

Highway Bridge Inspection Report

BR# 5196

AUGUSTA MEMORIAL BRIDGE

100,201,202

Over

KENNEBEC RIVER + MCRR

Town:

Augusta



Inspection Date: 05/12/2021

Inspected By: VHB,VHB

Inspection Type(s): Special

Highway Bridge Inspection Report

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over

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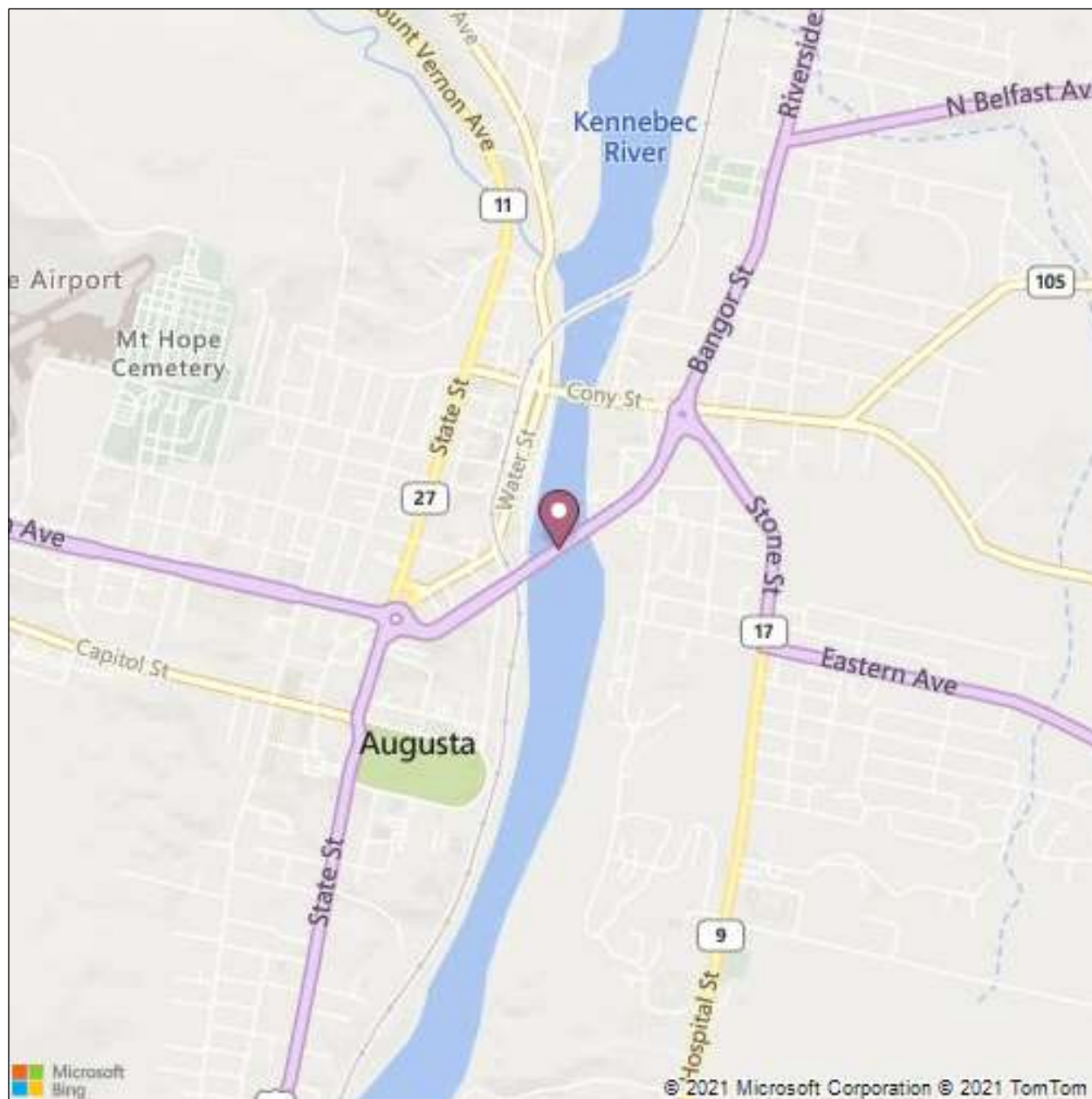
Inspection Type(s): Special

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Inspection Date: 05/12/2021

Structure Number: 5196
Facility Carried: 100,201,202

Highway Bridge Inspection Report

Location Map



Latitude: 44.31245
Longitude: -69.77286

National Bridge Inventory

Status: 0 - ND

Bridge Name: AUGUSTA MEMORIAL BRIDGE

Sufficiency Rating: 66.2

Inspections

(90) INSPECTION DATE	& (91) DESIGNATED INSPECTION FREQUENCY	24	10/11/2019
(92) CRITICAL FEATURE INSPECTION	& (93) CFI DATE		
(92A) FRACTURE CRITICAL DETAIL		Y 24	11/19/2019
(92B) UNDERWATER INSPECTION		Y 60	08/14/2019
(92C) OTHER SPECIAL INSPECTION		Y 60	05/12/2021

Identification

(1) STATE CODE	231 - Maine
(8) STRUCTURE NUMBER	5196
(5) INVENTORY ROUTE	
(5A) RECORD TYPE	1: Route carried "on" the structure
(5B) ROUTE SIGNING PREFIX	3 - STATE HIGHWAY
(5C) DESIGNATED LEVEL OF SERVICE	1 - MAINLINE
(5) INVENTORY ROUTE	201
(5) INVENTORY ROUTE	0 - NOT APPLICABLE
(2) HIGHWAY AGENCY DISTRICT	02 - Mid-Coast
(3) COUNTY CODE	011 Kennebec
(4) PLACE CODE	02100
(6) FEATURES INTERSECTED	KENNEBEC RIVER + MCRR
(7) FACILITY CARRIED	100,201,202
(9) LOCATION	.2 MI W 9
(11) MILEPOINT	31.510
(12) BASE HIGHWAY NETWORK	Inventory Route is on the Base Network
(13) LRS INVENTORY ROUTE, SUBROUTE	
(13A) LRS INVENTORY ROUTE	000000201X
(13B) SUBROUTE NUMBER	00
(16) LATITUDE	44.31245
(17) LONGITUDE	-69.77286
(98A) BORDER BRIDGE CODE	
(98B) PERCENT RESPONSIBILITY	0
(99) BORDER BRIDGE STRUCT NO.	n/a

Structure Type and Material

(43) STRUCTURE TYPE, MAIN	
(43A) KIND OF MATERIAL/DESIGN	4 - Steel continuous
(43B) TYPE OF DESIGN/CONSTR	09 - Truss - Deck
(44) STRUCTURE TYPE, APPROACH SPANS	
(44A) KIND OF MATERIAL/DESIGN	3 - Steel
(44B) TYPE OF DESIGN/CONSTRUCTION	02 - Stringer/Multi-beam or Girder
(45) NUMBER OF SPANS IN MAIN UNIT	5
(46) NUMBER OF APPROACH SPANS	6
(107) DECK STRUCTURE TYPE	1 - Concrete Cast-in-Place
(108) WEARING SURFACE/PROTECTIVE SYSTEMS	
(108A) WEARING SURFACE	6 - Bituminous
(108B) DECK MEMBRANE	2 - Preformed Fabric
(108C) DECK PROTECTION	0 - None

Age of Service

(27) YEAR BUILT	1949
(106) YEAR RECONSTRUCTED	2006
(42) TYPE OF SERVICE	
(42A) TYPE OF SERVICE ON BRIDGE	5 - Highway-pedestrian
(42B) TYPE OF SERVICE UNDER BRIDGE	8 - Highway - waterway - railroad
(28) LANES	
(28A) LANES ON THE STRUCTURE	02
(28B) LANES UNDER THE STRUCTURE	02
(29) AVERAGE DAILY TRAFFIC	22749
(30) YEAR OF AVERAGE DAILY TRAFFIC	2016
(109) AVERAGE DAILY TRUCK TRAFFIC	5
(19) BYPASS DETOUR LENGTH	6

Geometric Data

(48) LENGTH OF MAXIMUM SPAN (ft.)

