

# UNDERWATER BRIDGE INSPECTION REPORT

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STRUCTURE NO. 7111

CR NO. 229

OVER THE

BIG FORK RIVER

DISTRICT 1 - ITASCA COUNTY

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PREPARED FOR THE  
MINNESOTA DEPARTMENT OF TRANSPORTATION

BY  
COLLINS ENGINEERS, INC.

JOB NO. 3512 (CEI 27)

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 satisfactory condition below water with no structurally significant defects, except for a 3 inch wide split in the second pile from the upstream fascia of Pier 2 and several instances of deficient bracing and/or bracing connections. The recent repairs at the upstream piles of Piers 1 and 4 appear to be adequate. The last inspection noted an appreciable presence of timber drift at the bridge, which still exists, but is not as heavy as was found previously due to the new concrete filled steel pipe piles located approximately 15 feet upstream of each pier that now serve to catch drift before it reaches the bridge. 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, all of which is consistent with the last inspection.

INSPECTION FINDINGS:

- (A) Below water, the substructure timber was sound and firm with the only deficiency primarily being minor checking. Above water, the piles and bracing exhibited frequent cracking, splintering, and abrasion related loss of section, most of which is related to drift impact and ice damage. Included in this damage are several instances of deficient crossbracing with their connections to the piles no longer intact.

- (B) At Pier 4, the upstream pile that had been displaced out from under the pile cap is now laying parallel to Pier 4 and has been supplemented with a concrete filled steel pipe pile. At Pier 1, the upstream pile that had been displaced approximately 1.5 inches downstream under the cap with some related damage present at the pile top has also been supplemented by a concrete filled steel pipe pile. Both of these repairs appear to be functioning adequately.
- (C) Along all of the waterway upstream of the new steel pipe piles, across the entire upstream fascia of the bridge, along the sides of each pier, and within the piles of each pier, heavy timber drift was present, typically extending from just above the waterline down to the channel bottom.
- (D) The 2<sup>nd</sup> pile in from the upstream fascia of Pier 2 exhibited significant damage, consisting of a 3 inch wide split through the entire pile diameter with some related internal decay.
- (E) Both banks under the bridge exhibited signs of erosion.
- (F) A number of the horizontal pier protection planks at Piers 2 and 3 were damaged and missing section due to drift and ice related abrasion.

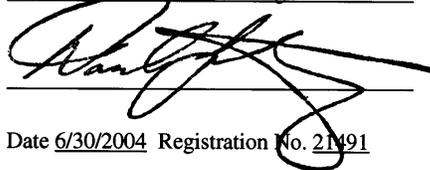
RECOMMENDATIONS:

- (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 should 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 five (5) years, 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.

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.

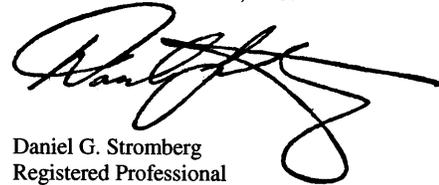
Daniel G. Stromberg



Date 6/30/2004 Registration No. 21491

Respectfully submitted,

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: The 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: Daniel G. Stromberg  
State of Minnesota, P.E., No. 21491

Dive Team: Michelle D. Koerbel, Matthew J. Lengyel

Date: August 24, 2002

Weather Conditions: Sunny,  $\pm 70^{\circ}$  F

Underwater Visibility:  $\pm 2 - 3$  Feet

Waterway Velocity:  $\pm 1.5$  fps

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 9.5 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 10.3 feet below reference.  
Assumed Waterline Elevation = 89.7.

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

Item 60: Substructure: Code 6

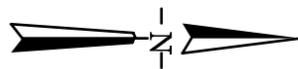
Item 61: Channel and Channel Protection: Code 4

