

2016 UNDERWATER BRIDGE INSPECTION REPORT



BRIDGE # 7759 CSAH 101 over EAST TWO RIVER

DISTRICT: District 1

COUNTY: St. Louis

CITY/TOWNSHIP: Mountain Iron

STATE: Minnesota

Date of Inspection: 09/12/2016

Equipment Used:

Owner: County Highway Agency

Inspected By: Parker, Marc

Report Written By: Marc Parker

Report Reviewed By:

Final Report Date:



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UNDERWATER INSPECTION

REPORT SUMMARY

The substructure units inspected at Bridge No. 7759, the West and East Abutment were found to be in fair condition with defects of structural significance. Spalling and vertical cracking is present at both abutments with some exposed reinforcing bars exhibiting minimal section loss. The East and West Abutments both exhibit undermining with up to 6 feet of horizontal present along the northwest wingwall.

INSPECTION FINDINGS

- (A) The channel bottom material typically consisted of soft silt allowing up to 1 foot of probe rod penetration.
- (B) A scour depression up to 1.5 feet deep was present along the entire length of the West Abutment. The channel bottom material within the depression consisted of sandy gravel allowing up to 4 inches of probe rod penetration.
- (C) The West Abutment footing was exposed the full height (2.0 feet) and was undermined the entire length with an undermining void measuring up to 6 feet horizontally and 2.5 feet vertically. Within the undermine void the majority of the square concrete piles were exposed.
- (D) The East Abutment footing was exposed the full height (2.0 feet) and was undermined the entire length with an undermining void measuring up to 1 foot horizontally and 3 feet vertically. No piles were exposed.
- (E) A spall 18 inches wide by 1 foot high with up to 3 inches of penetration and 2 exposed reinforcing bars with less than 5 percent section loss was present under Beam B of the West Abutment. The spall resulted in an approximately 20 percent loss of bearing area at Beam B.
- (F) A spall was present between Beams D and E at the bridge seat measuring 2 feet high by 2 feet wide with 1 exposed reinforcing bar and up to 3 inches of penetration at the West Abutment.
- (G) Vertical cracking up to 1/4 inch wide from the footing to the bridge seat was present at Beams B, D, and I of the West Abutment and between Beams A and B and D and E of the East Abutment. Associated spalling and impending spalling was observed along the length of the crack with up to 1 inch of penetration.
- (H) A spall measuring 1 foot wide by 18 inches high with up to 3 inches of penetration and 2 exposed reinforcing bars with less than 5 percent section loss was present under the concrete fascia beam (Beam 1) at the East Abutment.
- (I) Two 6 inch diameter spalls with up to 3 inches of penetration was present under Beams H and I of the East Abutment. The spalls have resulted in an approximately 15 percent loss of bearing area at Beams H and I.
- (J) The concrete surface of the abutment walls, footings, and exposed piles were typically smooth and sound.

RECOMMENDATIONS

- (A) Riprap should be placed along both abutments to minimize any additional undermining and close attention should be given to both abutment foundations in future underwater inspections for signs of settlement or movement. If additional undermining, settlement, or movement occurs additional preventative actions may be necessary to ensure the structural integrity of the bridge.
- (B) Reinspect the submerged substructure units at the normal maximum recommended (NBIS) interval of sixty (60) months.

Contractor: Collins Engineers, Inc.

Contractor Job Number: 9687

UNDERWATER INSPECTION

1. BRIDGE DATA

Bridge #: 7759
Feature Intersected: EAST TWO RIVER
Facility Carried: CSAH 101
District: District 1
County: 069 - St. Louis

Bridge Description:

The bridge superstructure consists of two concrete fascia beams and 9 steel girders. The substructure consists of two concrete abutments founded on concrete footings supported by concrete piles.

2. INSPECTION DATA

Professional Engineer/Team Leader: Marc Parker
Inspection Diver: Marc Parker
Date of Underwater Inspection: 09/12/2016
Weather Conditions: Overcast, 70°F
Underwater Visibility (feet): 1 foot
Waterway Velocity (ft/sec): 1 ft/sec

3. SUBSTRUCTURE INSPECTION DATA

Substructure(s) Inspected: The East and West Abutments.