	350
(49) STRUCTURE LENGTH (ft.)	2098.0
(50) CURB/SIDEWALK WIDTHS	
(50A) LEFT CURB SIDEWALK (ft.)	5
(50B) RIGHT CURB SIDEWALK (ft.)	5
(51) BRDG RDWY WIDTH CURB-TO-CURB (ft.)	34.0
(52) DECK WIDTH, OUT-TO-OUT (ft.)	48.5
(32) APPROACH ROADWAY WIDTH (ft.)	34.0
(33) BRIDGE MEDIAN	0 - No median
(34) SKEW (deg.)	0
(35) STRUCTURE FLARED	1 - Yes, flared
(10) INV RTE, MIN VERT CLEARANCE (ft.)	328.05
(47) TOTAL HORIZONTAL CLEARANCE (ft.)	34.0
(53) VERTICAL CLEARANCE OVER BRIDGE ROADWAY (ft.)	327.76
(54) MIN VERTICAL UNDERCLEARANCE	
(54A) REFERENCE FEATURE	H - Highway beneath structure
(54B) MIN VERTICAL UNDERCLEASENCE (ft.)	26.17
(55) MIN LATERAL UNDER CLEARANCE RIGHT	
(55A) REFERENCE FEATURE	H - Highway beneath structure
(55B) MIN LATERAL UNDER CLEARANCE RIGHT (ft.)	6.56
(56) MIN LATERAL UNDER CLEARANCE (ft.)	8.5

Classification

(112) NBIS BRIDGE LENGTH	Yes
(104) HIGHWAY SYSTEM OF THE INVENTORY ROUTE	0 - Structure/Route is NOT on NHS
(26) FUNCTIONAL CLASSIFICATION OF INVENTORY ROUTE	16 - Urban - Minor Arterial
(100) STRAHNET HIGHWAY DESIGNATION	Not a STRAHNET route
(101) PARALLEL STRUCTURE DESIGNATION	N - No parallel structure
(102) DIRECTION OF TRAFFIC	2-way traffic
(103) TEMP STRUCTURE	
(105) FEDERAL LANDS HIGHWAYS	Not Applicable
(110) DESIGNATED NATIONAL NETWORK	Inventory route not on network
(20) TOLL	3 - On Free Road
(21) MAINTENANCE RESPONSIBILITY	01 - State Highway Agency
(22) OWNER	01 - State Highway Agency
(37) HISTORICAL SIGNIFICANCE	2 - Eligible for National Register

Condition

(58) DECK	7 - Good Condition (some minor problems)
(59) SUPERSTRUCTURE	6 - Satisfactory Condition (minor deterioration)
(60) SUBSTRUCTURE	6 - Satisfactory Condition (minor deterioration)
(61) CHANNEL & CHANNEL PROTECTION	6 - Bank slump. widespread minor damage
(62) CULVERT	N - Not Applicable

Load Rating and Posting

(31) DESIGN LOAD	5 - HS 20
(63) METHOD USED TO DETERMINE OPERATING RATING	8 - Load and Resistance Factor Rating (LRFR) rating report by rating factor (RF) method using HL-93 loadings.
(64) OPERATING RATING	0.84
(65) METHOD USED TO DETERMINE INVENTORY RATING	8 - Load and Resistance Factor Rating (LRFR) rating report by rating factor (RF) method using HL-93 loadings.
(66) INVENTORY RATING	0.65
(70) BRIDGE POSTING	5 - Equal to or above legal loads
(41) STRUCTURE OPEN/POSTED/CLOSED	A - Open

Appraisal

(67) STRUCTURAL EVALUATION	5
(68) DECK GEOMETRY	4
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL	4
(71) WATERWAY ADEQUACY	9 - Bridge Above Flood Water Elevations
(72) APPROACH ROADWAY ALIGNMENT	7 - Better than present minimum criteria
(36) TRAFFIC SAFETY FEATURE	
36A) BRIDGE RAILINGS:	0 - Does not meet acceptable standards/safety feature is required
36B) TRANSITIONS:	0 - Does not meet acceptable standards/safety feature is required
36C) APPROACH GUARDRAIL	0 - Does not meet acceptable standards/safety feature is required
36D) APPROACH GUARDRAIL ENDS	0 - Does not meet acceptable standards/safety feature is required

Proposed Improvements

(75) TYPE OF WORK

(75A) TYPE OF WORK PROPOSED

(75B) WORK DONE BY

(76) LENGTH OF STRUCTURE IMPROVEMENT (ft.)

(94) BRIDGE IMPROVEMENT COST (\$K)

(95) ROADWAY IMPROVEMENT COST (\$K)

(96) TOTAL PROJECT COST

(97) YEAR OF IMPROVEMENT COST ESTIMATE

(114) FUTURE ADT

31849

(115) YEAR OF FUTURE ADT

2036

Navigation Data

(38) NAVIGATION CONTROL

1 - Navigation control on waterway (bridge permit required)

(111) PIER OR ABUTMENT PROTECTION

2 - In place and functioning

(39) NAV VERT CLEARANCE

70

(116) MIN NAVIGATION VERT CLEARANCE, VERT LIFT BRIDGE

0

(40) NAV HORIZONTAL CLEARANCE

67.0

See 11/19/2019 Hoyle, Tanner Routine and Fracture Critical Inspection Report.

Other

See 11/19/2019 Hoyle, Tanner Routine and Fracture Critical Inspection Report.

Special Inspection

An ultrasonic inspection of the bridges pin and link system was performed on all 6 pin connections and 2 pin and link connections. The pin connections are in fair condition overall minor corrosion the exposed area of the pins. The pin and link connections are in poor condition overall. There are gaps between the edges of the pin hole in the link plates and the circumference of the pin, the faces of the exterior link plates are out from the ends of the pins, and the link plate on the upstream truss is resting on and wearing into the top of the suspended retainer plate.

See the VHB 2021 Pin & Link Connection Inspection Report for more details.

Monitoring

Pontis Notes

Inspector: VHB VHB

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Highway Bridge Inspection Report

Element Inspection

Rollup

	Environment	Total Quantity	Units	Condition State 1	Condition State 2	Condition State 3	Condition State 4
29 - Steel Deck with Concrete Filled Grid	4 - Sev.	101888	sq. ft.	101828	60	0	0
107 - Steel Open Girder/Beam	2 - Low	1676	ft.	1176	500	0	0
515 - Steel Protective Coating		31965	sq. ft.	29965	2000	0	0
113 - Steel Stringer	2 - Low	14151	ft.	11851	2300	0	0
515 - Steel Protective Coating		80696	sq. ft.	80346	350	0	0
120 - Steel Truss	2 - Low	2900	ft.	253	2614	33	0
515 - Steel Protective Coating		156876	sq. ft.	155376	1500	0	0
152 - Steel Floor Beam	2 - Low	4160	ft.	1385	2775	0	0
515 - Steel Protective Coating		34538	sq. ft.	33838	700	0	0
161 - Steel Pin and Pin & Hanger Assembly or both	2 - Low	8	each	0	8	0	0
515 - Steel Protective Coating		604	sq. ft.	594	0	10	0
162 - Steel Gusset Plate	2 - Low	472	each	150	316	6	0
515 - Steel Protective Coating		9610	sq. ft.	9520	90	0	0
202 - Steel Column	2 - Low	2	each	0	2	0	0
515 - Steel Protective Coating		232	sq. ft.	232	0	0	0
205 - Reinforced Concrete Column	2 - Low	8	each	2	6	0	0
205 - Reinforced Concrete Column	3 - Mod.	4	each	0	4	0	0
210 - Reinforced Concrete Pier Wall	2 - Low	227	ft.	0	227	0	0
215 - Reinforced Concrete Abutment	2 - Low	118	ft.	0	118	0	0
302 - Compression Joint Seal	4 - Sev.	49	ft.	36	5	8	0
305 - Assembly Joint without Seal	4 - Sev.	146	ft.	111	35	0	0
310 - Elastomeric Bearing	2 - Low	12	each	10	0	2	0
311 - Movable Bearing	2 - Low	8	each	0	8	0	0
515 - Steel Protective Coating		631	sq. ft.	617	14	0	0
313 - Fixed Bearing	2 - Low	21	each	4	17	0	0
515 - Steel Protective Coating		392	sq. ft.	377	15	0	0
330 - Metal Bridge Railing	2 - Low	4166	ft.	4166	0	0	0
515 - Steel Protective Coating		11920	sq. ft.	11820	100	0	0
331 - Reinforced Concrete Bridge Railing	4 - Sev.	4180	ft.	4165	15	0	0
801 - Beam End	2 - Low	30	each	30	0	0	0
812 - Street Lighting	1 - Ben.	21	each	17	4	0	0
820 - Reinforced Concrete Wall	2 - Low	60	ft.	37	23	0	0
841 - Asphalt Wearing Surface with Membrane	4 - Sev.	71363	sq. ft.	71363	0	0	0
861 - Beam End – Protective Coating	2 - Low	30	each	30	0	0	0

