

Steel Bridge 4-Part Webinar Series: Learning by Example Forest Service Project, Northern Wisconsin



David Clemens
Director – Engineered Product Sales
Wheeler



Brunswweiler River Bridge #187-1.8

Overview

- Existing Bridge
 - Load Rating
- Design Considerations
 - Reuse abutments
 - Contractor Capabilities
- Plan Details
 - Design/Supply
- Other Options for Your Projects

Existing Bridge – Built 1951

Steel Beams w/ Concrete Deck



Outdated Standards & Details



- H-15 design vehicle
- 33 ksi steel
- Non-composite deck/beam connection
- Railing not crash-tested
- Load rating to current standards would require load posting and restricted access

Design Considerations for Superstructure Replacement

- Existing foundations to remain in place
- Use local contractors
 - Less sophisticated – limited capability
- Fairly remote site
- Steel performed well at this location
- Timber deck panels – lighter than concrete deck, easier to install

Design Considerations for Superstructure Replacement

- Weathering Steel Beams
 - Acceptable performance for location
 - Minimal maintenance
 - Enhanced aesthetic
- Timber Panelized Deck
 - Light weight
 - Ease of installation
 - Available railing details
 - Improved aesthetic

Plan Development for Superstructure Replacement



United States Department of Agriculture
Forest Service

EASTERN REGION
CHEQUAMEGON - NICOLET NATIONAL FOREST
ASHLAND COUNTY
WISCONSIN

BRIDGE 187-1.8 REHAB BRUNSWEILER RIVER GREAT DIVIDE RANGER DISTRICT SN: 091302000035571

LAT: 46.30583333
LONG: -90.83500000



FOREST LOCATION



VICINITY MAP

TRAVEL DIRECTIONS

FROM THE GLIDDEN DISTRICT OFFICE ON THE CHEQUAMEGON NICOLET NATIONAL FOREST, TAKE WA-13 TOWARDS KEMPFF ROAD / CR-D FOR 1.8 MILES, TURN LEFT ONTO WA-77 FOR 16.0 MILES, TURN RIGHT ONTO HWY M FOR 0.2 MILES, TURN RIGHT ONTO HWY GG FOR 12.0 MILES, TURN LEFT ONTO MINERAL LAKE ROAD / FR 187 FOR 1.8 MILES, KEEP STRAIGHT TO BRIDGE LOCATION.

COLEMAN ENGINEERING COMPANY

635 CIRCLE DRIVE - IRON MOUNTAIN, MICHIGAN 49801 - (906) 774-3440
200 EAST AYER STREET - IRONWOOD, MICHIGAN 49938 - (906) 932-5048
130 US HWY 41 E., STE B - NEGUNBE, MICHIGAN 49866 - (906) 475-7489
790 MARVELLE LANE, UNIT 3 - ASHWALBENON, WI 54304 - (920)-264-9404



March 2021

INDEX OF SHEETS

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C-11	GUARDRAIL DETAILS	
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C-13	CROSS SECTIONS	



RECOMMENDED BY:

Justin Blake
Digitally signed by
JUSTIN BLAKE
Date: 2021.04.23
09:42:59 -0500

FOREST ENGINEER

DATE

Michael Martin
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MICHAEL MARTIN
Date: 2021.04.29
16:07:06 -0500

DISTRICT RANGER

DATE

Paul Strong
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PAUL STRONG
Date: 2021.04.30
06:31:47 -0500

RD BRIDGE PROGRAM MANAGER

DATE

APPROVED:

Paul Strong
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PAUL STRONG
Date: 2021.04.30
06:31:47 -0500

FOREST SUPERVISOR

DATE

Josiah Kim
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JOSIAH KIM
Date: 2021.05.04
06:58:18 -0500

DIRECTOR OF ENGINEERING

DATE

Final Bridge Plan

SPECIFICATIONS:

GRADING

ALL DOUGLAS FIR-LARCH TO BE GRADED PER WCLB STANDARD GRADING RULES.

ALL SOUTHERN YELLOW PILE TO BE GRADED PER SPB STANDARD GRADING RULES.

MATERIALS & TREATMENT

TIMBER PRESERVATIVE TREATMENT SHALL BE IN ACCORDANCE WITH CURRENT STATE AND/OR AASHTO SPECIFICATIONS. ALL TIMBER SHALL BE COPPER NAPHTHENE TREATED UNLESS NOTED OTHERWISE.