General Shape:

The abutments are founded on concrete footings supported by concrete piles.

Maximum Water Depth at Substructure(s) Inspected (feet): 4.5 feet

4. WATERLINE DATUM

Water Level Reference: The bottom of the West Abutment bridge seat at the downstream end.
Waterline Elevation (feet): 87.0 feet
Description: The waterline was located approximately 4.4 feet below the reference.

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 62: Culvert: Code:
Item 92B: Underwater Inspection: Code: Y 48 09/2016

Item 113: Scour Critical Bridge:

Code: I

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

Yes

No

(Mark your selection with an X)

6. STRUCTURAL ELEMENT CONDITION RATING

ELEM #	Element Description	Quantity	Unit	Conditions			
				CS1	CS2	CS3	CS4
215	Reinforced Concrete Abutment	104	LF		84	20	
885	Scour	1	EA			1	

UNDERWATER INSPECTION

INSPECTION PROCEDURES

The routine underwater inspection of Bridge 7759 (CSAH 101 over East Two Rivers) was completed on September 12, 2016. The underwater inspection was conducted from shore. The inspection was conducted by a team consisting of a Professional Engineer Diver with a valid MnDOT Team Leader certification, a backup diver and dive tender. The inspection utilized commercial dive equipment and techniques in accordance with OSHA regulations. Channel bottom profiles were taken along the upstream and downstream faces of the bridge and around the periphery of substructure units to determine the presence, location and area of scour.

The bridge elements inspected consisted of two concrete abutments. According to the bridge inventory, the East and West Abutments are founded on concrete footings supported by concrete piles. Inspection procedures followed FHWA guidance and the MnDOT Bridge and Structure Inspection Program Manual with channel bottom probing to search for foundations. The maximum routine underwater inspection frequency is recommended to remain at 60 months based on those findings and risk factors. Also, inspection procedures should continue to follow the above approach and standard guidance with 100% Level I and 10% Level II intensity efforts.

MINNESOTA BRIDGE INSPECTION REPORT

01/12/2017

Inspector: CO Bridge

BRIDGE 7759 CSAH 101 OVER EAST TWO RIVER

County: St. Louis	Location: 0.3 MI E OF JCT CR315	Length: 38.0 ft.
City: Mountain Iron	Route: 04 - CSAH 101 Ref. Pt.: 001+00.650	Deck Width: 26.0 ft.
Township:	Control Section:	Rdwy. Area/ Pct. Unsnd: 872 sq. ft. / %
Section: 34 Township: 058N Range: 18W Maint. Area:		Paint Area/ Pct. Unsnd: sq. ft. / 50%
Span Type: 3 - Steel 2	Local Agency Bridge Nbr.: 500	Culvert: N/A
List:		Postings: 22 40 40

NBI Deck: 6 Super: 6 Sub: 4 Chan: 5 Culv: N
 Open, Posted, Closed: P - Posted for Load
 MN Scour Code: I - LOW RISK

Appraisal Ratings - Approach: 8 Waterway: 8 Unofficial Structurally Deficient Y
 Required Bridge Signs - Load Posting: 2 - Vehicle & Semi (Type R12-5) Traffic: 0 - Not Required Unofficial Functionally Obsolete N
 Horizontal: 1 - Object Markers Vertical: N - Not Applicable Unofficial Sufficiency Rating 37.3

