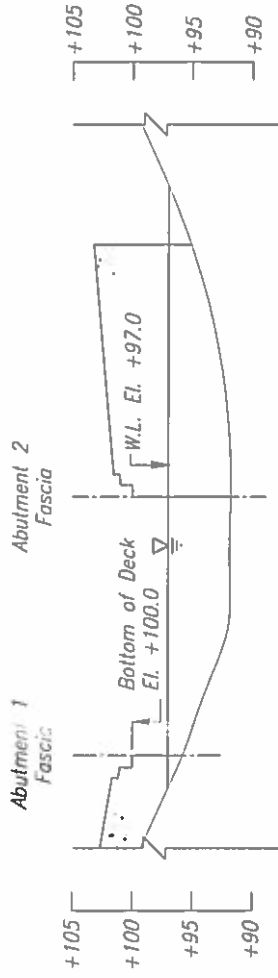
Legend
27.0 Channel Bottom Elevation (ft)

**KENTUCKY TRANSPORTATION CABINET
UNDERWATER BRIDGE INSPECTION**

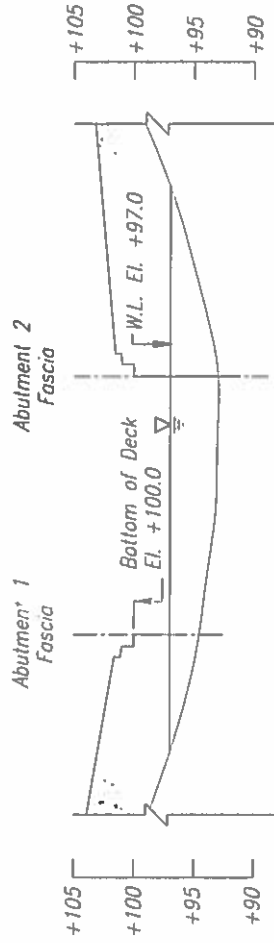
KY-288E OVER SIMPSON CREEK
SENDER COUNTY, KENTUCKY
STRUCTURE NO. 108600041N

SOUNDING PLAN

Drawn By: AJC	Date: JUL 2013
Checked By: AJC	Scale: NTS
Code: 108600041N	Collins Engineers, Inc.
	108600041N
	Figure No.: 2



50 FEET UPSTREAM CHANNEL CROSS SECTION



50 FEET DOWNSTREAM CHANNEL CROSS SECTION

Legend

- Approximate Channel Bottom - July 2013
- - - Approximate Channel Bottom - July 2008
- Approximate Channel Bottom - July 2003
- ▽ Water Surface
- +90 Elevation (ft)

Note:
Footing elevations unknown due to unavailable record drawings.

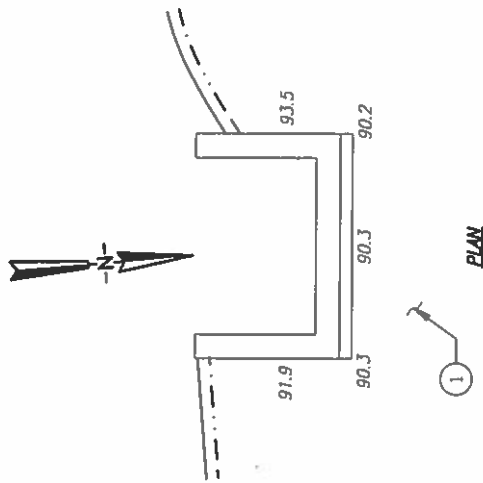
KENTUCKY TRANSPORTATION CABINET
UNDERWATER BRIDGE INSPECTION

KY-2885 OVER SIMPSON CREEK
SPENCER COUNTY, KENTUCKY
STRUCTURE NO. 108B00041N

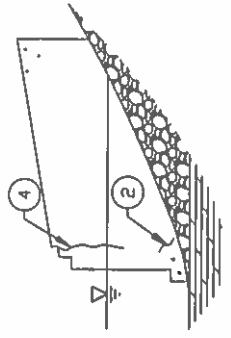
CHANNEL CROSS SECTIONS

Drawn By: ADC	Checked By: JJJ	Date: JUL. 2013
Code: 108B00041N	Scale: NTS	Figure No.: 3

