

UNDERWATER BRIDGE INSPECTION REPORT

STRUCTURE NO. 7111

CR NO. 229

OVER THE

BIG FORK RIVER

DISTRICT 1 - ITASCA COUNTY



AUGUST 14, 2012

PREPARED FOR THE

MINNESOTA DEPARTMENT OF TRANSPORTATION

BY

COLLINS ENGINEERS, INC.

JOB NO. 7423

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

REPORT SUMMARY:

The substructure units inspected at Bridge No. 7111, Piers 1 through 5, were found to be generally in fair to satisfactory condition below water with several instances of deficient bracing and/or bracing connections. The repairs at the upstream piles of Piers 1 and 4 appear to be functioning adequately. The last inspection noted an appreciable presence of timber drift at the bridge, which still exists. Drift impacting the bridge along with ice damage is still the source of most of the noted deficiencies throughout the bridge. The channel bottom at the piers did not exhibit any significant scour and was covered throughout the bridge by timber debris.

INSPECTION FINDINGS:

- (A) The upstream channel bottom material consisted of soft silty sand with 6 inches of probe rod penetration.
- (B) The downstream channel bottom material consisted of firm silty sand with 1 to 3 inches of probe rod penetration.
- (C) The channel bottom between the South Abutment and Pier 1 consisted of cobbles and riprap with no probe rod penetration.
- (D) A moderate accumulation of timber debris consisting of 18-inch-diameter and smaller logs and branches was observed along the south face of Pier 2 and extended towards the South Abutment and from the channel bottom to 3 feet above the waterline.
- (E) The F Pile at Piers 1 and 4 have been supplemented with concrete filled steel piles that were connected to the upstream end of the existing timber pier caps with steel braces.
- (F) The timber Pile F at Pier 4 has been displaced and was positioned at an incline towards the downstream fascia with the top of the pile about 4 feet above the

waterline.

- (G) Pile F at Pier 2 has been displaced approximately 1.5 inches westward under the cap with some related damage present at the pile top due to timber drift and high water.
- (H) All substructure timber was observed to be in sound and firm condition with minor 1/8 inch wide checking below the water. All piles exhibited frequent 1/8 inch to 1/2 inch wide splintering and checking, and abrasion damage, with typical loss of section between 5 and 15 percent, due to drift or ice impact and rubbing above water.
- (I) Both shorelines under the bridge consisted of bare slope with heavy erosion and 6 foot vertical slopes.
- (J) Pile E at Pier 2 was crushed and failed from 3 feet above waterline to 1 foot below the waterline.
- (K) The horizontal timber planking between Piles E and F at Pier 2 exhibited heavy impact damage from debris and ice.
- (L) The bottom horizontal timber planking on the north face of Pier 2 was missing from Pile C to Pile F. The rest of the timber planking on the north face of Pier 2 exhibited heavy damage due to drift and ice flows.
- (M) The timber cross bracing was broken off on the north face of Pier 3 at Pile E.
- (N) The horizontal timber planking on the south face of Pier 3 was missing at Piles D, E, and F from the waterline up 2 feet.
- (O) Moderate timber debris accumulation was observed along the north face and at the upstream pile of Pier 3. The debris extended from the channel

bottom to the waterline with 18 inch diameter and smaller timber.

- (P) Moderate to heavy timber debris accumulation consisting of 6- inch-diameter and smaller logs and branches was observed at Piers 4 and 5, extending from the waterline to the channel bottom.
- (Q) All of the piers had new concrete filled steel pipe piles located approximately 15 feet upstream of the pier. All of the concrete filled steel pipe piles had heavy accumulations of drift extending from the channel bottom to the waterline.
- (R) The timber cross bracing members exhibited splitting and other age related defects at multiple locations throughout the bridge at times jeopardizing bracing-to-pile connections. See figures 1 and 2 for more details and defect locations.