FLOORING TO BE DOUGLAS FIR-LARCH, NO.1, S1S1E (S 1/2" SMOOTH TOP).

GLU-LAM SCUFFERS, CURBS, RAILPOSTS, AND RAILPOST BLOCKS TO BE DOUGLAS FIR COMB. SYMBOL 24F-V4, DF/DF.

GLU-LAM RAIL TO BE DOUGLAS FIR COMB. SYMBOL 24F-V8, DF/DF.

3" X 12" WEAR COURSE TO BE DOUGLAS FIR-LARCH, NO.1, S1S1E (2 1/2" X 11 1/2").

BALANCE OF TIMBER TO BE DOUGLAS FIR-LARCH, IN ACCORDANCE WITH DESIGN REQUIREMENTS.

ALL TIMBER IS ROUGH UNLESS OTHERWISE NOTED.

MISCELLANEOUS

ALL TIMBER TO BE CUT TO EXACT LENGTH, DRESSED TO SIZE REQUIRED AND ALL PRACTICAL FRAMING TO BE DONE PRIOR TO TREATMENT.

ALL DECK PLANKS SHALL BE PREFORLED PRIOR TO TREATMENT.

ALL PLANK FOR DECK PANELS SHALL BE PRECISION END TRIMMED TO LENGTH WITH 1/4" UNDERLENGTH & NO OVERLENGTH TOLERANCE PERMITTED.

DECK PANELS SHALL BE ASSEMBLED WITH 3/8" DIAMETER RING SHANK DOWELS. ALL DOWELS ARE TO BE SIMULTANEOUSLY DRIVEN WITH EQUAL FORCE USING A MECHANICAL PRESS THE FULL LENGTH OF THE DECK, ENSURING ALL HEADS ARE FLUSH WITH THE SURFACE OF THE TIMBER PLANK. MULTIPLE IMPACT TOOLS ARE NOT TO BE USED TO SET DOWELS BECAUSE OF POTENTIAL FOR WOOD FIBER RUPTURE.

DECK PANELS WILL BE DELIVERED TO JOBSITE AFTER BEING FULLY ASSEMBLED AT FABRICATION PLANT.

TIMBER CONNECTION HARDWARE: ALL HARDWARE TO MEET ASTM A307-97 GALVANIZED TO ASTM F2329 (A153). ALL HIGH STRENGTH HARDWARE TO MEET ASTM A325 OR A449 GALVANIZED TO ASTM F2329 (A153). ALL STRUCTURAL STEEL TO MEET ASTM A36, GALVANIZED TO ASTM A123.

STEEL CONNECTION HARDWARE: ALL HIGH STRENGTH HARDWARE TO MEET ASTM A325 TYPE 3. STRUCTURAL STEEL PLATES & SHAPES TO CONFORM TO ASTM A709, GRADE 50W.

STEEL GENERAL NOTES:

THE WELDING PROCESS SHALL BE THE FLUX CORE ARC WELDING PROCESS, UTILIZING E81T1-W2/W2M ELECTRODES OR EQUAL, OR APPROVED BY WHEELER LUMBER, LLC.

STRUCTURAL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AASHTO D1.5 WELDING CODE.

OUTSIDE FACE OF FASCIA BEAMS SHALL BE BLAST CLEANED BY ACCORDANCE WITH THE STEEL STRUCTURES PAINTING COUNCIL SURFACE PREPARATION SPECIFICATION NO. 6 COMMERCIAL BLAST CLEANING (SSPC-SP6).

TEN PERCENT OF EACH DIFFERING STRUCTURAL WELDS SHALL BE RANDOMLY TESTED (MAGNETIC PARTICLE). TWENTY PERCENT OF ALL WELD TERMINATIONS SHALL BE RANDOMLY TESTED (MAGNETIC PARTICLE). ONE HUNDRED PERCENT OF BEARING STIFFENER WELDS SHALL BE TESTED (MAGNETIC PARTICLE).

STRINGER STIFFENERS SHALL BE PERPENDICULAR TO FLANGE.

ALL BOLTED CONNECTIONS SHALL BE MADE WITH 7/8" DIA. A325 TYPE 3 BOLTS.

NO FIELD OR SHOP STRINGER SPLICES ARE PERMITTED.

PLACE STRINGERS WITH NATURAL CAMBER UP.