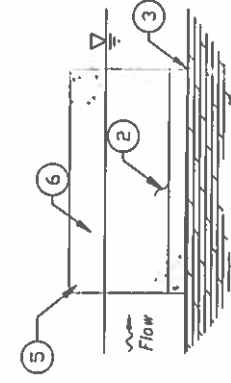
COLLINS
ENGINEERS



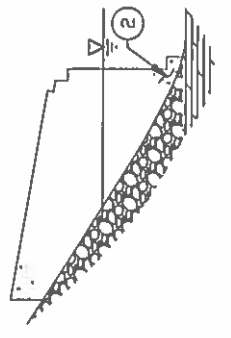
Legend
 27.0 Channel Bottom Elevation (ft)
 Water Surface



EAST ELEVATION



SOUTH ELEVATION



WEST ELEVATION

Note:
 Footing elevations unknown due to unavailable record drawings.

INSPECTION NOTES:

- ① The channel bottom material consisted of bedrock along the breastwall of each abutment and transitioned to rip rap along all wingwalls with no probe rod penetration.
- ② The submerged portions of the abutment exhibited light scuffing and the top of the exposed footing was rough pour concrete.
- ③ The footing was socketed into bedrock with no undermining observed.
- ④ Vertical crack typically $\frac{1}{8}$ " wide at the location of a previous repair extending from 18" below the waterline to bottom of the deck.
- ⑤ Spall at the location of a previous repair measuring 2' vertical by 2' horizontal with 8" penetration and 1 exposed reinforcing steel bar.
- ⑥ Spall measuring 1' vertical by 2" penetration with no exposed reinforcing steel bars centered 6" above the waterline.

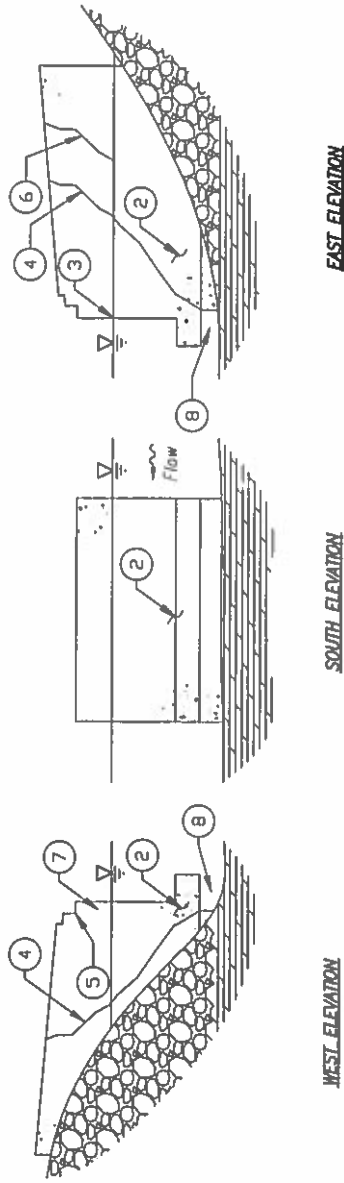
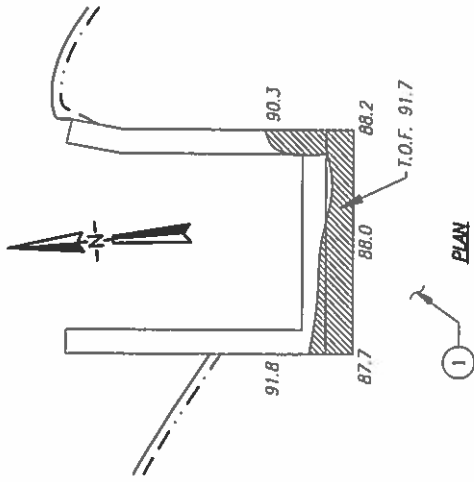
**KENTUCKY TRANSPORTATION CABINET
 UNDERWATER BRIDGE INSPECTION**