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Element Inspection

Deck Truss

	Environment	Total Quantity	Units	Condition State 1	Condition State 2	Condition State 3	Condition State 4
29 - Steel Deck with Concrete Filled Grid	4 - Sev.	70527	sq. ft.	70482	45	0	0
113 - Steel Stringer	2 - Low	10150	ft.	8150	2000	0	0
515 - Steel Protective Coating		58643	sq. ft.	58393	250	0	0
120 - Steel Truss	2 - Low	2900	ft.	253	2614	33	0
515 - Steel Protective Coating		156876	sq. ft.	155376	1500	0	0
152 - Steel Floor Beam	2 - Low	2788	ft.	938	1850	0	0
515 - Steel Protective Coating		23131	sq. ft.	22661	470	0	0
161 - Steel Pin and Pin & Hanger Assembly or both	2 - Low	8	each	0	8	0	0
515 - Steel Protective Coating		604	sq. ft.	594	0	10	0
162 - Steel Gusset Plate	2 - Low	472	each	150	316	6	0
515 - Steel Protective Coating		9610	sq. ft.	9520	90	0	0
210 - Reinforced Concrete Pier Wall	2 - Low	227	ft.	0	227	0	0
305 - Assembly Joint without Seal	4 - Sev.	146	ft.	111	35	0	0
310 - Elastomeric Bearing	2 - Low	2	each	2	0	0	0
311 - Movable Bearing	2 - Low	6	each	0	6	0	0
515 - Steel Protective Coating		622	sq. ft.	612	10	0	0
313 - Fixed Bearing	2 - Low	4	each	4	0	0	0
515 - Steel Protective Coating		350	sq. ft.	345	5	0	0
330 - Metal Bridge Railing	2 - Low	2959	ft.	2959	0	0	0
515 - Steel Protective Coating		8297	sq. ft.	8227	70	0	0
331 - Reinforced Concrete Bridge Railing	4 - Sev.	2900	ft.	2890	10	0	0
812 - Street Lighting	1 - Ben.	15	each	13	2	0	0
841 - Asphalt Wearing Surface with Membrane	4 - Sev.	49301	sq. ft.	49301	0	0	0

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Highway Bridge Inspection Report

Element Inspection

Approaches

	Environment	Total Quantity	Units	Condition State 1	Condition State 2	Condition State 3	Condition State 4
29 - Steel Deck with Concrete Filled Grid	4 - Sev.	31361	sq. ft.	31346	15	0	0
107 - Steel Open Girder/Beam	2 - Low	1676	ft.	1176	500	0	0
515 - Steel Protective Coating		31965	sq. ft.	29965	2000	0	0
113 - Steel Stringer	2 - Low	4001	ft.	3701	300	0	0
515 - Steel Protective Coating		22053	sq. ft.	21953	100	0	0
152 - Steel Floor Beam	2 - Low	1372	ft.	447	925	0	0
515 - Steel Protective Coating		11407	sq. ft.	11177	230	0	0
202 - Steel Column	2 - Low	2	each	0	2	0	0
515 - Steel Protective Coating		232	sq. ft.	232	0	0	0
205 - Reinforced Concrete Column	2 - Low	8	each	2	6	0	0
205 - Reinforced Concrete Column	3 - Mod.	4	each	0	4	0	0
215 - Reinforced Concrete Abutment	2 - Low	118	ft.	0	118	0	0
302 - Compression Joint Seal	4 - Sev.	49	ft.	36	5	8	0
310 - Elastomeric Bearing	2 - Low	10	each	8	0	2	0
311 - Movable Bearing	2 - Low	2	each	0	2	0	0
515 - Steel Protective Coating		9	sq. ft.	5	4	0	0
313 - Fixed Bearing	2 - Low	17	each	0	17	0	0
515 - Steel Protective Coating		42	sq. ft.	32	10	0	0
330 - Metal Bridge Railing	2 - Low	1207	ft.	1207	0	0	0
515 - Steel Protective Coating		3623	sq. ft.	3593	30	0	0
331 - Reinforced Concrete Bridge Railing	4 - Sev.	1280	ft.	1275	5	0	0
801 - Beam End	2 - Low	30	each	30	0	0	0
812 - Street Lighting	1 - Ben.	6	each	4	2	0	0
820 - Reinforced Concrete Wall	2 - Low	60	ft.	37	23	0	0
841 - Asphalt Wearing Surface with Membrane	4 - Sev.	22062	sq. ft.	22062	0	0	0
861 - Beam End – Protective Coating	2 - Low	30	each	30	0	0	0

Over Limit Report

Bridge #: 5196
 Bridge Name: AUGUSTA MEMORIAL BRIDGE
 Owner: 01 - State Highway Agency
 Co-Owner: N Not applicable
 Region: 02 - Mid-Coast

Town1: Augusta
 Town2:
 Maintainer: 01 - State Highway Agency
 Co-Maintainer: N Not applicable

Vertical Clearance - Under

Left, Center, and Right is based on the direction of travel

Roadway - Heading North or East

Actual Heights in Feet-Inches

Date Measured: 07/23/2013

	<u>Left</u>	<u>Center</u>	<u>Right</u>	<u>Posted</u>	<u>Deficient Sign</u>
Main: KENNEBEC RIVER + MCRR	28 - 10	27 - 8	27 - 4	☐ Main -	
Other:	-	-	-	☐ Other -	
Ramps:	-	-	-	☐ Ramp -	

Roadway - Heading South or West

Actual Heights in Feet-Inches

Date Measured: 07/23/2013

	<u>Left</u>	<u>Center</u>	<u>Right</u>	<u>Posted</u>	<u>Deficient Sign</u>
Main: KENNEBEC RIVER + MCRR	27 - 4	27 - 8	28 - 10	☐ Main -	
Other:	-	-	-	☐ Other -	
Ramps:	-	-	-	☐ Ramp -	

Vertical Clearance - Portal

Roadway: 100,201,202

Heading North or East

Actual Heights in Feet-Inches

Date Measured:

	<u>Left</u>	<u>Center</u>	<u>Right</u>	<u>Posted</u>	<u>Deficient Sign</u>
	-	-	-	☐ Portal -	

Heading South or West

Actual Heights in Feet-Inches

Date Measured:

	<u>Left</u>	<u>Center</u>	<u>Right</u>	<u>Posted</u>	<u>Deficient Sign</u>
	-	-	-	☐ Portal -	

Permitting

Pointer

☐ Red Flag Comments

Heading North Height: 27 - 2 2037600-BRPT
 Heading South Height: 27 - 2 2037600-BRPT
 Left Ramp Height: -
 Right Ramp Height: -
 Portal North Height: -
 Portal South Height: -
 Other Road Height: -
 Bridge Width: 34.0 ft
 Roadway Width: 34.0 ft

Underclearance heights are signed if less than 14 ft 6 in

Check with Maine Turnpike Authority for load heights over 13 ft 6 in

Always check 511

Load Restrictions

Posted		tons	Date posted:
Posted One Truck at aTime			
Posted for 4 axle only			
Operating Load Rating	0.84		
Permit Load Ratings	Crane	5 axles	No Go
	Crane with dolly	5 axles	No Go
		axles	

Underwater Dive Inspection Report

Structure Number: 5196

Bridge Name: AUGUSTA MEMORIAL BRIDGE

Town 1: 11020 - Augusta

Town 2:

Division: Fairfield

DiveID: 850

☐ Tidal:

Location: .2 MI W 9

Tide Information: Dove low tide long window. lo tide today @ 9:21am (Augusta)

Photos:

Dive Entry Location: Boat landing upstream.

topside

Scour: 6

Comments/Hazards:

can be done at low tide - vis not bad.
deep hole in front of Pier #3

Streambed Description:

Gravel and boulders.

Channel Description:

Scour action revealed on pier 2/3, Pier 4 dry at low tide.
Pier 2 has 30" footing exposed max, on downstream channel corner.
Pier 3 has 6' seal exposed max. on upstream end.

Substructure Description:

Inspected piers 2 and 3. Four nearly out of water. Noted up to 5' vertical face of seal exposed at upstream pier 3.
2003: Piers have some scour action as noted in channel description.

2009: No major changes in cond. or exposure of footings/seal. Scour appears to be slightly worse and probably should be on grout repair list.

2015: Middle channel pier remains heavily scoured exposing seal foundation on upstream end. No major changes from previous report. Ratings remain same.

2019: Pier #3 has about 6' of scour hole immediately in front of pier seal foundation. 8' deep. just 4' upstream is 4' deep.
Pier #2 has about 30" scour depth on downstream, channel corner of footing. No major changes. Ratings remain same.