CONSTRUCTION NOTES:

PANEL "A" IS PLACED IN ITS FINAL POSITION ON THE STRINGERS. NEXT DRILL 13/16" HOLES THRU THE PANEL AND FASTEN DECK TO STRINGERS WITH 3/4" DOME HEAD BOLTS & HCP-15 BRIDGE TE ANCHORS. NEXT PLACE THE NEXT PANEL "C" SO THAT ITS UPPER SPLICE BLOCK IS DIRECTLY OVER THE LOWER SPLICE BLOCK ON THE PANEL "A" AND DRAW TIGHT TOGETHER. THEN DRILL THE 9/16" DIA HOLES THRU LOWER SPLICE BLOCK AND DRIVE THE 5/8" DIA HD DR SPIKES FOR THE SHIP LAP JOINTS AT LOCATIONS SHOWN. AGAIN, DRILL 13/16" HOLES THRU THE PANELS AND INSTALL THE 3/4" DOME HEAD BOLTS & HCP-15 BRIDGE TE ANCHORS. THEREAFTER, SUCCESSIVELY PLACE THE REMAINING "C'S" & "B" PANELS FOR THE STEEL STRINGER CONNECTIONS IN THE SAME MANNER, ENSURING ALL PANELS ARE DRAWN TIGHT TOGETHER BEFORE ANY FASTENING OCCURS.

ALL HOLES DRILLED IN FIELD WHERE SPIKES ARE USED ARE TO BE 1/16" SMALLER THAN SPIKE SIZE.

HOLES DRILLED FOR BOLTS ARE TO BE 1/16" LARGER THAN BOLT SIZE.

HOLES DRILLED FOR 3/4" LAG BOLTS ARE TO BE 9/16" IN DIAMETER FOR THE THREADED PORTION OF THE BOLT AND 13/16" FOR THE SHANK.

ANY NUT OR MACHINE BOLT HEAD IN DIRECT CONTACT WITH TIMBER TO HAVE ONE PLATE WASHER BETWEEN NUT & TIMBER, OR BOLT HEAD & TIMBER.

ANY HEX LAG IN DIRECT CONTACT WITH TIMBER TO HAVE ONE CUT WASHER BETWEEN HEAD & TIMBER.

SET THREADS ON ALL BOLTS AT NUT WITH A CENTER PUNCH AFTER TIGHTENING.

ALL DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO FABRICATING MATERIALS.

ALL TIMBER CUT OR DRILLED IN THE FIELD SHALL BE TREATED WITH AN APPROVED PRESERVATIVE.

CONSTRUCTION REQUIREMENTS SHALL CONFORM TO STATE SPECIFICATIONS UNLESS NOTED OTHERWISE.

ALTHOUGH ALL PRACTICAL PRE-FRAMING WILL BE DONE PRIOR TO TREATING, SOME CUTTING & DRILLING WILL BE REQUIRED IN THE FIELD.

STRUCTURAL STEEL NOTES:

CORROSION RESISTANT HIGH-STRENGTH LOW-ALLOY MATERIAL MEETING ASTM A588, OR A587 WITH MIN. CORROSION INDEX OF 6.0 PER ASTM G101. ALL STRUCTURAL STEEL SHALL BE UNPAINTED AND SELF-WEATHERING.

BRIDGE 187-1.8 REHAB ASHLAND COUNTY, WISCONSIN BRUNSWEILER RIVER TRANSV. SPAN TIMBER DECK ON STEEL STRINGERS

DESIGN DATA:

DESIGN OF SUPERSTRUCTURE COMPLIES WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS 9TH EDITION.

BRIDGE SPAN RATINGS	
BRIDGE IS DESIGNED TO AASHTO HL-93 LOADING	
RATINGS BASED ON FLEXURE	
LOAD	HL93 RATING FACTOR
INVENTORY	RF = 1.22
OPERATING	RF = 1.58

PLAN SHEET INDEX

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1	COVER SHEET & SPECIFICATIONS
2	GENERAL BRIDGE PLAN & ELEVATION
3	FRAMING PLAN/ABUTMENT PLAN & ELEVATION
4	ABUTMENT PLAN & ELEVATION
5	BEARING DETAILS
6	SECTION THRU/DIAPHRAGM DETAILS
7	SECTION THRU RAILPOST & DETAILS
8	RAIL & CURB CONNECTION DETAILS
9	RAIL & CURB TRANSITION DETAIL
10	TRANSITION DETAILS