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
12	Reinforced Concrete Deck	Underwater	12/27/2016	988 SF	778	210	0	0
		Routine	08/04/2016	988 SF	778	210	0	0
Notes: [2016] Crack in north east corner of underside of deck with efflorescence. [2015] Hairline cracking throughout underside of deck. [2014-2013] Spalling concrete along top flange of beams due to rusting. REBAR EXPOSED AT SPALLS.								
510 - Wearing Surfaces		Underwater	12/27/2016	872 SF	0	872	0	0
		Routine	08/04/2016	872 SF	0	872	0	0
Notes: [2016] Few cracks and light scale throughout bituminous. [2015-2013] No change. MINOR CRACKS SOUTH.								
113	Steel Stringer	Underwater	12/27/2016	381 LF	0	381	0	0
		Routine	08/04/2016	381 LF	0	381	0	0
Notes: [2016-2013] Beams have complete paint failure with surface corrosion throughout. Flaking rust starting to form on top flange and at abutments, with little to no section loss, causing concrete to start to spall. RUST AT ABUTMENTS.								
515 - Steel Protective Coating		Underwater	12/27/2016	1683 SF	0	0	0	1683
		Routine	08/04/2016	1683 SF	0	0	0	1683
Notes: [2016] Beams have complete paint failure with surface corrosion throughout.								
215	Reinforced Concrete Abutment	Underwater	12/27/2016	104 LF	0	84	20	0
		Routine	08/04/2016	104 LF	23	50	31	0
Notes: [2016 U/W] East and West Abutments undermined along length. 5 vertical cracks and 5 spalls observed. [2016] Added 52 LF to abutment quantity to account for wingwalls. Spalls below steel beams 8 and 9 on east abutment. Crack 3/16" middle of west and 1/4" middle of east abutments. East abutment has moved in 3.25". [2015] Spalls between north facia-beam 1 and beams 4 -5 on east abutment. Spalls with exposed rebar below beams 2 and 8 on west abutment. East abutment has pushed in 3" [2014-2013] 3 vertical cracks in each abutment. Middle crack 1/8" and some spalling along crack. 2 VERTICAL CRACKS DOWN EACH ABUT. SOME SPALLS ON E. ABUT. WINGS MINOR CRACKS & LEACHING N. CORNERS.								
330	Metal Bridge Railing	Underwater	12/27/2016	104 LF	104	0	0	0
		Routine	08/04/2016	104 LF	104	0	0	0
Notes: [2016] No notable impact damage or surface corrosion present. W-beam and rub rail attached to concrete rail.								
515 - Steel Protective Coating		Underwater	12/27/2016	181 SF	181	0	0	0
		Routine	08/04/2016	181 SF	181	0	0	0
Notes: [2016] No notable damage to galvanizing on w-beam and rub rail.								

BRIDGE 7759 CSAH 101 OVER EAST TWO RIVER

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
331	Reinforced Concrete Bridge Railing	Underwater	12/27/2016	75 LF	0	75	0	0
		Routine	08/04/2016	75 LF	0	75	0	0
Notes: [2016] Light scale throughout rail. [2015-2013] W-beam rail bolted to concrete rail at some point. Some cracking.								
800	Critical Deficiencies or Safety Hazards	Underwater	12/27/2016	1 EA	1	0	0	0
		Routine	08/04/2016	1 EA	1	0	0	0
Notes: [2016-2014] No critical deficiencies or safety hazards found during this inspection.								
822	Bituminous Approach Roadway	Underwater	12/27/2016	2 EA	0	2	0	0
		Routine	08/04/2016	2 EA	0	2	0	0
Notes: [2016] Minor settlement on both approaches with minor ruts forming in driving lanes. [2015-2014] Cracks are 1/2" to 1" in width. [2013] Some cracking on both and minor settlement on west approach. Bituminous road.								
881	Steel Section Loss	Underwater	12/27/2016	1 EA	0	1	0	0
		Routine	08/04/2016	1 EA	0	1	0	0
Notes: [2016] Flaking rust along top flange of some beams. [2015-2013] Some flaking rust at abutments.								
884	Substructure Settlement & Movement	Underwater	12/27/2016	1 EA	0	1	0	0
		Routine	08/04/2016	1 EA	0	1	0	0
Notes: [2016] East abutment has moved in 3.25". [2015-2013] East abutment has moved in 3". MOVED IN 2-1/2"(EAST ABUT. ONLY).								
885	Scour	Underwater	12/27/2016	1 EA	0	0	1	0
		Routine	08/04/2016	1 EA	0	0	0	1
Notes: [2016 U/W] Significant undermining at the northwest corner of the West Abutment. The piles vertically exposed up to 2.5 feet. [2016] Able to probe 3' to 4' under north end of east abutment. Settlement in west approach may indicate some loss of backfill due to undermining. [2015] Channel migration undermining west abutment. 2' gap between bottom abutment and stream bottom on north end. Gap gets smaller moving to the south. Possible 2' of piling exposed near NW wing and north end of abutment (Check plan for pile locations). Scour is exposing the end of NW wing. [2014-2013] Underwater could not see. SCOUR OCCURRING UNDER BOTH ABUTMENTS. Not affecting piles yet.								
890	Load Posting or Vertical Clearance Signing	Underwater	12/27/2016	1 EA	1	0	0	0
		Routine	08/04/2016	1 EA	1	0	0	0
Notes: [2016] All signs present with no notable deterioration. [2015 Update] 22T/40T/40T Load posting signs placed at bridge that match February 2015 load rating. Advance warning signs also placed. [2014-2013] Load rated for 20-34-34 and posted for 18-30-30. Posted lower than load rated.								
891	Other Bridge Signing	Underwater	12/27/2016	1 EA	1	0	0	0
		Routine	08/04/2016	1 EA	1	0	0	0
Notes: [2016] NE delineator has been replaced [2015] NE delineator missing. [2014-2013] No change. DELINEATORS.								