RECOMMENDATIONS:

- (A) All deficient cross bracing should be renewed at the piers to restore the original overall lateral stability of bridge.
- (B) Remove timber drift at the bridge to prevent additional build-up and to eliminate potential for abrasion or scour damage and excessive lateral loads on the piers. Until drift can be removed, closely monitor the accumulations at the bridge especially during any high water events.
- (C) Since it appears that the bridge is prone to drift build-up, it is recommended that consideration be given to implementing a regular program of drift monitoring and removal.
- (D) The stability and load carrying capacity of Pier 2 should be examined based on the damaged pile, and if found to be insufficient, it may be necessary to supplement the pile with some means of carrying load for the pier. If Pier 2 still has sufficient capacity/stability, given the significantly cracked pile, then future inspections should particularly monitor that pile and pier for any further distress.

- (E) The channel banks under the bridge should be monitored, and if erosion continues, channel protection measures may need to be considered.

- (F) Reinspect the bridge on a biannual basis above water to monitor drift until it can be removed. Underwater inspections need only be made at the normal maximum (NBIS) interval of sixty (60) months, assuming drift is removed in a timely manner. If drift is not removed, an underwater inspection may be required sooner, if drift increases and damage is suspected.

Inspection Team Leader



Roy A. Forsyth, PE
Date 6/30/2014 License# 49270

Respectfully submitted,

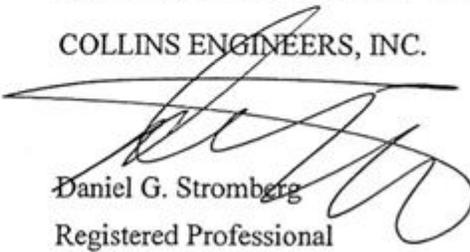
PROFESSIONAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Daniel G. Stromberg

Date 6/30/14 License # 21491

COLLINS ENGINEERS, INC.



Daniel G. Stromberg

Registered Professional

Engineer, State of Minnesota

MINNESOTA DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION

1. BRIDGE DATA

Bridge Number: 7111

Feature Crossed: Big Fork River

Feature Carried: CR No. 229

Location: District 1 - Itasca County

Bridge Description: The superstructure consists of six spans of timber deck on multiple timber stringers. The superstructure is supported on five timber pile piers and two timber pile abutments. The piers are numbered 1 through 5 starting from the south end of the bridge. No design drawings were available for this bridge.

2. INSPECTION DATA

Professional Engineer Diver: Roy A. Forsyth, P.E.

Dive Team: Jordan T. Furlan, P.E., Charles R. Euwema

Date: August 14, 2012

Weather Conditions: Cloudy, 80° F

Underwater Visibility: 5 Feet

Waterway Velocity: 0 ft/s

3. SUBSTRUCTURE INSPECTION DATA

Substructure Inspected: Piers 1 through 5.

General Shape: Each pier consists of a single row of six timber piles under a common pile cap and interconnected with timber cross bracing and/or horizontal planking.

Maximum Water Depth at Substructure Inspected: Approximately 9.1 Feet.

4. WATERLINE DATUM

Water Level Reference: The top of the pier cap on the west end of Pier 5.

Water Surface: The waterline was approximately 10.4 feet below reference.
Assumed Waterline Elevation = 89.6.

5. NBIS CODING INFORMATION (Minnesota specific codes are used for 92B and 113)

Item 60: Substructure: Code 5

Item 61: Channel and Channel Protection: Code 4

Item 92B: Underwater Inspection: Code B/08/12

Item 113: Scour Critical Bridges: Code K/95

Bridge is scour critical because abutment or pier foundation is rated as unstable due to observed scour at bridge site.

 Yes X No

6. STRUCTURAL ELEMENT CONDITION RATING

Item #	Element Description	Quantity	Unit	Conditions				
				1	2	3	4	5
228	Timber Piling	35	EA		25	8	2	
419	Steel Piles	2	EA	2				
985	Slopes and Slope Protection	1	EA	1				



Photograph 1. Overall View of the Structure, Looking East.



Photograph 2. View of Pier 1, Looking Southeast.



Photograph 3. View of Pier 2, Looking Southeast.