REVISION	DESCRIPTION	DATE	INITIALS
▲	ADJUSTED DIMENSIONS, NOTES, & BOLTS	9/21/22	JLS
▲			
▲			

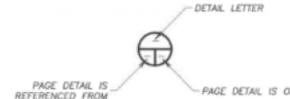
COVER SHEET & SPECIFICATIONS

**61'-0" TREATED TRANSVERSE TIMBER
DECK ON STEEL STRINGERS
14'-6" CLEAR ROADWAY
BRIDGE 187-1.8, BRUNSWEILER RIVER
ASHLAND COUNTY, WISCONSIN**



9531 W 78th Street, Ste.100
Eden Prairie, MN 55344
952-929-7854
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DATE: 08/09/22	TRACING NO. 121892P	SHEET NO.
DWN: JLS	CHR: DSN	ORDER NO. 711-15054
		1 OF 10



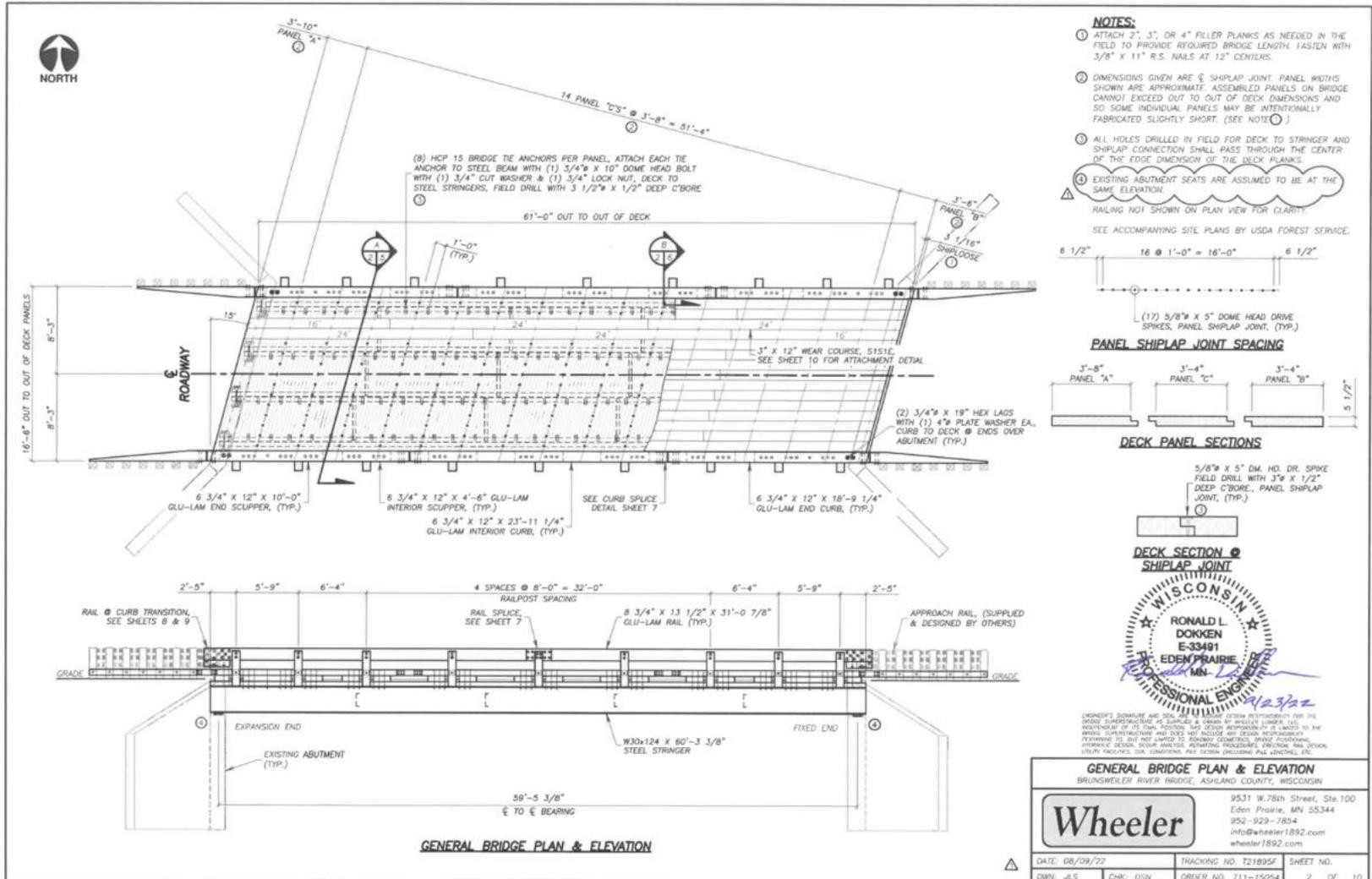
CALLOUT LEGEND

DO NOT SCALE DRAWINGS



ENGINEER'S SIGNATURE AND SEAL ARE TO ASSUME DESIGN RESPONSIBILITY FOR THE BRIDGE SUPERSTRUCTURE AS SUPPLIED BY WHEELER LUMBER, LLC. INDEPENDENT OF ITS FIRM POSITION. THIS