Item 92B: Underwater Inspection: Code B/08/02

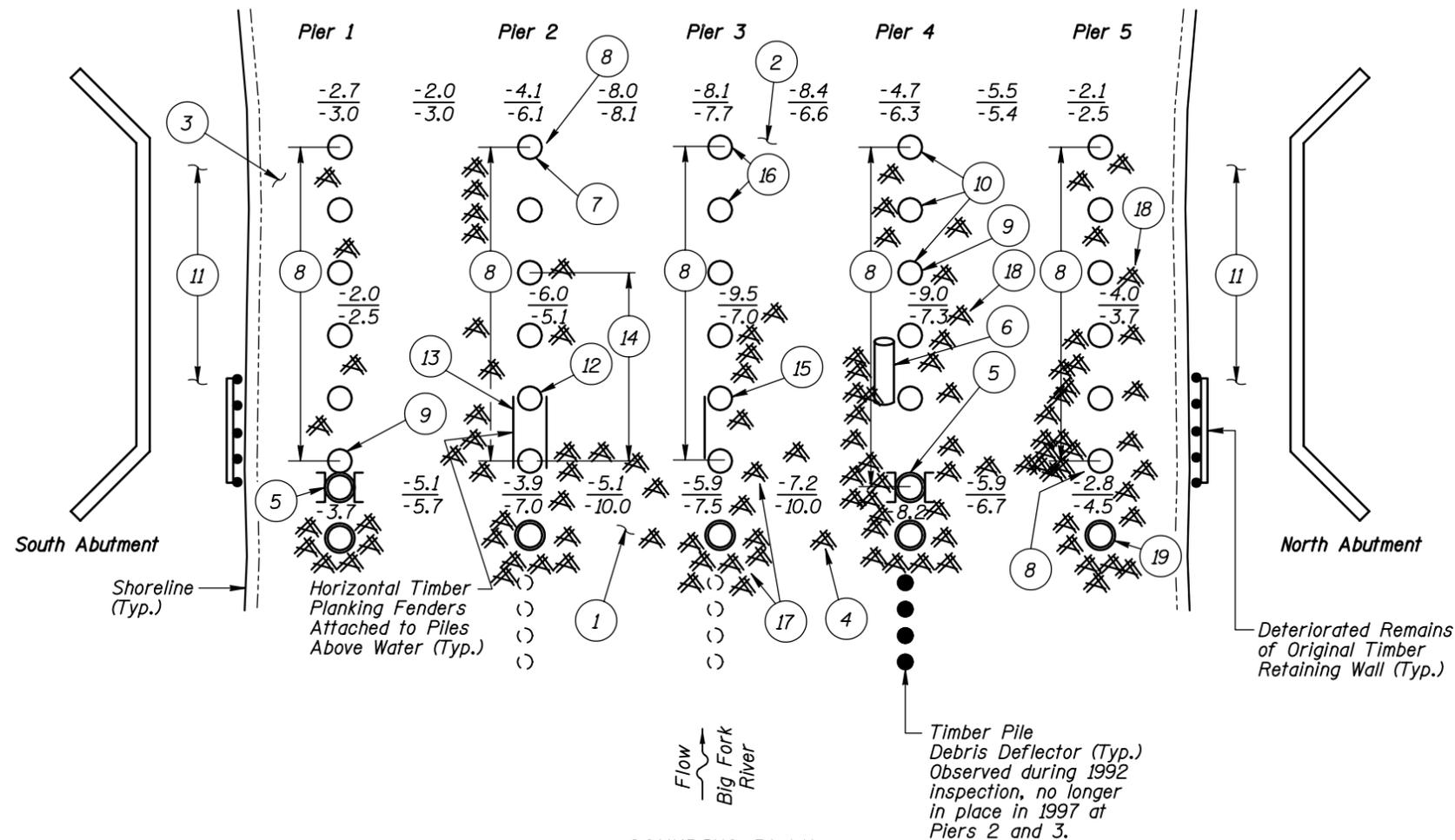
Item 113: Scour Critical Bridges: Code K/95

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

\_\_\_\_\_ Yes  X  No



153'± out to out



**SOUNDING PLAN**

**GENERAL NOTES:**

1. Piers 1 through 5 were inspected underwater.
2. At the time of inspection on August 24, 2002, the waterline was located approximately 10.3 feet below the top of the pile cap at the west end of Pier 5. Design plans were not available, therefore a reference elevation of 100.0 was assumed. Based on assumed reference the waterline elevation was 89.7.
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 mid point intervals between the substructure units.
5. Refer to Figure 2 for Inspection Notes.