Inspection Team:

Edwards

Reeves

Merrithew

Stevens

Brunelle

Role:

TL

D

SD

SD

D

Dive Conditions:

Time: Entry: 8:58 AM/PM AM

Time: Exit: 9:35 AM/PM AM

Water Temp: 72

Visibility (ft): 8

Max Depth (ft): 8

Current: slow

Weather: sunny

Underwater Inspection Date: 08/14/2019

Channel Condition: 5

Substr/Culvert Condition: 7

Inspection Cycle: Y60

Ratings Comments:

scour at #2 & #3 piers

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Pictures

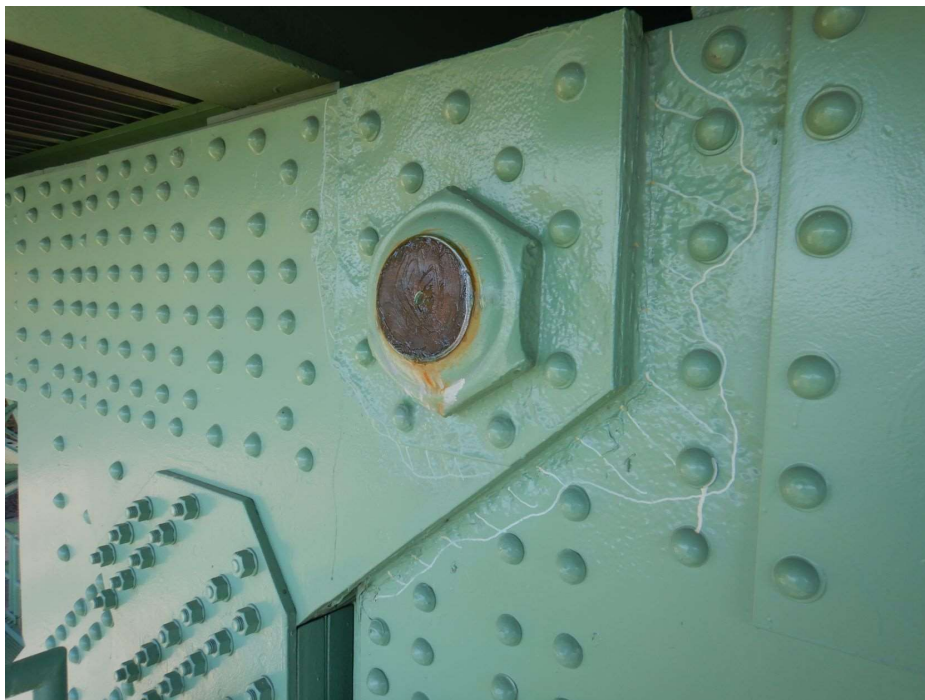


PHOTO 1

Description Downstream end of Pin X3 of Span 2. Note minor pitting (up to 1/8" deep) of connection plates.



PHOTO 2

Description Upstream end of Pin X3 of Span 2. Note bent and cracked bracket pad due to the movement in the pin connection.

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Highway Bridge Inspection Report

Pictures



PHOTO 3

Description Upstream end of Pin X7 of Span 4. Note section loss adjacent to the pin connection and warped plates due to significant pitting between the gusset plates.



PHOTO 4

Description Bottom of Pin X3 of Span 2. Note minor pitting on the bottom of the pin at both ends and adjacent connection plates.

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Highway Bridge Inspection Report

Pictures

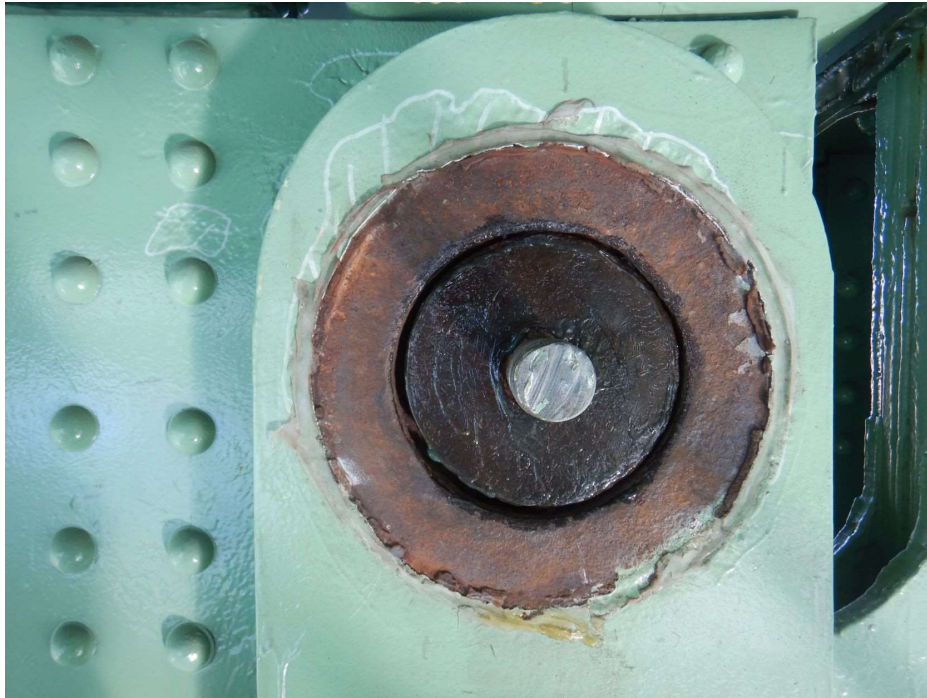


PHOTO 5

Description Downstream end of Pin mg of Span 4. Note the corrosion on the face of pin and link plate. Also note the gap between the pin and link plate.



PHOTO 6

Description Upstream end of Pin mg of Span 4. Note the corrosion on the face of pin and link plate, the gap between the pin and link plate, and the link plate resting on the bottom catch plate.

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Highway Bridge Inspection Report

Pictures



PHOTO 7

Description Upstream end on Pin mg of Span 4. Note plates have shifted approximately 9/16". The plates have also warped due to previously arrested pitting.

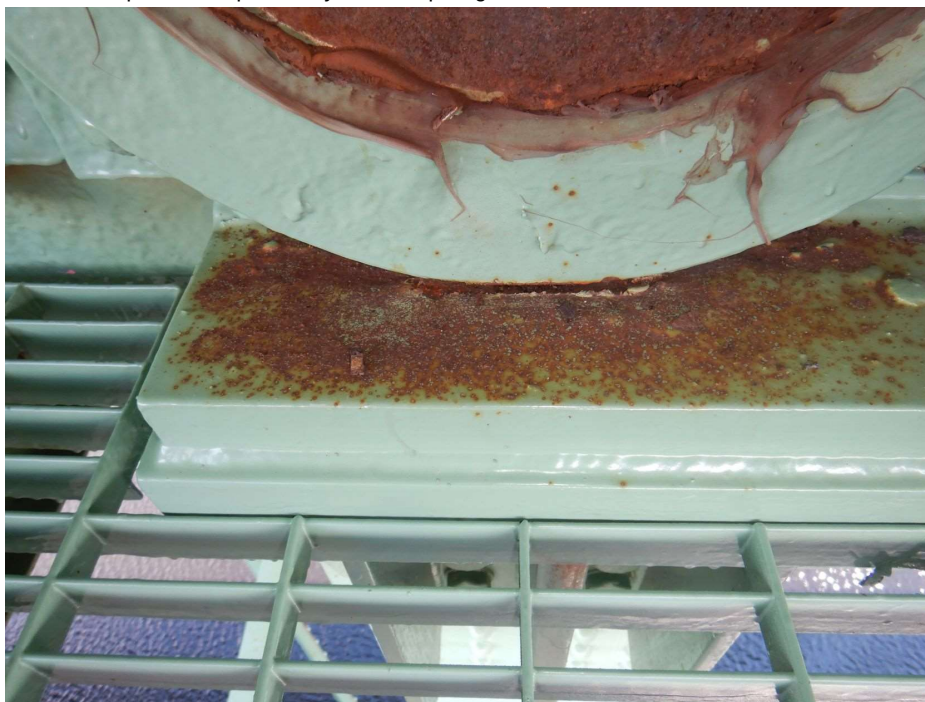


PHOTO 8

Description Upstream end of Pin mg of Span 4. Close up look at the link plate in contact with the bottom catch plate.

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Highway Bridge Inspection Report

Pictures



PHOTO 9

Description Upstream end of Pin mg of Span 4. Note the corrosion on the face of pin and link plate and the gap between the pin and link plate.

Maintenance Work Items

Structure Number: 5196

Structure Name: AUGUSTA MEMORIAL
BRIDGE

Town: 11020

Owner: VHB,VHB

Type	Work Item	Priority	Notes
Maintenance	Stabilize Substructure	4	grout bag exposed pier seal

MaineDOT NBIS Bridge Safety Inspection JSA

Inspector: VHB,VHB
Team Lead: Robert Blunt
Structure Number: 5196
Structure Name: AUGUSTA MEMORIAL BRIDGE
Town: Augusta

Additional Team Members/Visitors:

- | | |
|---------------------------------|-----|
| 1.) Megan Suffel | 6.) |
| 2.) Scott Shanaman (Aerial NDT) | 7.) |
| 3.) | 8.) |
| 4.) | 9.) |
| 5.) | |

Job being performed:

Pin and Pin & Link Connection Inspection

Potential Hazard:

- ☒ Exposure to traffic

Controls:

- ☐ Parked off road with strobe
☐ Less than 1 hour on bridge
☒ Wear standard reflective clothing and hard hat
☐ Spotter ☒ Traffic Control Crew

Potential Hazard:

- ☒ Steep slopes and uneven working areas
(rip rap, mud, loose fill, etc)

Controls:

- ☒ Wear appropriate, prudent footwear
☐ Rope or fall protection

Potential Hazard:

- ☐ Chipped Concrete or Steel (hand tools only)

Controls:

- ☐ Wear appropriate, prudent eye/hand protection

Potential Hazard:

- ☒ 6' Vertical drops

Controls:

- ☐ Stay away from areas

Potential Hazard:

- ☒ Water Hazards
- ☐ Water depth under 1 foot
 - ☐ Water depth 1 to 4 feet
 - ☒ Water depth over 4 feet
 - ☒ Water flow calm/slow moving
 - ☐ Water flow visible/not rapid
 - ☐ Water flow rapid with some short falls
 - ☒ Tidal Water

Controls:

- ☒ Evaluate Water Hazard conditions
☒ Use/Wear appropriate PPE
☒ Buddy System

Potential Hazard:

- ☒ Insects, Poison Ivy, or other environmental hazards

Controls:

- ☒ Apply insect repellent and/or sunscreen

Potential Hazard:

☐ Lead paint and Avian excrement

Potential Hazard:

☐ Heavy Manual Lifting

Potential Hazard:

☐ DCS, Lung Expansion

Potential Hazard:

☐ Entanglement U/W

Potential Hazard:

☒ Boat Traffic

Potential Hazard:

☐ Cold Water

Potential Hazard:

☒ Live Boating

Other Potential Hazards:

☒ Protect skin with appropriate, prudent clothing

Controls:

☐ Wear gloves, do not scrape

Controls:

☐ Ask for assistance in donning dive gear,
lifting equipment

Controls:

☐ Ascend slowly, user computers, Safety Stops
(15' mark for 3 min.)