DESIGN RESPONSIBILITY IS LIMITED TO THE BRIDGE SUPERSTRUCTURE AND DOES NOT INCLUDE ANY DESIGN RESPONSIBILITY PERTAINING TO, BUT NOT LIMITED TO, ROADWAY DIMENSIONS, BRIDGE PROVISIONS, PROBABLE DESIGN, SOIL ANALYSIS, FOUNDATION PROVISIONS, SECTION, DIM. DETAIL, QUALITY ANALYSIS, OR CONDITIONS FILE BEING (INCLUDING PLAN LENGTH), ETC.

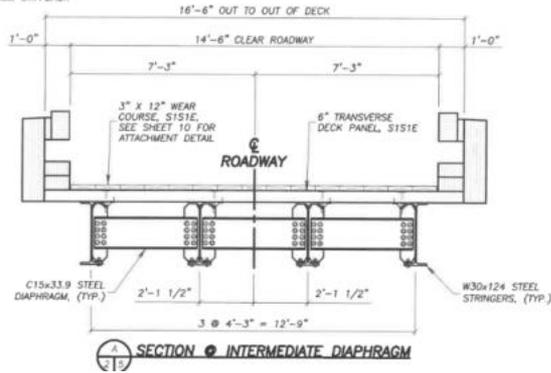
Final Bridge Plan



Steel Beam Details

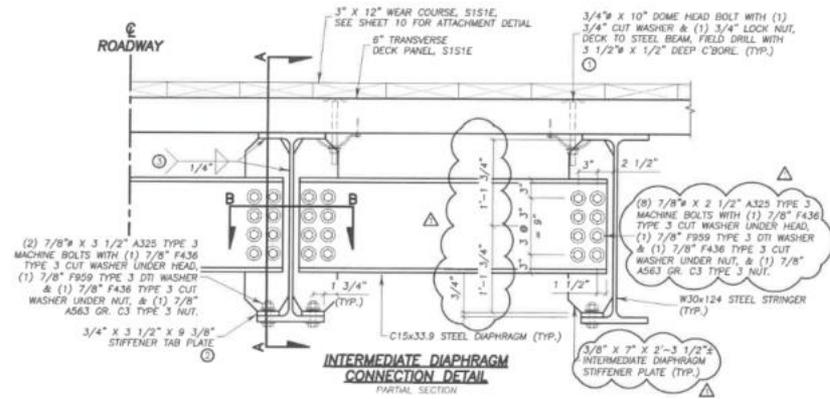
NOTES:

- ① ALL HARDWARE PENETRATING THE TOP OR BOTTOM EDGE OF THE DECK PLANK SHALL PASS THROUGH THE CENTER OF THAT EDGE DIMENSION.
- ② BOLT PLATE TO BEAM FLANGE PRIOR TO WELDING PLATE TO DIAPHRAGM STIFFENER

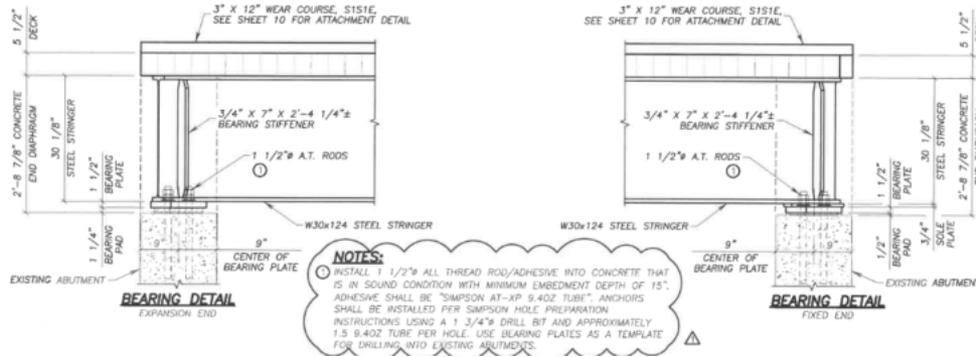


NOTES:

- ③ SEE SHEET 5 FOR TYP. STOP WELD DIMENSION DETAILS.