**TYPICAL END VIEW OF PIERS**  
(U.O.N.)



**UPSTREAM END VIEW OF PIERS 1 AND 4**



**Legend**

- 2.7 Sounding Depth from Waterline (8/24/02)
- 3.5 Sounding Depth from Waterline (8/22/97)
- Timber Pile
- ⊗ Concrete Filled Steel Pile w/ Bracing
- Concrete Filled Steel Pile
- ① Inspection Note Number

**MINNESOTA  
DEPARTMENT OF TRANSPORTATION  
UNDERWATER BRIDGE INSPECTION**

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

**INSPECTION AND SOUNDING PLAN**

Drawn By: PRH	<b>COLLINS ENGINEERS, INC.</b>	Date: AUG. 2002
Checked By: MDK	300 W. WASHINGTON, STE. 600 CHICAGO, ILLINOIS 60606 (312) 704-9300	Scale: NTS
Code: 35120027		Figure No.: 1

INSPECTION NOTES:

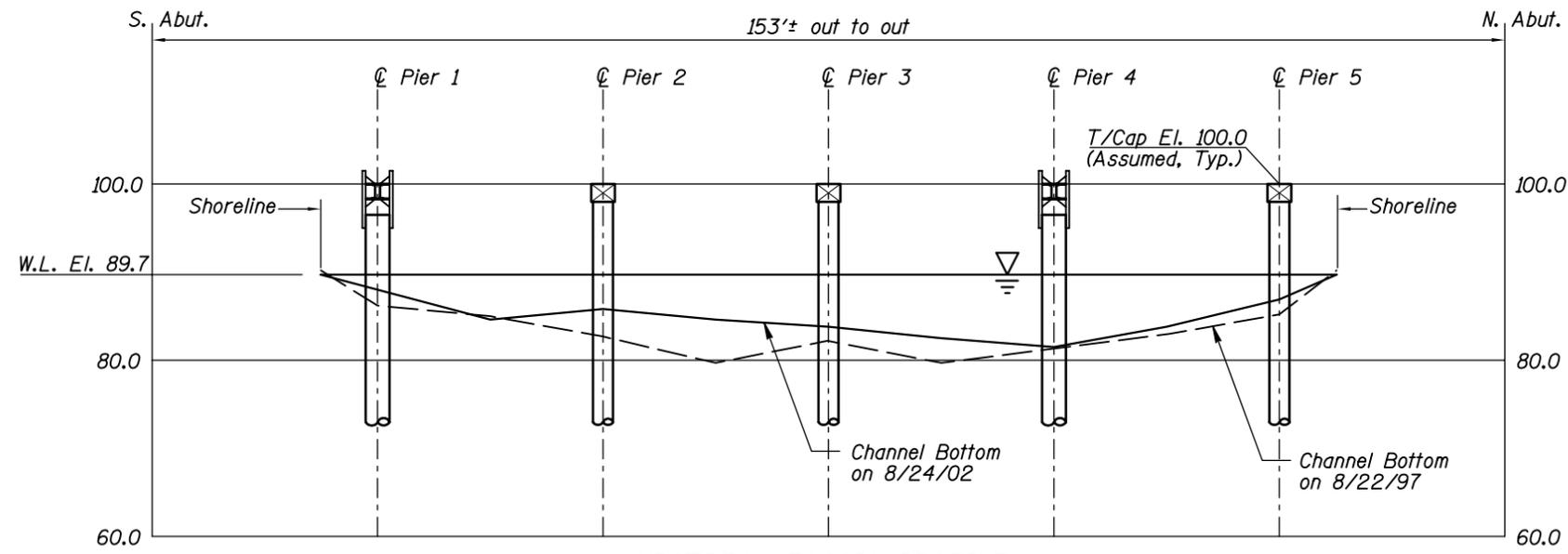
- 1 The upstream channel bottom material consisted of soft silty sand with 6 inches of probe rod penetration.
- 2 The downstream channel bottom material consisted of firm silty sand with 1 to 3 inches of probe rod penetration.
- 3 The channel bottom between the South Abutment and Pier 1 consisted of cobbles and riprap with no probe rod penetration.
- 4 Along the upstream fascia of the bridge between Piers 2 through 5 and along the sides of the piers, heavy timber drift was present typically extending from just above the waterline down to the channel bottom.
- 5 The upstream piles at Piers 1 and 4 have been supplimented with concrete filled steel piles that were connected to the upstream end of the existing timber pier caps with steel braces.
- 6 The upstream timber pile had been displaced and was laying at an incline towards the downstream fascia with the top of the pile about 4 feet above the waterline.
- 7 The upstream pile 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 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 cracking, splintering, and abrasion damage, with typical loss of section between 5 and 15 percent, due to drift or ice impact and rubbing above water.
- 9 Pile exhibited a 1/2 to 1 inch wide crack above the waterline.
- 10 The timber cross bracing had a split extending from the downstream pile to the 3rd pile in from the downstream fascia of Pier 4. The split extended through the connection at the downstream pile and approximately 3 feet of the timber bracing under the split was broken away.
- 11 Both shorelines under the bridge exhibited signs of erosion.
- 12 A 3 inch wide split through the entire pile diameter was observed from 3 feet above the waterline to 6 inches below the waterline, with moderate decay exhibited inside the split.
- 13 Heavy drift and ice related damage to the horizontal timber planking.
- 14 The bottom horizontal timber planking on the north face of Pier 2 was missing from the 1st upstream pile to the 4th pile in from the upstream fascia. The rest of the timber planking on the north face of Pier 2 exhibited heavy damage due to drift and ice flows.
- 15 The timber cross bracing was broken off on the north face of Pier 3, at the 2nd pile in from the downstream fascia. The timber cross bracing was no longer connected to the 2nd pile in from the downstream fascia.
- 16 The top horizontal timber planking on the south face of Pier 3 was missing from the 1st upstream pile to the 2nd pile in from the upstream fascia.
- 17 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 3 feet above the channel bottom along the north face, and extended from the channel bottom to 6 feet above the channel bottom at the upstream pile.
- 18 Moderate to heavy timber debris consisting of up to 1-1/2 inch diameter branches was observed from the upstream piles of Piers 4 and 5 through the rest of the piers, extending from the waterline to the channel bottom.
- 19 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.