Controls:

☐ Use knife, Comm gear

Controls:

☐ Fly Dive Flag, user spotter, contact bridge
on Chan. 13

Controls:

☐ Use adequate dry suit underwear
for water temperature

Controls:

☐ Keep track of divers, avoid powering during
drop-off/pick-up

Other Controls:

Safety Equipment Required:

☒ Hard hat

☒ Vest

☒ Sunscreen

☒ First Aid

☒ Throw Ring

☐ Throw Rope

Emergency Action Plan:

☒ Call 911

☒ First Aid Kit

☒ Glasses

☒ Gloves

☐ PFD

☒ Rain Gear

☐ Bug Spray

☒ O2

☐ AED

☐ Comm Gear

☒ Cell Phone

☒ Boat

☐ Positioning Device

☒ Fall Rescue Plan

☐ Water Rescue Plan

☐ Dan 1-919-684-9111

☐ USCG 741-5465

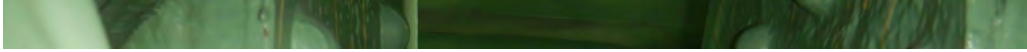
Other Safety Equipment:

Other Emergency Action Plan:

I certify that the MaineDOT NBIS Bridge Safety Inspection JSA has been completed according to all proper procedures required by the Maine Department of Transportation.

☒ Complete

Robert Blunt

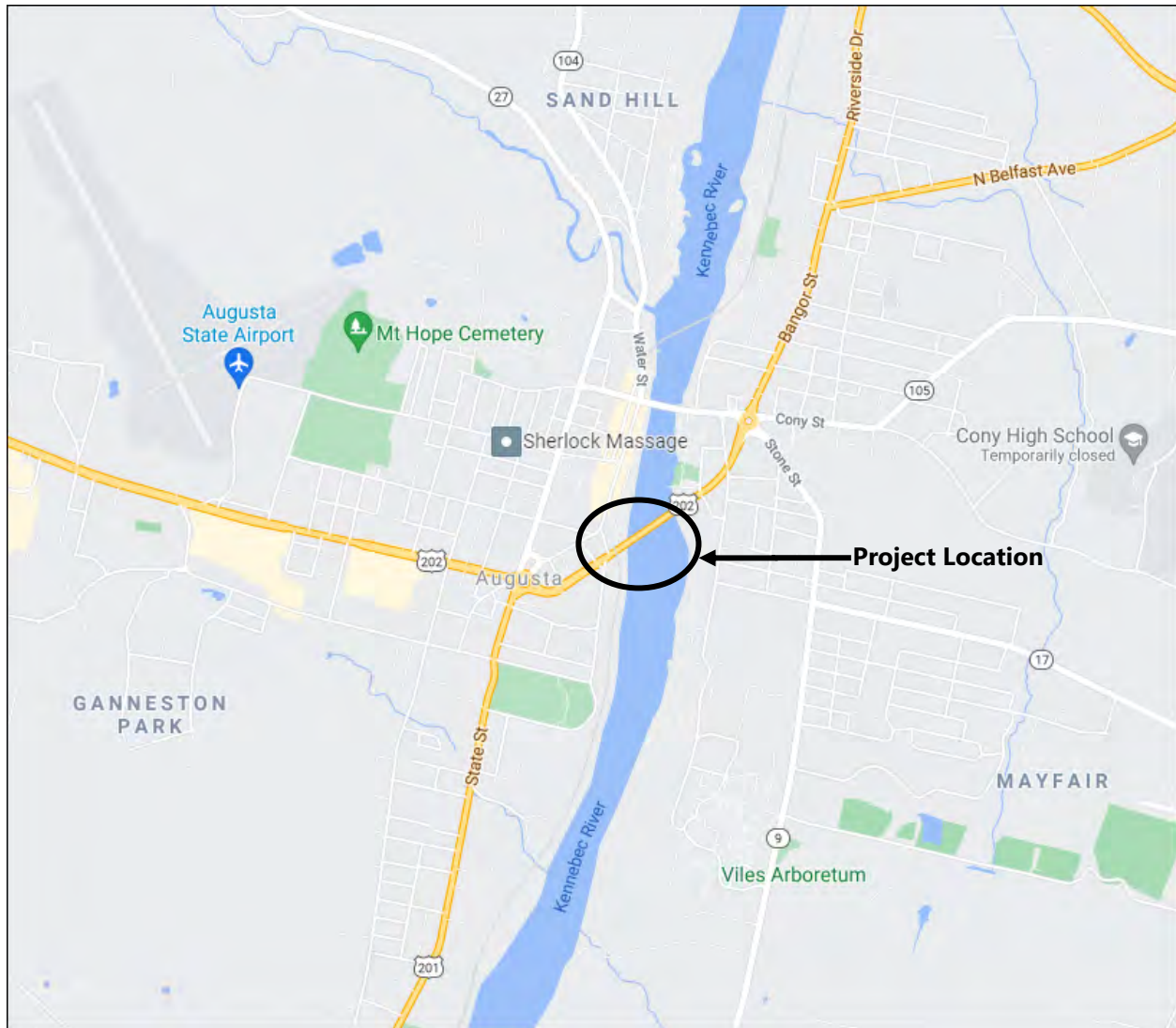


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Location Map

Augusta, Maine Bridge # 5196 Augusta Memorial Bridge



Latitude: 44° 18' 44.82" N, Longitude: 69° 46' 22.29" W

Introduction

Scope of Inspection

Bridges in Maine are inspected biennially by Maine Department of Transportation (MaineDOT) bridge inspectors in accordance with Federal Highway Administration National Bridge Inspection Standards (NBIS). These hands-on visual inspections assess the general condition of the entire bridge. Some bridges contain fracture critical components, such as the pin connections and pin and link connections in the bridges in this project. Visual inspection of these fracture critical components cannot detect some types of possible defects and deterioration, such as hidden wearing and cracking. Non-destructive testing methods such as ultrasonic inspection and magnetic particle testing are required to assess the fracture critical components for these types of hidden defects and deterioration.

MaineDOT engaged Vanasse Hangen Brustlin, Inc. (VHB) to inspect pin, and pin and link connections at five bridges throughout the state using both visual and non-destructive testing inspection methods. This report summarizes the findings of the inspection of the Memorial Bridge, Bridge No. 5196, in Augusta, ME.

Bridge Description:

- Superstructure: Concrete deck slab supported by one steel wide flange beam span; five steel deck truss spans with floor beams and stringers; and five steel plate girder spans.
- Spans: Eleven – 50'-0", 250'-0", 300'-0", 350'-0", 300'-0", 250'-0", 116'-5", 117'-10", 117'-10", 117'-10", 116'-5". Total bridge length is approximately = 2,092'-5".
- Number of Fracture Critical Pin Connections: 6
- Number of Pin and Link Connections: 2
- Date Built: 1948
- Design Loading: HS20-44

See Appendix A for a plan, elevation, and transverse section of the bridge, taken from the existing plans. The pin, and pin and link, connections that are the focus of this project are located in Spans 2, 4, and 6, which are all deck truss spans. The pins and the pin and link assemblies connect the suspended portions of these span to the cantilevered portions. See Appendix A for details of the pin connections and the pin and link connections taken from the existing plans. Because there are only two trusses supporting the deck in these spans, they have no load path redundancy. If one of the two trusses were to fail, the span would collapse. These spans are consequently classified as nonredundant, and the pin connections and the pin and link connections in them are considered fracture critical.