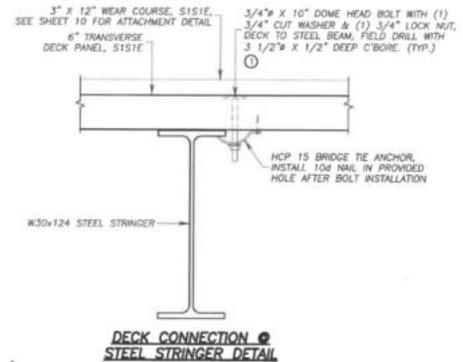


LOCATION	BEAM FLANGE WIDTH	BEARING PAD SIZE			STEEL PLATES		LAMINATES	SHAPE FACTOR	BEARING PLATE SIZE			SOLE PLATE SIZE			ASSY. HEIGHT
		W	L	T	NO.	THICK.	NO.		THICK.	W	L	T	W	L	
EXP. ABUT.	10 1/2"	8"	14"	1 1/4"	2	1/8"	1	1/2"	5.1	10"	23"	1 1/2"	-	-	2 3/4"
FIXED ABUT.	10 1/2"	8"	14"	1/2"	-	-	1	1/2"	5.1	10"	23"	1 1/2"	11"	13"	3/4"

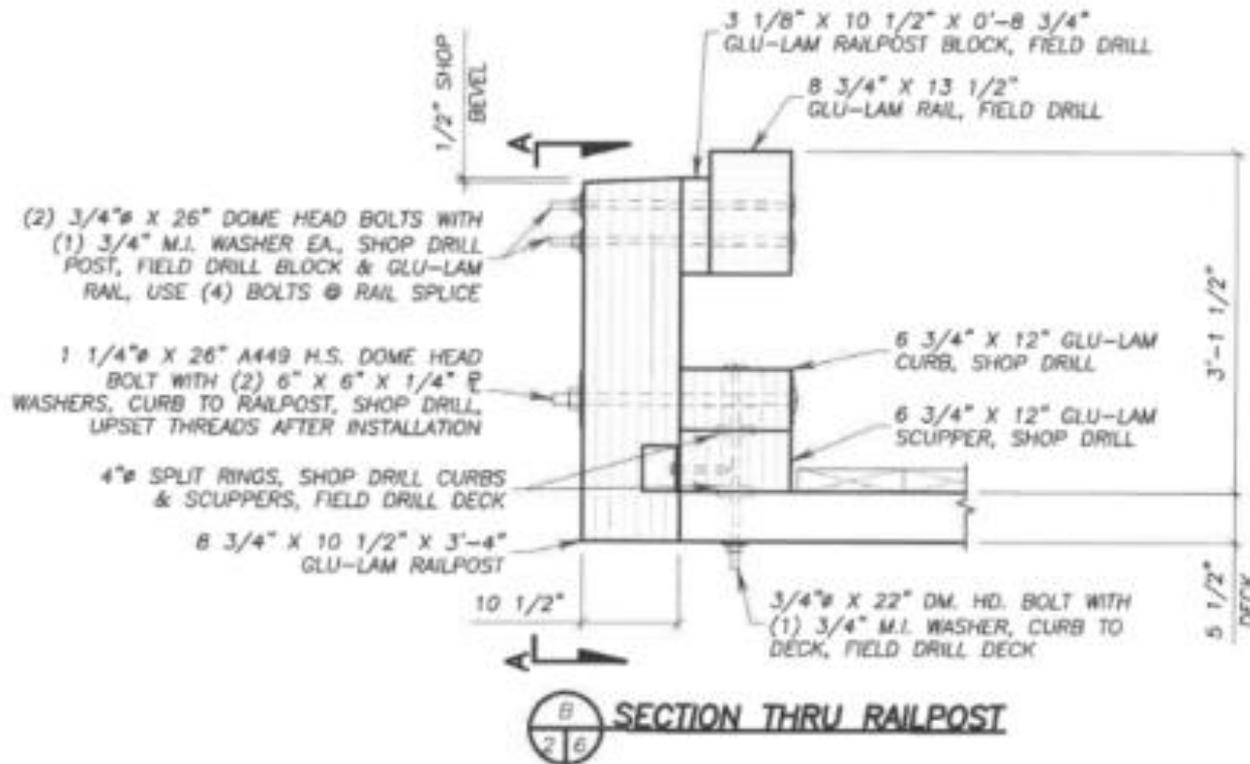


NOTES:

- ① INSTALL 1 1/2" ALL THREAD ROD/ADHESIVE INTO CONCRETE THAT IS IN SOUND CONDITION WITH MINIMUM EMBEDMENT DEPTH OF 15". ADHESIVE SHALL BE "SIMPSON AT-XP 9.40Z TUBE" ANCHORS SHALL BE INSTALLED PER SIMPSON HOLE PREPARATION INSTRUCTIONS USING A 1 3/4" DRILL BIT AND APPROXIMATELY 1.5 9.40Z TUBE PER HOLE. USE BEARING PLATES AS A TEMPLATE FOR DRILLING INTO EXISTING ABUTMENTS.



TL-4 Crash-tested Railing Details (NCHRP 350)



Calculation Packet

Wheeler

T21895 W15054
Final Design
Brunsweller River Bridge

Page 1 of 24
Design: DSN - 8/26/2022

program version 11/14/2020

Wheeler Lumber, LLC
DESIGN COMPUTATIONS
Steel Stringer Bridge

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Title, _____ Page #

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"CONSTANTS AND FACTORS"	5
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"STRINGER DESIGN"	12
"DEFLECTION AND VIBRATION"	21
"DIAPHRAGM DESIGN"	22
"HL-93 LRFR RATING"	23



On to construction...starting with deconstruction



Removing the concrete deck...not composite with beams



Setting the beams with two excavators



Diaphragms and anchor bolts installed



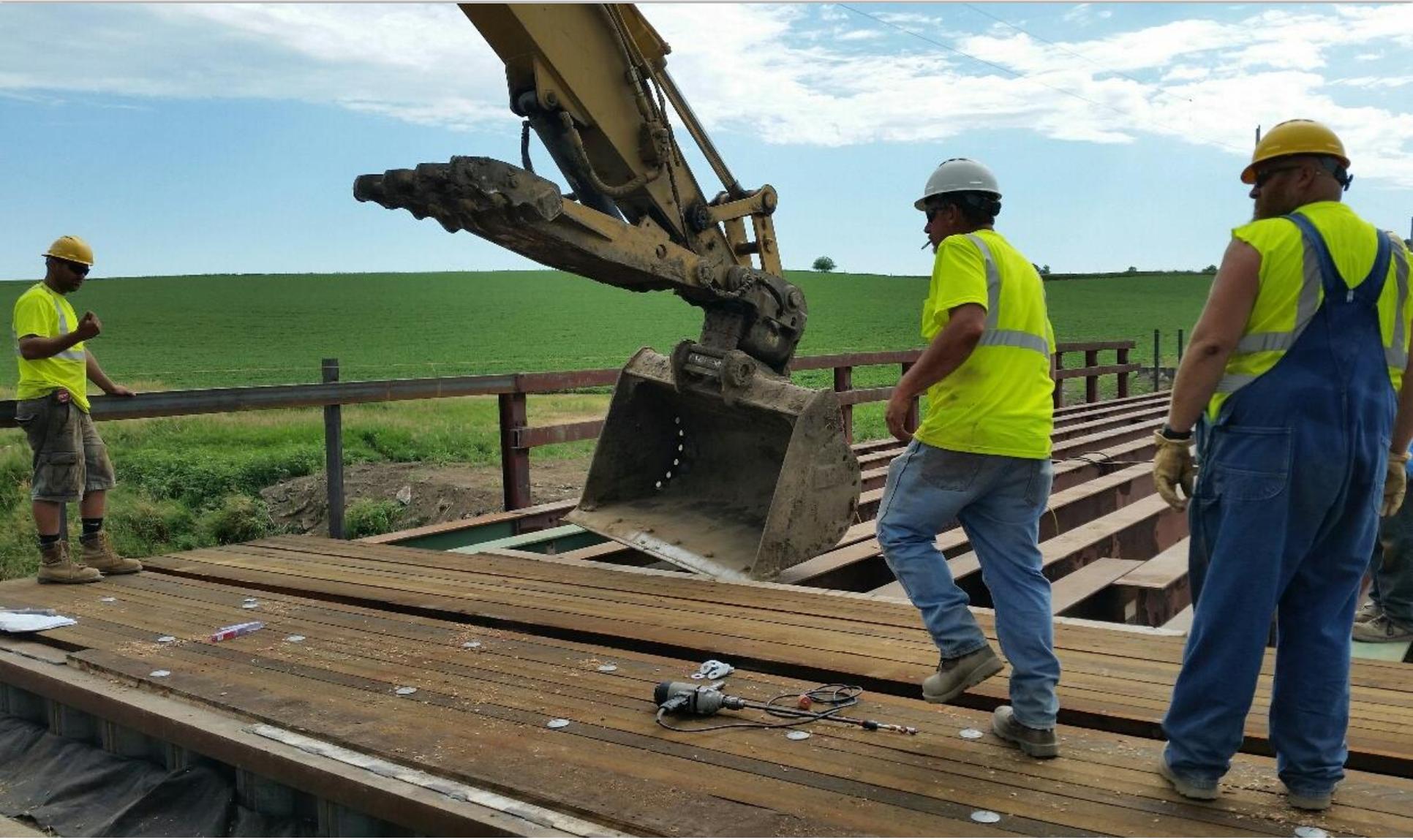
Typical deck panel installation



Typical deck panel installation



Typical deck panel installation



Typical deck panel installation



Typical deck panel installation



Railing and wear course attached to finished deck



Bridge open to traffic



Timeline for road closer

- 10/24/22 Deck demolition
- 11/3/22 Beam install
- 11/16/22 Wear course/railing install
- 11/23/22 Open to traffic

Approach rail added



Railing attachment



Finished abutment



A good-looking bridge complimenting the location



Superior National Forest



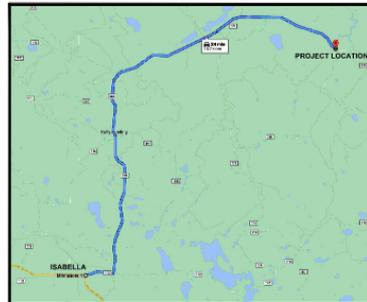
United States Department of Agriculture