Photograph 4. View of Pier 3, Looking Southeast.



Photograph 5. View of Pier 4, Looking Southeast.



Photograph 6. View of Pier 5, Looking Northeast.



Photograph 7. View of South Abutment, Looking Southeast.



Photograph 8. View of North Abutment, Looking Northeast.



Photograph 9. View of Weight Limit Posting, Looking North.

INSPECTION NOTES:

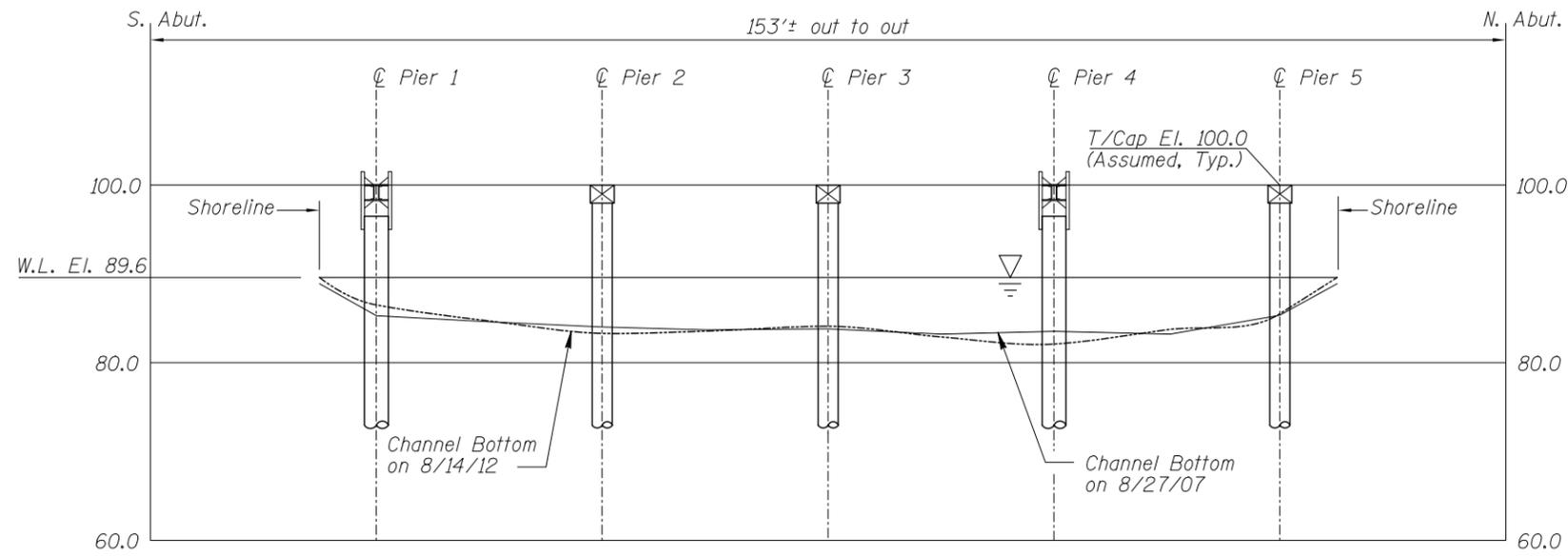
- 1 The upstream channel bottom material consisted of soft silty sand with 6 inches of probe rod penetration.
- 2 The downstream channel bottom material consisted of firm silty sand with 1 to 3 inches of probe rod penetration.
- 3 The channel bottom between the South Abutment and Pier 1 consisted of cobbles and riprap with no probe rod penetration.
- 4 A moderate accumulation of timber debris consisting of 18-inch-diameter and smaller logs and branches was observed along the south face of Pier 2 and extended towards the South Abutment and from the channel bottom to 3 feet above the waterline.
- 5 The F Pile at Piers 1 and 4 have been supplemented with concrete filled steel piles that were connected to the upstream end of the existing timber pier caps with steel braces.
- 6 The timber Pile F at Pier 4 has been displaced and was positioned at an incline towards the downstream fascia with the top of the pile about 4 feet above the waterline.
- 7 Pile F at Pier 2 has been displaced approximately 1.5 inches westward under the cap with some related damage present at the pile top due to timber drift and high water.
- 8 All substructure timber members were observed to be in sound and firm condition with minor 1/8 inch wide checking below the water. All piles exhibited frequent 1/8 inch to 1/2 inch wide splintering and checking, and abrasion damage, with typical loss of section between 5 and 15 percent, due to drift or ice impact and rubbing above water.