In this report the pins are referred to by their shop drawing marks. Pin X3 and Pin X7 are used in the pinned connections. Pin X3 is in Span 2 and Span 6. Pin X7 is in Span 4. The pinned connections are designed to allow rotation and release moment. Pin mg is used in the pin and link connections. The pin and link connections are designed to allow rotation and release moment, and to allow longitudinal movement to accommodate expansion and contraction. There are suspended span retainers below each

pin and link connection and each fracture critical pin connection. These supplementary supports are designed to arrest the drop of a suspended member after a pin or link plate failure. The suspended span retainers were designed by MaineDOT and installed during a major bridge rehabilitation project in 2006/2007.

There are smaller diameter pins in the lower chords of the trusses. These pins are in members that are designed to carry no force. They are not fracture critical and were not inspected as part of this project.

Inspection Team:

The inspection of the pin connections and the pin and link connections in this bridge involved the following project team members:

- VHB coordinated all parties involved in the inspection and performed the visual inspection of the connections.
- New England Bridge Contractors, Inc. (NEBC), a subcontractor to VHB, provided equipment necessary for pin and link plate preparation.
- Aerial NDT Inspection, Inc., (Aerial NDT) a subconsultant to VHB, performed the ultrasonic testing of the pins and link plates.

Calibration Pins:

Ultrasonic inspection is performed by introducing high frequency sound waves into the pin with a sending transducer. Discontinuities in the specimen interrupt the sound wave and deflect it toward a receiving transducer. The size of the flaw and its distance from the end of the pin can be estimated from ultrasonic inspection. It is the responsibility of the ultrasonic testing technician to interpret indications as significant and recordable.

In order to accurately calibrate the ultrasonic testing equipment for the inspection of a pin, a calibration pin of similar dimensions and metallurgy is required. There are two different size pins in this bridge. A calibration pin for each size was fabricated prior to the 2012 inspection. The pin connection pins are 8" diameter by 27 $\frac{3}{8}$ " long with threaded ends. The pin and link connection pins are 8" diameter by 26 $\frac{1}{2}$ " long with a center hole for a through bolt. See Appendix A for the fabrication drawings of each calibration pin.

The pins were fabricated in accordance with the original shop drawings, and were made from ASTM A576 Grade 1045 steel, to match the existing pins as closely as possible. Saw cuts were made in three quadrants of each pin at different distances from the end of the pin. These artificial defects are used to verify that the ultrasonic test equipment is calibrated so that it can pick up similar size defects, if any exist, in the pins in the bridge. One quadrant of each calibration pin was kept free of defects for distance calibration.

Inspection Procedure:

Traffic control was not needed for the 2021 inspection. The pin connections and pin and link connections were accessed via the permanent inspection catwalk that is suspended from the truss framing. The catwalk entrance is located at Pier 1.

The ends of the pins in the pin connections were coated with paint which had to be removed to bare metal to perform the ultrasonic inspections. NEBC removed the paint from the pin ends with a handheld grinder. NEBC attempted to remove the nuts from the ends of the pins but they were not able to loosen any of them. This limited the visual inspection but had no effect on the ultrasonic inspection of these pins.

Each pin in the pin and link connections has a cap plate on each end that is held in place by a 2" diameter through bolt and hex nuts. In order to perform the ultrasonic inspection of these pins, the nuts and cap plates had to be removed. NEBC removed the nuts and cap plates using a large wrench and a breaker bar after applying PB Blaster. The upper cap plate on the Span 4, Pin mg, on the downstream side was not removed because the through bolt could not be removed.

Once the pins were prepared and the ultrasonic testing technician had calibrated the UT equipment, the UT technician and a VHB NBIS-certified bridge inspector began the inspection of the connections. Generally, the VHB inspector performed a visual inspection of each connection first, and then the UT technician performed the ultrasonic inspection of the pin. The visual inspection consisted of photo documentation, limited measurement of pin and link plate dimensions, and recording of any visible deficiencies. After completion of the inspections, NEBC painted the pin ends and any other areas where paint was removed with a single coat of Carbozinc 859 Organic Zinc Rich Epoxy Primer. The ends of the pins in the pin and link connections were not painted.

Inspection Findings

General Inspection Findings:

The pin and pin and link connections have been inspected every five years beginning in 1996. Below is a summary of the general findings from past years:

1996 Inspection Summary

- No evidence of out-of-plane bending or twisting of any of the link plates was found.
- The faces of the exterior link plates were between 1/32" and 3/8" out from the ends of the pins.
- The gap between the edge of the pin hole in the link plates and the pin circumference was found to be no larger than 1/16".

2012 Inspection Summary

- The faces of the exterior link plates were between 1/32" and 9/16" out from the ends of the pins.
- The bolt through the center of the upper pin at Pin mg on the downstream truss was found to be necked down on the upstream side of the link plate.
- The gap between the edge of the pin hole in the link plates and the circumference of the pin ranged from 1/4" to 11/16".

2016 Inspection Summary

- The faces of the exterior link plates were between 1/32" and 9/16" out from the ends of the pins.
- No change in the bolt through the center of the pin at Pin mg on the downstream truss.
- The gap between the edge of the pin hole in the link plates and the circumference of the pin ranged from 1/4" to 11/16".
- The sealant in the gap between the suspended span and cantilever span retainer plates was in place.

2021 Inspection Summary

The bridge was completely cleaned and painted in 2012 and the paint is in good condition. The overall condition of the six pin connections was found to be fair. See Appendix B for selected inspection photographs. The ultrasonic inspection found minor wear indications in the pin connections up to 1/16". Wear indications less than 1/16" were not considered recordable for the ultrasonic inspection reports. The ultrasonic inspection report is included in Appendix C. There is minor corrosion on many of the pin nuts, exposed areas of pins, and the adjacent truss members and connection plates. The exposed surfaces of many of the plates have areas of moderate pitting, and up to 3/16" section loss was measured in some localized areas. Section loss up to 1/8" from around the circumference of some of the pins was measured adjacent to the plates. Because the plates do not bear on the portions of the pins that have experienced this section loss, it was most likely caused by corrosion. Pack rust has caused minor to severe warping of the plates at most of the pin connections, with the plates warped as much as 1" at some locations. During the 2012 painting project the gaps between the plates were sealed with a caulking or other sealant

before the plates were painted. The sealant is intact and the paint is not broken at most of these gaps between the plates, indicating that the plates have not warped further since the painting project was completed. It could not be determined if rotation is still occurring at all of the pin connections.

The overall condition of the two pin and link connections was found to be poor. See Appendix B for selected inspection photographs. The ultrasonic inspection found minor wear indications in the four pins in the pin and link connections up to 1/16". No loss of backwall was observed in any of the pins, indicating that none of the pins are cracked. The ultrasonic inspection report is included in Appendix C. There is minor corrosion on all of the link plates and pins in the pin and link connections. The link plates also have severe surface corrosion in the areas under the cap plates and several small localized areas of severe corrosion and pitting in other locations. Ultrasonic thickness measurements in some of the most severely corroded areas of the link plates found small localized section losses as high as 3/16" from the 1-3/8" thick link plate.

The faces of the exterior link plates are out from the ends of the pins between 1/32" and 9/16". According to the design plans and shop drawings, they should be flush. A timeline of the out of plane movement of the link plates can be found in the table under Specific Inspection Findings. The link plate bowing did not increase and the necking of the through bolt at upper Pin mg on the downstream truss is unchanged.

The gap between the edge of the pin hole in the link plates and the circumference of the pin was between 1/8" and 3/4". The link plates should have a tight fit around the pins according to the design drawings. These gaps are caused by corrosion and section loss from both the circumferences of the pins and the edges of the pin holes in the link plates. The corrosion on both the circumferences of the pins and the edges of the pin holes in the link plates is severe. The section loss from circumference of the 8" diameter pins is up to 5/8" at the pin ends. The gap between the circumference of the pin and the edge of the pin hole in each link plate is greatest 180 degrees from the top of the pin, forcing the link plates to be in contact with the top of the top pin and the top of the bottom pin at both pin and link connections. A timeline of this movement can be found in the table under Specific Inspection Findings.

The suspended span retainers below the pin and link and the pin connections, which were installed in 2006/2007 and are in good condition. By design there is a small gap between the suspended span and cantilever span retainer plates so that the pin and link and pin connections can continue to function as originally designed and the gap is filled with a flexible sealant to prevent debris from accumulating in the gap. The Span 4 upstream link plate was resting on and wearing into the top of the suspended retainer plate on the upstream end. When the top pin cap plate was removed and the link plate was sounded with a two-pound hammer, and based on the tonal differences between this upstream exterior link plate and the other three link plates at this pin and link connection, it appears that some load sharing may be occurring between the suspended span retainer and the upstream exterior link plate. The gaps between the remaining link plate and retainer plates range from 0.015" and 0.097". See Appendix D for additional details in the Significant Findings Memo.

Specific Inspection Findings:

The specific inspection findings for each connection are summarized below. Pins are identified by the span they are in, the shop drawing pin mark of the pin, and upstream (north) or downstream (south) to indicate which truss they are in. Deficiencies in the link plates that were found during the inspection are noted with the findings for the closest pin. See Appendix A for a plan and elevation of the bridge that shows the shop drawing pin mark of each pin.