BRIDGE 7759 CSAH 101 OVER EAST TWO RIVER

ELEM NBR	ELEMENT NAME	REPORT TYPE	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4
892	Slopes & Slope Protection	Underwater	12/27/2016	1 EA	0	0	0	1
		Routine	08/04/2016	1 EA	0	0	0	1
Notes: [2016] Able to probe 3' to 4' under north end of east abutment. Settlement in west approach may indicate some loss of backfill due to undermining. [2015] Channel migration undermining west abutment. 2' gap between bottom abutment and stream bottom on north end. Gap gets smaller moving to the south. Scour is exposing the end of NW wing. [2014-2013] Slopes protected by vegetation. MINOR WASHING AT NW WING. SMALL HOLE AT SW WING. 6" daylight below E. abut. No riprap								
893	Guardrail	Underwater	12/27/2016	1 EA	1	0	0	0
		Routine	08/04/2016	1 EA	1	0	0	0
Notes: [2016] Minor damage to SW ET 2000 end knocking post out of base. [2015-2013] No notable deterioration. W-Beam w/ ET 2000 ends.								
894	Deck & Approach Drainage	Underwater	12/27/2016	1 EA	0	0	1	0
		Routine	08/04/2016	1 EA	0	0	1	0
Notes: [2016] North drains rusting through. [2015] Sand along gutter line blocking some drains and restricting flow of water to drains causing ponding on deck. [2014-2013] Deck gutter line filled with sand but drains open.								
895	Sidewalk, Curb, & Median	Underwater	12/27/2016	1 EA	0	1	0	0
		Routine	08/04/2016	1 EA	0	1	0	0
Notes: [2016-2013] Curb has moderate wear damage from plowing. End chipped NE.								
900	Protected Species	Underwater	12/27/2016	2 EA	0	1	1	0
		Routine	08/04/2016	2 EA	0	1	1	0
Notes: [2016] Barn and cliff swallow nests present on underside. Some bat droppings present on end diaphragms with unknown species type.								

General Notes: SLC District 7
 Inspected by: [2016] CG, NR : [2015] CG, BJ : [2015 Update] CG : [2014] BH, CG : [2013] BH, CG
 [2015] Possible addition to underwater inspection for undermining at west abutment.
 [2015 Update] Update inspection to update signing element due to new load posting signs being placed at bridge and to upload date stamped photos.
 [2014] Water high return inspection required at a later date. Boat may be necessary.

58. Deck NBI: [2016] Crack in north east corner of underside of deck with efflorescence.
 [2015] Hairline cracking throughout underside of deck.
 [2014-2013] Deck is in good condition. There is some spalling on the underside along beams top flange due to beams rusting.

36A. Brdg Railings NBI: Concrete rail with w-beam and rub rail mounted on middle of rail.