- 9 The timber cross bracing on both the north and south faces had a split extending from Pile A to Pile C at Pier 4. The split extended through the connection at Pile A and approximately 3 feet of the timber bracing under the split was broken away and failed.
- 10 Both shorelines under the bridge consisted of bare slope with heavy erosion and 6 foot high vertical cut slopes.
- 11 Pile E at Pier 2 was crushed and failed from 3 feet above waterline to 1 foot below the waterline.
- 12 The horizontal timber planking between Piles E and F at Pier 2 exhibited heavy impact damage from debris and ice.
- 13 The bottom horizontal timber planking on the north face of Pier 2 was missing from Pile C to Pile F. The rest of the timber planking on the north face of Pier 2 exhibited heavy damage due to drift and ice flows.
- 14 The timber cross bracing was broken off on the north face of Pier 3 at Pile E.
- 15 The horizontal timber planking on the south face of Pier 3 was missing at Piles D, E, and F from the waterline up 2 feet.
- 16 Moderate timber debris was observed along the north face and at the upstream pile of Pier 3. The debris extended from the channel bottom to the waterline and consisted of 18 inch diameter and smaller timber pieces.
- 17 Moderate to heavy timber debris consisting of 6 inch diameter and smaller logs and branches was observed at Piers 4 and 5, extending from the waterline to the channel bottom.
- 18 All of the piers had new concrete filled steel pipe piles located approximately 15 feet upstream of the pier.
- 19 The timber cross bracing along Pier 2 at the downstream end exhibited several 5-foot-long splits, one extending through the connection to the pile.
- 20 The timber cross bracing exhibited a 2-foot-long by 1/4-inch-wide split through Pile D at Pier 3.
- 21 The timber cross bracing exhibited two 1/4-inch wide splits through the connection to Piles D and F at Pier 5.
- 22 The timber cross bracing exhibited a 3-foot-long by 1/4-inch wide split through the connection at Pile A of Pier 5.
- 23 The cross bracing on the south face of Pier 5 at Pile F was crushed and failed.