Pin Connections**Span 2, Pin X3, Upstream:**

- Pack rust has caused approximately 1/4" warping of edges of thinner exterior plates.
- The exterior upstream plate has 1/16" pitting at the top left edge.
- Pack rust between interior plates has caused approximately 3/8" warping.
- The top of the pin has a 1" diameter pitted area that is 1/16" deep.
- There is an approximately 1" wide band of 1/16" deep section loss around the pin circumference adjacent to the interior plates.
- There is some minor corrosion on the exposed surfaces of the pin.
- The bracket pad at the gusset plate connecting the diagonal truss member to the pin connection has shifted 7/16" and has cracked, indicating the movement in the pin connection.
- Ultrasonic testing noted minor wear at the top and bottom of the pin up to 1/32".

Span 2, Pin X3, Downstream:

- Pack rust between the exterior plates has caused the plates directly under the nuts to warp approximately 1/2". These plates have moderate pitting. The downstream exterior plate has pitting up to 1/8" over half the surface.
- The interior plates have severe corrosion and pitting approximately 1/8" deep and are warped approximately 5/8" due to pack rust.
- The downstream face of the interior gusset plate on the downstream end of the pin has 3/16" deep pitting around the edge of the exterior gusset plate.
- There is some minor corrosion on the exposed surfaces of the pin.

Span 4, Pin X7, Upstream:

- Pack rust between the exterior plates has caused the plates directly under the nuts to warp approximately 1/2". These plates have minor pitting and show signs of active corrosion.
- Pack rust between the interior plates has caused them to warp approximately 3/8". The exposed face of each interior plate has areas of pitting approximately 1/8" deep.
- There is a 1" wide, 1/16" deep pitted area on the downstream 3/4" gusset plate. The pitted area is along the vertical and diagonal edges of the adjacent exterior plate.
- There is a 2" wide, 1/8" deep pitted area on the upstream 3/4" gusset plate.

- Inside the truss member there is moderate corrosion on the exposed surfaces of the pin.
- There is an approximately 1" wide band of 1/16" deep section loss around the pin circumference adjacent to the interior plates.
- The bracket pad has shifted up to 1/8".
- Ultrasonic testing noted minor wear at the top and bottom of the pin up to 1/32".

Span 4, Pin X7, Downstream:

- Pack rust between the exterior plates has caused the plates directly under the nuts to warp approximately 1/2". These plates have minor pitting. The vertical edges of the upstream and downstream plates are also warped approximately 5/8" due to pack rust.
- Pack rust between the interior plates has caused them to warp approximately 1". The exposed face of each interior plate has areas of pitting approximately 1/8" deep.
- Inside the truss member there is moderate corrosion on the exposed surfaces of the pin.
- There is an approximately 1" wide band of 1/16" deep section loss around the pin circumference adjacent to the interior plates.
- Ultrasonic testing noted minor wear at the top and bottom of the pin up to 1/32".

Span 6, Pin X3, Upstream:

- Pack rust between the exterior plates has caused the plates directly under the nuts to warp approximately 1/4". These plates have minor pitting.
- The exterior gusset plates (the second plate in from each end of the pin) are warped approximately 1/2" due to pack rust.
- Pack rust between the interior plates has caused them to warp approximately 3/4". The exposed face of each interior plate has areas of pitting approximately 1/16" deep.
- Inside the truss member there is minor corrosion on the exposed surfaces of the pin.
- The bracket pad has shifted up to 1/8"
- Ultrasonic testing noted minor wear at the top and bottom of the pin up to 1/32".

Span 6, Pin X3, Downstream:

- Pack rust between the exterior plates has caused the plates directly under the nuts to warp approximately 1/2". These plates have minor pitting, including several areas on the downstream end plate that measured approximately 1/16" deep.
- The exterior gusset plates (the second plate in from each end of the pin) are warped approximately 1/2" due to pack rust and have areas of 1/16" to 3/16" deep pitting at the edges of the adjacent plates.
- Pack rust between the interior plates has caused them to warp approximately 3/4". The exposed face of each interior plate has areas of pitting approximately 1/16" deep.
- Inside the truss member there is minor corrosion on the exposed surfaces of the pin.

- There is an approximately 1" wide band of 1/8" deep section loss around the pin circumference adjacent to the interior plates.
- Ultrasonic testing noted minor wear at the top and bottom of the pin up to 1/32".

Pin and Link Connections

Span 4, Pin mg, Upstream, Upper:

- The face of the upstream link plate is 3/8" out from the end of the pin.
- On the downstream end of the pin, the gap between the edge of the pin hole in the link plate and the circumference of the pin is approximately 3/8" at the bottom of the pin, and pin diameter is 7 5/8". On the upstream end of the pin, the gap between the edge of the pin hole in the link plate and the circumference of the pin is approximately 1/2" at the bottom of the pin, and the pin diameter is 7 9/16".
- There is moderate corrosion and pitting of the pin face and face of link plate under the cap plate at both ends of the pin. The pitting is 1/16" to 1/8" deep in some areas around the edge of the cap plate. All four link plates have areas of minor paint failure and corrosion.
- There is an approximately 1" wide band of 1/16" deep pitting and section loss around the pin circumference adjacent to each of the interior link plates.

Span 4, Pin mg, Upstream, Lower:

- The end of the pin is 1/16" out from the face of the upstream link plate. The end of the pin is 1/4" out from face of the downstream link plate.
- On the downstream and upstream ends of the pin, the gap between the edge of the pin hole in the link plate and the circumference of the pin is approximately 3/4" at the top of the pin, and the pin diameter is 7 5/8".
- There is an approximately 1" wide band of 1/16" deep pitting and section loss around the pin circumference adjacent to each of the interior link plates.
- There is moderate corrosion and pitting of the pin face and face of link plate under the cap plate at both ends of the pin. The pitting is 1/16" to 1/8" deep in some areas around the edge of the cap plate. All four link plates have areas of minor corrosion.
- The upstream link plate is bearing fully on the retainer plate. The downstream gap between the link plate and retainer plate is 0.016".
- Small localized areas of pitting and section loss ranging from approximately 1/8" to 3/16" deep were measured ultrasonically on the interior face of each link plate around the bottom pin hole.

Span 4, Pin mg, Downstream, Upper:

- The face of the upstream link plate is 3/8" out from the end of the pin
- On the downstream end of the pin the cap plate could not be removed because, as in the 1996, 2012, and 2016 inspections, it was not possible to remove the through bolt. This limited the

visual inspection but did not prevent ultrasonic testing of the entire pin, which was performed from the upstream end.

- The upstream link plate is bowed approximately $3/16"$. The through bolt is necked down to $1-3/4"$ diameter at the upstream end of the pin, apparently caused by the bowed link plate.
- On the upstream end of the pin, the gap between the edge of the pin hole in the link plate and the circumference of the pin is approximately $5/8"$ at the bottom of the pin, and the pin diameter is $7\ 3/8"$.
- There is an approximately $1"$ wide band of $1/16"$ deep pitting and section loss around the pin circumference adjacent to each of the interior link plates.
- Ultrasonic testing noted minor wear at the top and bottom of the pin up to $1/16"$.

Span 4, Pin mg, Downstream, Lower:

- The face of the upstream link plate is $1/8"$ out from the end of the pin. The face of the downstream link plate is $3/16"$ out from the end of the pin.
- On the downstream end of the pin, the gap between the edge of the pin hole in the link plate and the circumference of the pin is approximately $1/2"$ at the top of the pin. On the upstream end of the pin, the gap between the edge of the pin hole in the link plate and the circumference of the pin is approximately $5/8"$ at the top of the pin.
- There is moderate to heavy corrosion and pitting of the pin face and face of link plate under the cap plate area.
- Small localized areas of pitting and section loss ranging from approximately $1/8"$ to $3/16"$ deep. These were measured ultrasonically on the interior face of each link plate around the bottom pin hole during the 2016 inspection. Thin layers of delaminated corroded steel were removed from the interior faces of the link plates in this area around the bottom pin. The pitting and section loss at one approximately $1"$ diameter area on the interior downstream link plate just above the pin was ultrasonically measured at $1/4"$.
- There is an approximately $1"$ wide band of $1/16"$ deep pitting and section loss around the pin circumference adjacent to each of the interior link plates.
- The gusset plates are resting on the retainer plate on both the upstream and downstream ends. The gap between the link plate and the retainer plate on the upstream end is $0.015"$ and $0.097"$ on the downstream end.