KY-2885 OVER SIMPSON CREEK
 SPENCER COUNTY, KENTUCKY
 STRUCTURE NO. 108800041N

ABUTMENT 1 - INSPECTION NOTES

Drawn By: AJC	Checked By: AJC	Date: JUL 2013
Code: 108800041N	Scale: NTS	Figure No.: 4
COLLINS ENGINEERS		

**APPENDIX B:
PHOTOGRAPHS**



Note:

Footing elevations unknown due to unavailable record drawings.

INSPECTION NOTES:

- ① The channel bottom material consisted of bedrock along the breastwalls of each abutment and transitioned to rip rap along all wingwalls with no probe rod penetration.
- ② The submerged portions of the abutment exhibited light scaling and the top of the exposed footing was rough pour concrete.
- ③ Spall measuring 6' vertical by 3' wide with 3" penetration centered at the waterline with no exposed reinforcing steel bars.
- ④ Shear crack typically 1/4" wide and maximum 1/2" wide extending approximately 30' from the top of footing to bottom of the deck.
- ⑤ Separation of the construction joint typically 1/4" and maximum 1/2" wide.
- ⑥ Shear crack typically hairline extending from the waterline to the bottom of the deck.
- ⑦ Spall measuring 2' vertical by 3' horizontal with 2" penetration with no exposed reinforcing steel bars.
- ⑧ Undermining of the footing with a maximum horizontal penetration of 3' and a maximum vertical exposure of 2'.

Legend	
27.0	Channel Bottom Elevation (ft)
	Undermining
	Water Surface

KENTUCKY TRANSPORTATION CABINET
UNDERWATER BRIDGE INSPECTION

KY-2885 OVER SIMPSON CREEK
SPENCER COUNTY, KENTUCKY
STRUCTURE NO. 108B00041N

ABUTMENT 2 - INSPECTION NOTES

Drawn By: JDC	Checked By: JAU	Date: JUL 2013	Scale: NTS	Figure No.: 5



Photograph No. 1: Overall View of Structure No. 108B00041N, Looking West.



Photograph No. 2: Overall View of Structure No. 108B00041N, Looking East.



Photograph No. 3: View of North Embankment Upstream of the Structure, Looking Northeast.



Photograph No. 4: View of North Embankment Downstream of the Structure, Looking Northwest.



Photograph No. 5: View of South Embankment Upstream of the Structure, Looking Southeast.



Photograph No. 6: View of South Embankment Downstream of the Structure, Looking Southwest.



Photograph No. 7: View of East Wingwall of Abutment 1, Looking Southwest.



Photograph No. 8: View of Abutment 1, Looking Southwest.



Photograph No. 9: View of West Wingwall of Abutment 1, Looking Southeast.



Photograph No. 10: View of Failed Concrete Repair at Upstream Corner of Abutment 1, Looking South.



Photograph No. 13: View of West Wingwall of Abutment 2, Looking Northeast.



Photograph No. 14: View of Shear Crack above the Water Line on East Wingwall of Abutment 2, Looking West.



Photograph No. 11: View of East Wingwall of Abutment 2, Looking Northwest.



Photograph No. 12: View of Abutment 2, Looking Northwest.



Photograph No. 15: View of Shear Crack below the Water Line on East Wingwall of Abutment 2, Looking West.



Photograph No. 16: View of Spall on East Wingwall of Abutment 2, Looking Southwest.



Photograph No. 17: View of Shear Crack above the Water Line on West Wingwall of Abutment 2, Looking East.



Photograph No. 18: View of Spall on West Wingwall of Abutment 2, Looking Southeast.