**MINNESOTA  
DEPARTMENT OF TRANSPORTATION  
UNDERWATER BRIDGE INSPECTION**

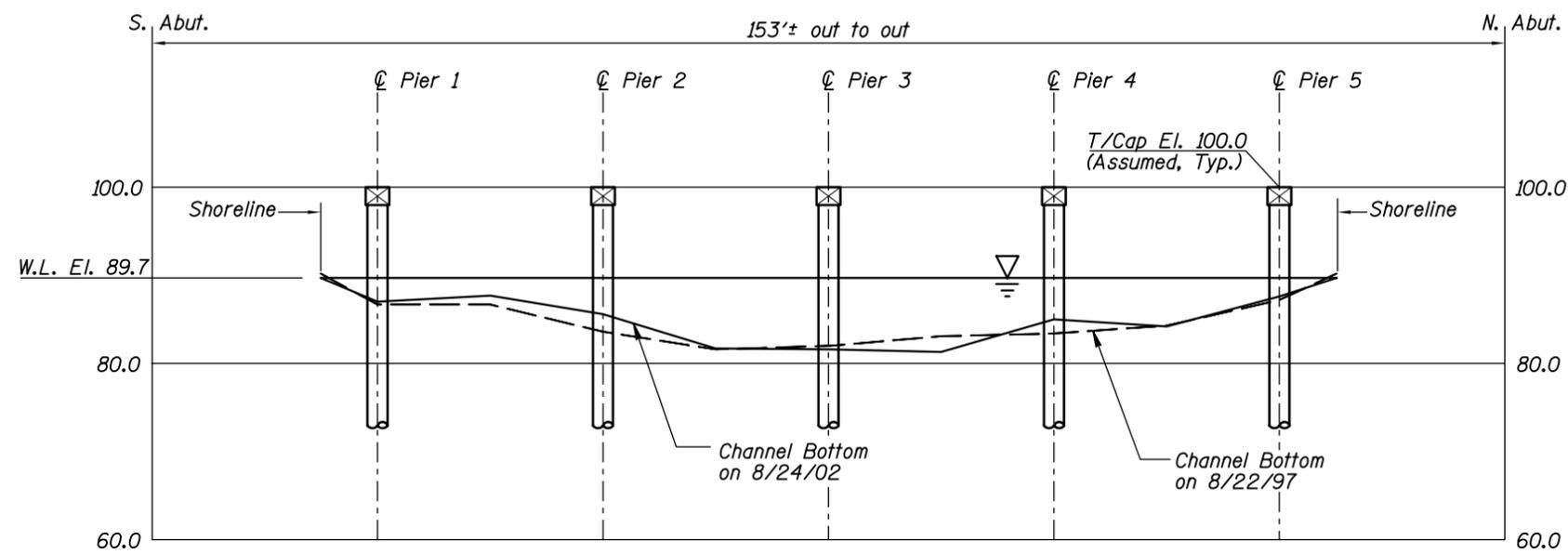
STRUCTURE NO. 7III  
OVER THE BIG FORK RIVER  
DISTRICT I, ITASCA COUNTY

**INSPECTION NOTES**

Drawn By: PRH	 <b>COLLINS ENGINEERS, INC.</b> 300 W. WASHINGTON, STE. 600 CHICAGO, ILLINOIS 60606 (312) 704-9300	Date: AUG. 2002
Checked By: MDK		Scale: N/A
Code: 35I20027		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.

<b>MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION</b>		
STRUCTURE NO. 7III OVER THE BIG FORK RIVER DISTRICT I, ITASCA COUNTY		
<b>UPSTREAM AND DOWNSTREAM FASCIA PROFILES</b>		