**MINNESOTA
DEPARTMENT OF TRANSPORTATION
UNDERWATER BRIDGE INSPECTION**

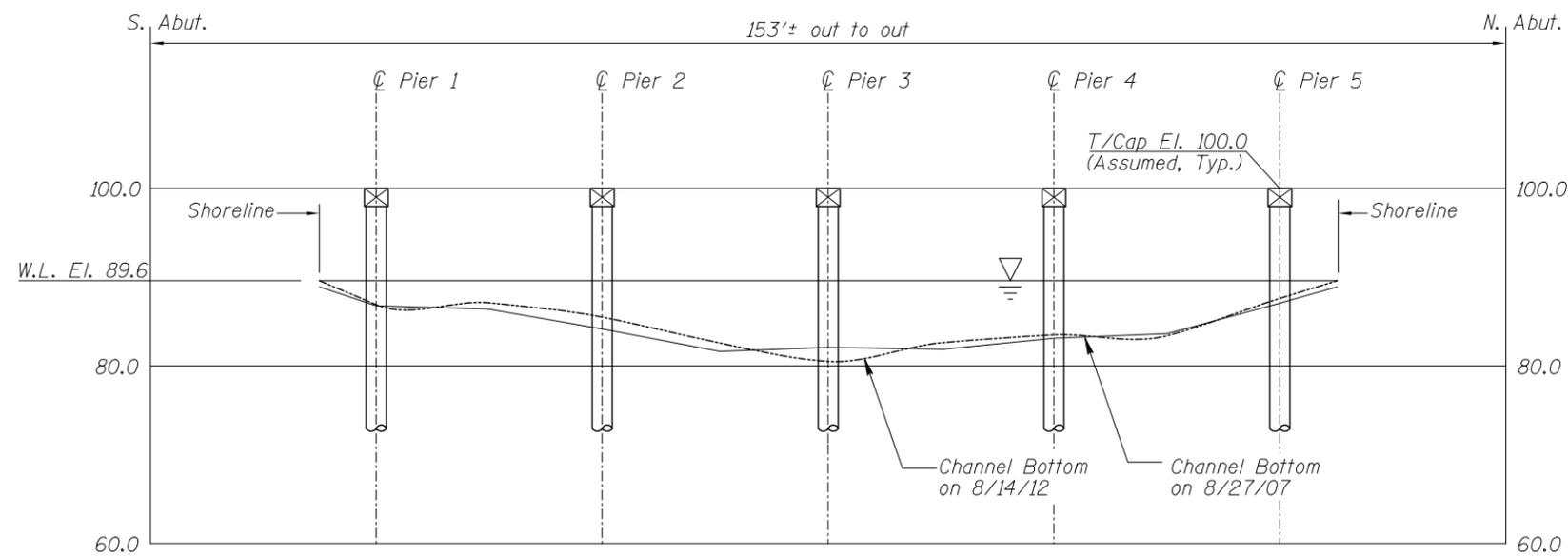
STRUCTURE NO. 7III
OVER THE BIG FORK RIVER
DISTRICT I, ITASCA COUNTY

INSPECTION NOTES

Drawn By: CRE	 123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com	Date: AUGUST 2012
Checked By: DGS		Scale: N/A
Code: 522I0027		Figure No.: 2



UPSTREAM FASCIA PROFILE
Vertical Scale: 1"=20'-0"



DOWNSTREAM FASCIA PROFILE
Vertical Scale: 1"=20'-0"

Note:
Refer to Figure 1 for General Notes
and Figure 2 for Inspection Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 7III OVER THE BIG FORK RIVER DISTRICT I, ITASCA COUNTY		
UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
Drawn By: CRE	COLLINS ENGINEERS <small>123 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	Date: AUGUST 2012
Checked By: DGS		Scale: NTS (U,O,N)
Code: 52210027		Figure No.: 3

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES
DAILY DIVING REPORT

INSPECTORS: Collins Engineers, Inc. DATE: August 14, 2012

ON-SITE TEAM LEADER: Roy A. Forsyth, P.E.

BRIDGE NO: 7111 WEATHER: Cloudy, 80° F

WATERWAY CROSSED: The Big Fork River

DIVING OPERATION: SCUBA SURFACE SUPPLIED AIR
 OTHER

PERSONNEL: Jordan T. Furlan, P.E., Charles R. Euwema

EQUIPMENT: Scuba, U/W Light, Scraper, Sounding Pole, Lead Line, Probe Rod

TIME IN WATER: 16:20 P.M.

TIME OUT OF WATER: 17:00 P.M.

WATERWAY DATA: VELOCITY 0 ft/s

VISIBILITY 5 feet

DEPTH 9.1 feet maximum at Pier 3

ELEMENTS INSPECTED: Piers 1 through 5

REMARKS: Overall, Piers 1 through 5, were found to be generally in satisfactory to fair condition below water with several instances of deficient bracing and/or bracing connections. The repairs at the upstream piles of Piers 1 and 4 appear to be functioning adequately. The last inspection noted an appreciable presence of timber drift at the bridge, which still exists. Drift impacting the bridge along with ice damage is still the source of most of the noted deficiencies throughout the bridge. The channel bottom at the piers did not exhibit any significant scour and was covered throughout the bridge by timber drift.