36B. Transitions NBI: Concrete end post does not meet minimum requirements.

36C. Appr Guardrail NBI: W-beam with timber posts. Traffic barrier B8307

36D. Appr Guardrail Terminal NBI: 4 ET 2000 Ends.

59. Superstructure NBI: [2016-2013] Beams have complete paint failure with surface corrosion throughout. Flaking rust starting to form on top flange and at abutments, with little to no section loss, causing concrete to start to spall.

60. Substructure NBI: [2016 U/W] Undermining of the West Abutment was present along the entire length with the most significant undermining present at the northwest corner with up to 6 feet of penetration (footing on piles).
 [2016] Spalls below steel beams 8 and 9 on east abutment. Crack 3/16" middle of west and 1/4" middle of east abutments. East abutment has moved in 3.25".
 [2015] Spalls between north fascia-beam 1 and beams 4-5 on east abutment. Spalls with exposed rebar below beams 2 and 8 on west abutment. East abutment has pushed in 3"
 [2014-2013] Substructure is in fair condition. Each abutment has 3 vertical cracks and the south abutment has moved in 3". Wingwalls are in good condition

61. Channel NBI: [2016 U/W] Channel migrating towards the West Abutment causing significant scour.
 [2016] Settlement of west approach may indicate backfill washing away behind west abutment.

Pictures



Photo 1 - Upstream Fascia, Looking Southeast



Photo 2 - Downstream Fascia, Looking North

Pictures



Photo 3 - West Abutment, Looking Southwest



Photo 4 - East Abutment, Looking Southeast

Pictures



Photo 5 - Spall Under Beam B at the West Abutment, Looking West



Photo 6 - Vertical Crack Under Beam I at the West Abutment, Looking West

Pictures



Photo 7 - West Abutment Footing, Looking South



Photo 8 - Vertical Crack Between Beams D and E at the East Abutment, Looking East