Drawn By: PRH	 <b>COLLINS ENGINEERS, INC.</b> 300 W. WASHINGTON, STE. 600 CHICAGO, ILLINOIS 60606 (312) 704-9300	Date: AUG. 2002
Checked By: MDK		Scale: NTS (U.O.N)
Code: 35I20027		Figure No.: 3



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



Photograph 2. View of Pier 1, Looking Southeast.



Photograph 3. View of Pier 2, Looking Southeast.



Photograph 4. View of Pier 4, Looking Southeast.



Photograph 5. View of Pier 5, Looking Northeast.



Photograph 6. View of Erosion at North Abutment, Looking Northeast.



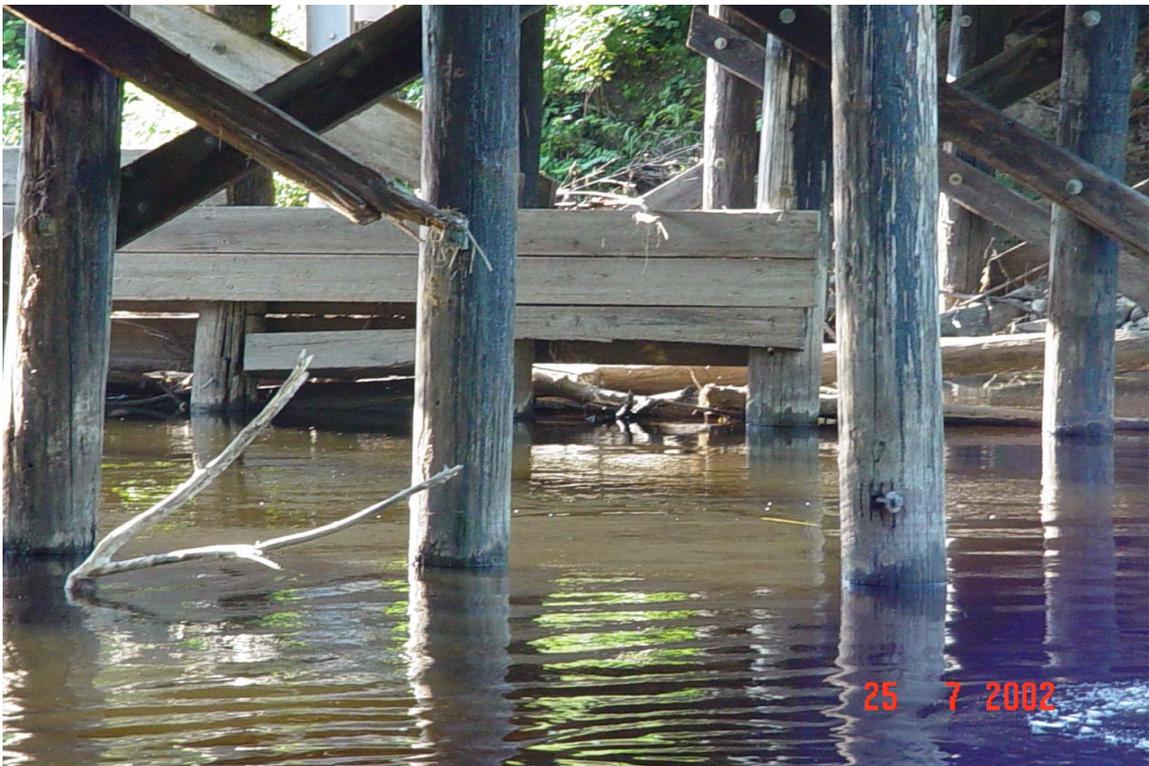
Photograph 7. View of Repair Pile at the Upstream Fascia of Pier 1, Looking South.