FURTHER ACTION NEEDED: YES NO

The stability and load carrying capacity of Pier 2 should be examined based on the damaged pile, and if found to be insufficient, it may be necessary to supplement the pile with some means of carrying load for the pier. If Pier 2 still has sufficient capacity/stability, given the significantly cracked pile, then future inspections should particularly monitor that pile and pier for any further distress.

FURTHER ACTION NEEDED (CONTINUED)

As previously noted and recommended in the last inspection, the deficient bracing at the bridge should be renewed to restore sufficient lateral stability (especially a concern given the frequency for drift build-up) for the piers.

The additional piles installed upstream of the piers is a good measure towards restricting drift from impacting/accumulating at the bridge. Currently, however, there is still excessive drift at the bridge which can exert excessive loads on the bridge and/or influence scour/restrict flow. Therefore, the present drift accumulations should be removed before they can worsen and adversely affect the bridge. At the time the drift is removed from around the bridge piers, it should also be removed from the additional upstream piles.

Reinspect the bridge on a biannual basis above water to monitor drift until it can be removed. Underwater inspections need only be made at the normal maximum (NBIS) interval of sixty (60) months, assuming drift is removed in a timely manner. If drift is not removed, a sooner underwater inspection may be required if drift increases and damage is suspected.

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGES AND STRUCTURES

UNDERWATER INSPECTION CONDITION RATING FORM

BRIDGE NO. 7111
 INSPECTORS Collins Engineers, Inc.
 ON-SITE TEAM LEADER Roy A. Forsyth, P.E.
 WATERWAY CROSSED The Big Fork River

INSPECTION DATE August 14, 2012

NOTE: USE ALL APPLICABLE CONDITION DEFINITIONS AS DEFINED IN THE MINNESOTA RECORDING AND CODING GUIDE INCLUDING GENERAL, SUBSTRUCTURE, CHANNEL AND PROTECTION, AND CULVERTS AND WALL DEFINITIONS TO COMPLETE THIS FORM.

CONDITION RATING

UNIT REFERENCE NO.	UNIT DESCRIPTION	MAXIMUM DEPTH OF WATER	SUBSTRUCTURE					CHANNEL					GENERAL						
			PILING	COLUMNS, SHAFTS, OR FACES*	FOOTINGS	DISPLACEMENT	OTHER (BRACING)	OVERALL SUBSTRUCTURE CONDITION CODE*	SCOUR	EMBANKMENT EROSION	EMBANKMENT PROTECTION	OTHER (DRIFT/DEBRIS)	OVERALL CHANNEL & PROTECTION CONDITION	CONCRETE	STEEL	TIMBER	LOSS OF SECTION	PREVIOUS REPAIR OR MAINTENANCE	OTHER
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Pier 1	3.1'	6	N	N	7	6	6	8	6	7	4	4	N	N	6	N	N	N
	Pier 2	6.3'	5	N	N	7	6	5	8	N	N	4	4	N	N	5	N	N	N
	Pier 3	9.1'	5	N	N	7	6	5	8	N	N	4	4	N	N	5	N	N	N
	Pier 4	7.5'	6	N	N	7	6	6	8	N	N	4	4	N	N	6	N	N	N
	Pier 5	5.1'	5	N	N	7	6	6	8	7	7	4	4	N	N	5	N	N	N

*UNDERWATER PORTION ONLY

REMARKS: Overall, Piers 1 through 5, were found to be generally in satisfactory to fair condition below water with several instances of deficient bracing and/or bracing connections. The recent repairs at the upstream piles of Piers 1 and 4 appear to be functioning adequately. The last inspection noted an appreciable presence of timber drift at the bridge, which still exists. Drift impacting the bridge along with ice damage is still the source of most of the noted deficiencies throughout the bridge. The channel bottom at the piers did not exhibit any significant scour and was covered throughout the bridge by timber drift.

NOTES: ATTACH SKETCHES AS NEEDED, IDENTIFY REMARK BY REFERRING TO UNIT REFERENCE NO. AND REMARK NO. USE GENERAL SECTION TO IDENTIFY OVERALL PRESENCE OF SPALLS, CRACKS, CORROSION, ETC.