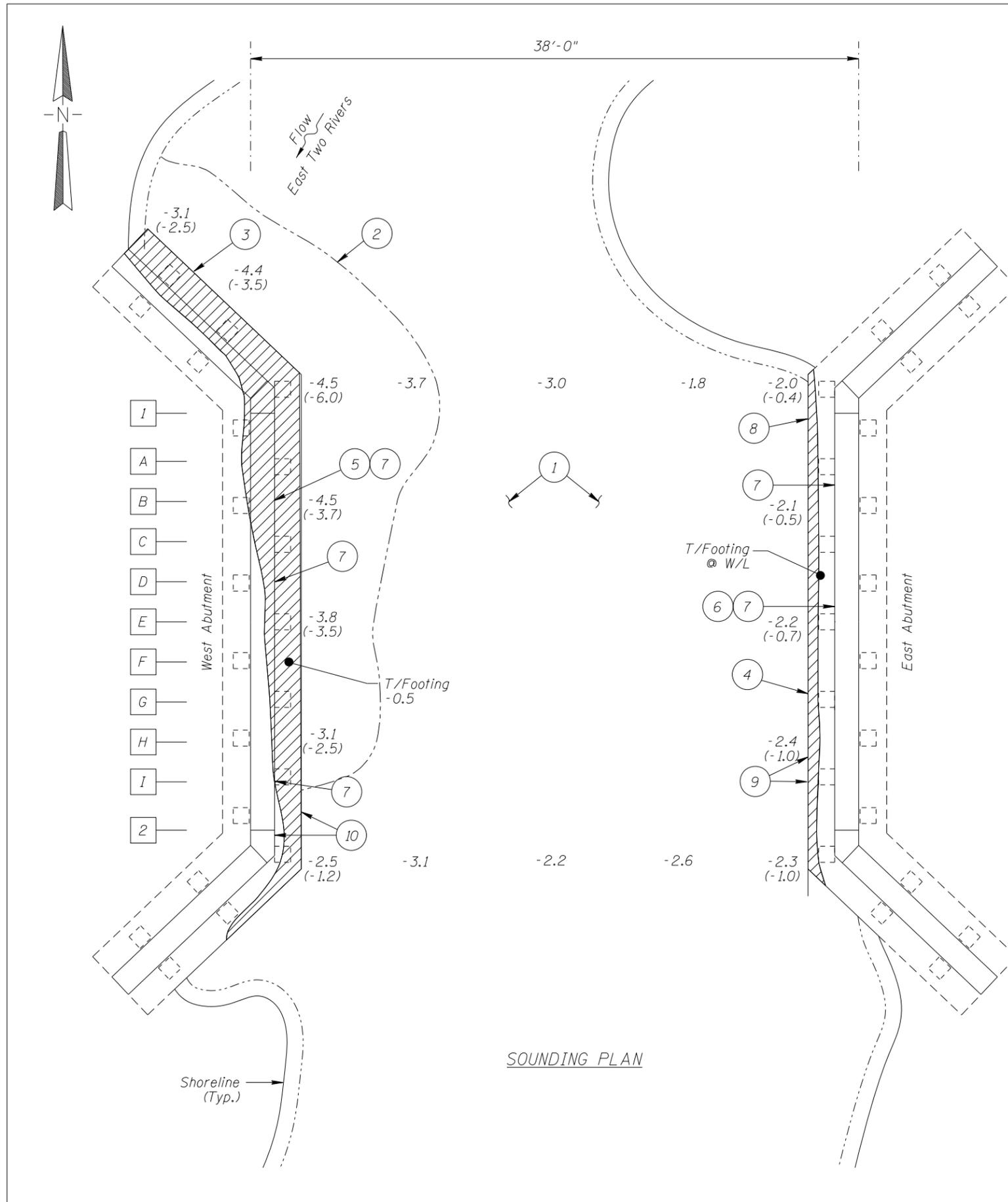
Pictures



Photo 9 - Spalls Under Beams H and I at the East Abutment, Looking Southeast



Photo 10 - East Abutment Footing, Looking North



GENERAL NOTES:

1. The East and West Abutments were inspected during the underwater inspection.
2. At the time of inspection on September 12, 2016, the waterline was located approximately 4.4 feet below the bottom of the West Abutment bridge seat at the downstream end. This corresponds to a waterline elevation of 87.0 based on design drawings dated April 16, 1928.
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 1/4 point intervals between the substructure units.

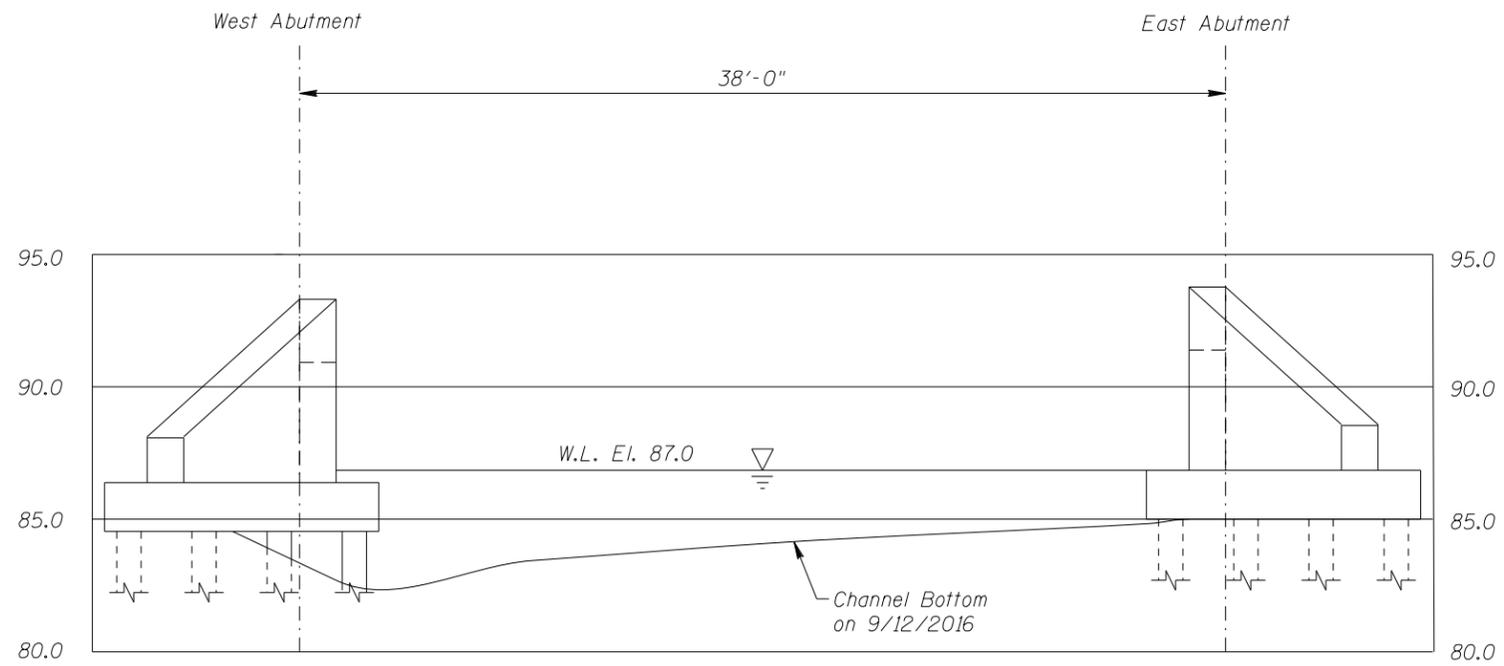
INSPECTION NOTES:

- 1 The channel bottom material typically consisted of soft silt allowing up to 1 foot of probe rod penetration.
- 2 A scour depression up to 1.5 feet deep was present at the West Abutment with the extents shown. The channel bottom material within the depression consisted of sandy gravel allowing up to 4 inches of probe rod penetration.
- 3 The West Abutment footing was exposed the full height (2.0 feet) and was undermined the entire length with an undermining void measuring up to 6 feet horizontally and 2.5 feet vertically. Within the undermine void the square concrete piles were exposed as shown.
- 4 The East Abutment footing was exposed the full height (2.0 feet) and was undermined the entire length with an undermining void measuring up to 1 foot horizontally and 3 feet vertically. No piles were exposed.
- 5 A spall 18 inches wide by 1 foot high with up to 3 inches of penetration and 2 exposed reinforcing bars with less than 5 percent section loss was present under Beam B of the West Abutment. The spall resulted in an approximately 20 percent loss of bearing area at Beam B.
- 6 A spall was present between Beams D and E at the bridge seat measuring 2 feet high by 2 feet wide with 1 exposed reinforcing bar and up to 3 inches of penetration at the West Abutment.
- 7 Vertical cracking up to 1/4 inch wide from the footing to the bridge seat was present at Beams B, D, and I of the West Abutment and between Beams A and B and D and E of the East Abutment. Associated spalling and impending spalling was observed along the length of the crack with up to 1 inch of penetration.
- 8 A spall measuring 1 foot wide by 18 inches high with up to 3 inches of penetration and 2 exposed reinforcing bars with less than 5 percent section loss was present under the concrete fascia beam (Beam 1) at the East Abutment.
- 9 Two 6 inch diameter spalls with up to 3 inches of penetration was present under Beams H and I of the East Abutment. The spalls have resulted in an approximately 15 percent loss of bearing area at Beams H and I.
- 10 The concrete surface of the abutment walls, footings, and exposed piles were typically smooth and sound.