Photograph 8. View of Repair Pile at the Upstream Fascia of Pier 4, Looking Southwest.



Photograph 9. View of Split Timber Pile at the 2<sup>nd</sup> Pile in From the Upstream Fascia of Pier 2, Looking Southwest.



Photograph 10. View of Broken Cross Bracing at the Downstream Pile of Pier 3, Looking Southeast.



Photograph 11. View of Broken Cross Bracing at the Downstream Pile of Pier 4, Looking Southeast.



Photograph 12. View of New Debris/Timber Protection System, Looking Northeast.

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

INSPECTORS: Collins Engineers, Inc. DATE: August 24, 2002  
ON-SITE TEAM LEADER: Daniel G. Stromberg, P.E.  
BRIDGE NO: 7111 WEATHER: Sunny, " 70° F  
WATERWAY CROSSED: The Big Fork River  
DIVING OPERATION: X SCUBA SURFACE SUPPLIED AIR  
OTHER

PERSONNEL: Michelle D. Koerbel, Matthew J. Lengyel  
EQUIPMENT: Scuba, U/W Light, Scraper, Sounding Pole, Lead Line, Probe Rod  
TIME IN WATER: 8:20 P.M.  
TIME OUT OF WATER: 9:30 P.M.  
WATERWAY DATA: VELOCITY " 1.5 fps  
VISIBILITY " 2-3 feet  
DEPTH 9.5 feet maximum at Pier 3

ELEMENTS INSPECTED: Piers 1 through 5

REMARKS: The submerged portions of the timber piles of the piers were typically in satisfactory condition, exhibiting sound material with random checking that ranged from 1/8 inch to 3/8 inch in width. The one above water exception to this was the second from the upstream pile of Pier 2, which was cracked and decayed completely through. Much of the timber bracing was sound and satisfactory, although there were broken and/or deficient braces at Piers 2, 4, and 5. The previously noted upstreammost piles at Piers 1 and 4, which were broken/displaced, have been adequately addressed with new steel helper piles. Drift accumulation continues to be a major item for this bridge with moderate to heavy accumulations at all five piers. Additional steel piles have been driven upstream of the piers to catch drift, and considerable accumulations existed around these piles.

FURTHER ACTION NEEDED:  X  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 five (5) years, 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 Daniel G. Stromberg, P.E. 21491  
WATERWAY CROSSED The Big Fork River

INSPECTION DATE August 24, 2002  
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'	7	N	N	8	7	7	8	N	N	4	4	N	N	7	7	N	N
	Pier 2	+6.0'	5	N	N	7	6	5	8	N	N	4	4	N	N	5	6	N	N
	Pier 3	+9.5'	7	N	N	8	4	6	8	N	N	4	4	N	N	6	7	N	N
	Pier 4	+9.0'	7	N	N	8	4	5	8	N	N	4	4	N	N	6	6	N	N
	Pier 5	+4.0'	7	N	N	8	6	7	8	N	N	4	4	N	N	6	7	N	N

\*UNDERWATER PORTION ONLY

REMARKS: The submerged portions of the timber piles of the piers were typically in satisfactory condition, exhibiting sound material with random checking that ranged from 1/8 inch to 3/8 inch in width. The one above water exception to this was the second from the upstream pile of Pier 2, which was cracked and decayed completely through. Much of the timber bracing was sound and satisfactory, although there were broken and/or deficient braces at Piers 2, 4, and 5. The previously noted upstream most piles at Piers 1 and 4, which were broken/displaced, have been adequately addressed with new steel helper piles. Drift accumulation continues to be a major item for this bridge with moderate to heavy accumulations at all five piers. Additional steel piles have been driven upstream of the piers to catch drift, and considerable accumulations existed around these piles.

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.