Forest Service

MINNESOTA
LAKE COUNTY
(R09) EASTERN REGION
SUPERIOR NATIONAL FOREST
TOFTE RANGER DISTRICT

FR 369-12.8 DUMBBELL RIVER BRIDGE REPLACEMENT



FOREST LOCATION



PROJECT SITE

PROJECT LOCATION: FROM ISABELLA ON MN HWY 1, GO EAST ON WANLESS RD FR172 FOR 1 MILE, THEN GO NORTH ON TRAPPERS LAKE RD FR369 FOR 5.5 MILES, STAY RIGHT AT THE WYE AND CONTINUE NE ON FR369 TO THE BRIDGE.

STRUCTURE NUMBER: 090907000034765 (47.7111N, 91.20189W)
STRUCTURE DESCRIPTION:
40 FOOT SINGLE SPAN TIMBER BRIDGE CONSISTING OF
LONGITUDINAL SPIKE GI LULAM LAMINATED SLAB DECK, TIMBER
ABUTMENTS, AND TIMBER PILES
DESIGN SPEED: 45 MPH
AADT <200

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5	MISCELLANEOUS QUANTITIES	12/21/2020
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RECOMMENDED BY: **JAMES STREZISHAR**
FOREST ENGINEER
Date: 2021.01.04 15:55:01 -06'00'

BY BRIDGE PROGRAM MANAGER: *[Signature]*
DISTRICT RANGER

APPROVED: **JOSHUA KIM**
SUPERVISOR OF ENGINEERING
Date: 2021.01.06 11:43:42 -06'00'

Digitally signed by JAMES STREZISHAR
Digitally signed by LLEN BOGARDEUSZYMANIAK
Digitally signed by CONSTANC E CUMMINS

FR 369 – 12.8 Dumbbell River Bridge Replacement



Steel Beam with Timber Deck Considerations

- Multiple finishes available
 - Weathering, Painted, Galvanized
- Non-composite deck to beam design
- Simple installation
 - Less sophisticated contractors, smaller equipment
 - Not weather dependent
- Crash-tested railings available
 - TL-1, TL-2 & TL-4
- Wear surfaces
 - Asphalt, Chip-seal, Timber

Multi-span application - Buffalo County, WI



Painted Steel Beams - Saint Louis County, MN



Painted Steel Beams - Saint Louis County, MN



Painted Steel Beams – Monroe County, WI



TL-2 Railing Detail



Thank you!



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