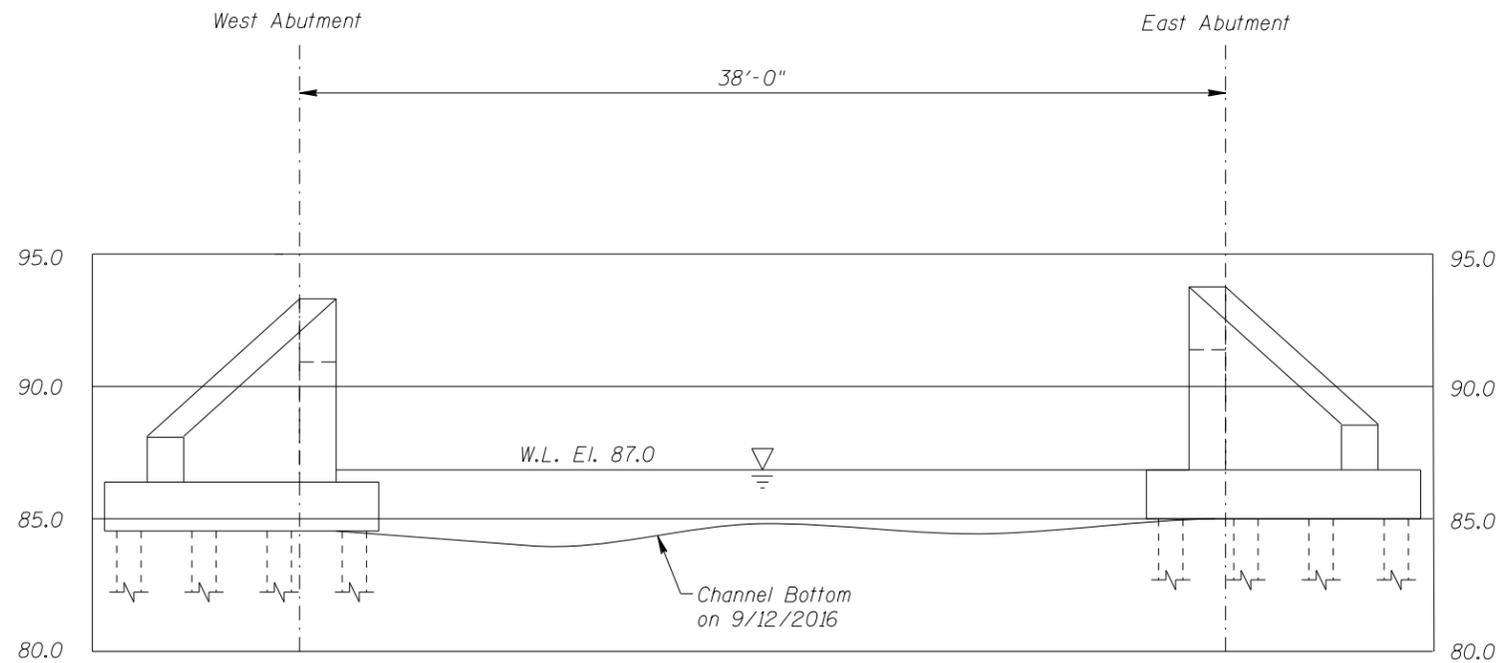
Legend

- 2.5 Sounding Depth from Waterline (9/12/2016)
- (3.0) Horizontal Penetration of Undermining
- 1 Inspection Note Number
- Concrete Pile
- Footing Undermining

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 7759 CSAH 101 OVER THE EAST TWO RIVERS DISTRICT 1, ST. LOUIS COUNTY		
INSPECTION AND SOUNDING PLAN		
DRAWN BY: ELN	COLLINS ENGINEERS	DATE: SEPT 12, 2016
CHECKED BY: MBP	<small>133 North Wacker Drive Suite 900 Chicago, IL 60606 (312) 704-9300 www.collinsengr.com</small>	SCALE: NTS
CODE: 96877759		FIGURE NO.: 1



UPSTREAM FASCIA PROFILE



DOWNSTREAM FASCIA PROFILE

Note:
 Refer to Figure 1 for General Notes.

MINNESOTA DEPARTMENT OF TRANSPORTATION UNDERWATER BRIDGE INSPECTION		
STRUCTURE NO. 7759 CSAH 101 OVER THE EAST TWO RIVERS DISTRICT 1, ST. LOUIS COUNTY UPSTREAM AND DOWNSTREAM FASCIA PROFILES		
DRAWN BY: ELN	COLLINS ENGINEERS	DATE: SEPT 12, 2016
CHECKED BY: MBP		SCALE: 1"=7'-6"
CODE: 96877759		FIGURE NO.: 2

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