Pin and Link Connections – Out of Plane Movement Timeline

Pin Location	Year	Upstream Face	Downstream Face
Pin mg Upstream Truss Upper Pin	2021	0.375	0.188
	2016	0.438	0.188
	2012	0.438	0.188
	1996	0.250	0.188
Pin mg Upstream Truss Lower Pin	2021	0.063	0.250
	2016	0.063	0.250
	2012	0.063	0.250
	1996	0.063	0.031
Pin mg Downstream Truss Upper Pin	2021	0.375	N/A
	2016	0.563	N/A
	2012	0.563	N/A
	1996	0.375	N/A
Pin mg Downstream Truss Lower Pin	2021	0.125	0.188
	2016	0.063	0.188
	2012	0.125	0.063
	1996	0.063	0.063

**Pin and Link Connections – Link Plate Gap Timeline**

Pin Location	Year	Upstream Face	Downstream Face
Pin mg Upstream Truss Upper Pin	2021	0.500	0.375
	2016	0.688	0.625
	2012	0.625	0.375
	1996	N/A	N/A
Pin mg Upstream Truss Lower Pin	2021	0.750	0.750
	2016	0.625	0.625
	2012	0.375	0.375
	1996	N/A	N/A
Pin mg Downstream Truss Upper Pin	2021	0.625	N/A
	2016	0.688	N/A
	2012	0.688	N/A
	1996	N/A	N/A
Pin mg Downstream Truss Lower Pin	2021	0.625	0.500
	2016	0.625	0.500
	2012	0.250	0.375
	1996	N/A	N/A



Recommendations

- Evaluate the structural capacity impacts of the exterior link plates being slightly off the ends of the pins in some of the exterior link plates, the areas of measured section loss in all the link plates at the pin and link connections, and the potential load sharing occurring when the link plates are resting on the suspended span retainer plates. It is not likely, but if any of these link plates become the controlling element of the truss's capacity, replacement of the link plate, or plates, may be required. Because suspended span retainers are in place under both pin and link connections, failure of one of the pin and link connections would not result in failure of the truss. If replacement of one or more link plates is required, the suspended span retainers may be able to be used to temporarily support the truss during the replacement.
- Evaluate the structural capacity impacts of the section loss from the circumference of the 8" diameter pins in the pin and link connections. It is not likely, but if any of these pins become the controlling element of the truss's capacity, replacement of the pin may be required. Because suspended span retainers are in place under both pin and link connections, failure of one of the pin and link connections would not result in failure of the truss. If replacement of one or more pins is required, the suspended span retainers may be able to be used to temporarily support the truss during the replacement.
- Ultrasonically inspect the pins in the pin and link and pin connections at least every 5 years.
- When the nuts, through bolts and cap plates are removed for ultrasonic inspection of the pins in the pin and link connections, at each pin measure the gap between the edge of the pin hole in the link plate and circumference of the pin. If these gaps continue to increase, as they did between the 1996 and 2021 inspections, the impacts of this section loss should be evaluated further.
- During future biennial bridge condition inspections monitor the bending in the upstream link plate in the downstream truss pin and link connection.
- Consider analyzing the truss for the existing condition assuming some amount of load re-distribution is occurring through the contact of the link plates with the suspended span retainer.
- Replace the pins and link plates in all the pin and link connections.
- Consider replacing all the pins throughout the structure, while a contractor is mobilized to this location for replacement of the pins and link plates in the pin & link connections.

Appendices

Appendix A – Figures

Plan and Elevation

Pin and Link Connection Details

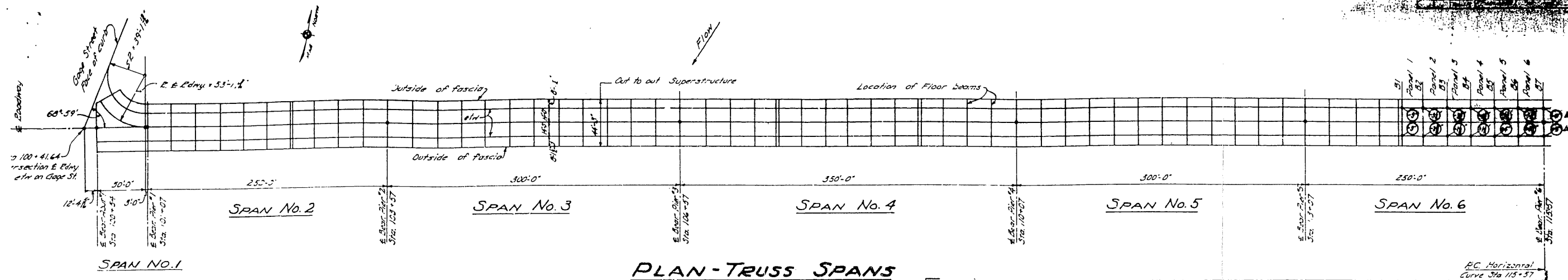
Calibration Pin Fabrication Drawing

Appendix B – Inspection Photographs

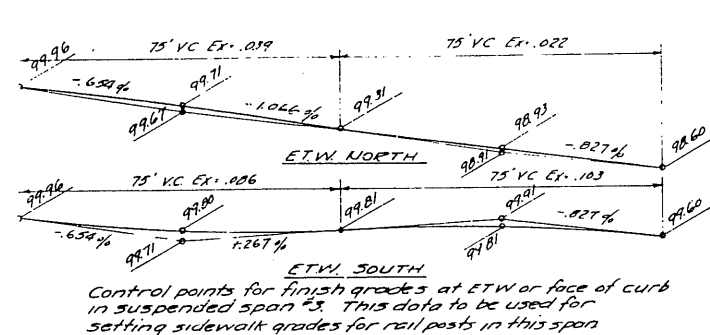
Appendix C – Non-Destructive Test Report

Appendix D – Significant Findings Memo

Appendix A – Figures



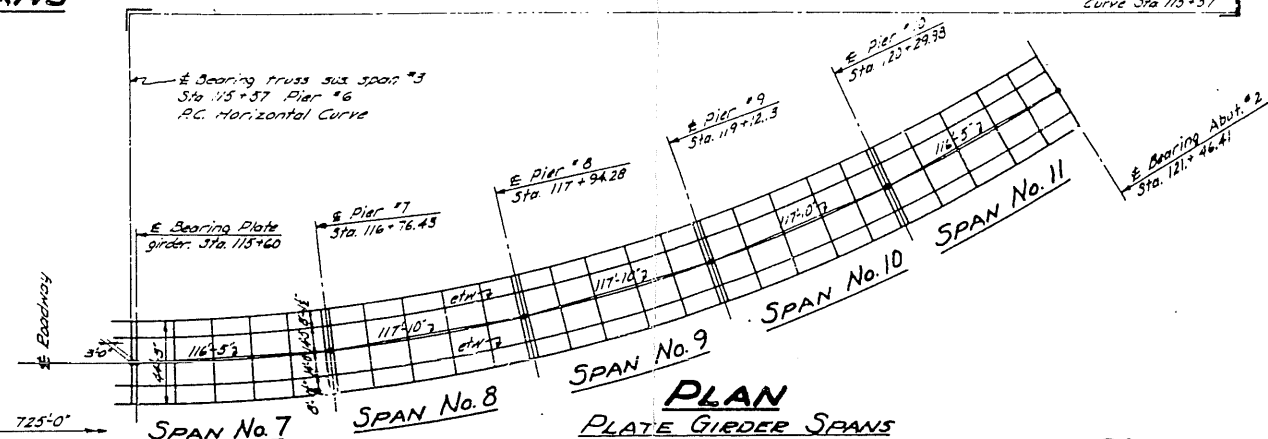
PLAN - TRUSS SPANS



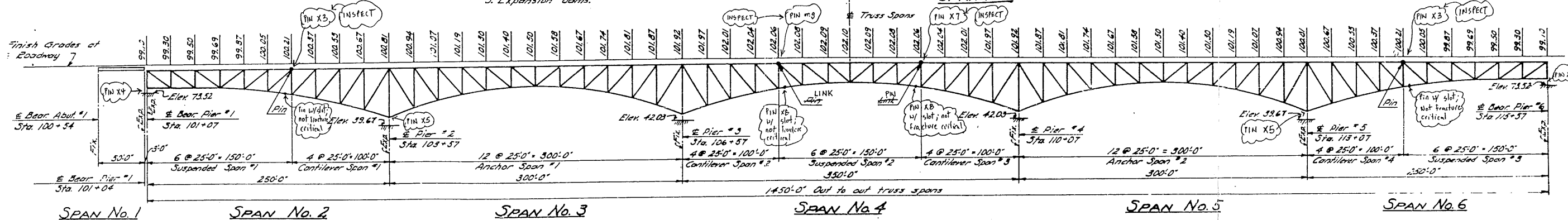
Control points for finish grades at ETW or face of curb in suspended span #3. This data to be used for setting sidewalk grades for rail posts in this span

NOTE: Normal Crown of 3" (Sta 101+07 to & pin in Span #6) Crown at etw for suspended span #3 shown on "PLAN - TRUSS SPANS." Crown for plate girder spans starting at Sta 115+60 equals +6" outside of curve, -6" inside of curve. Crown is vertical distance from finish grade at & Roadway to etw.

NOTE: Finish grades along center line of roadway are symmetrical about & truss spans. Truss details symm. about this line except as follows:
1. Pin and link connections for suspended span #2 to cantilever spans #2 & #3.
2. Sidewalk stringers and connections to floor beams in suspended span #3. See table sh #27.
3. Expansion dams.

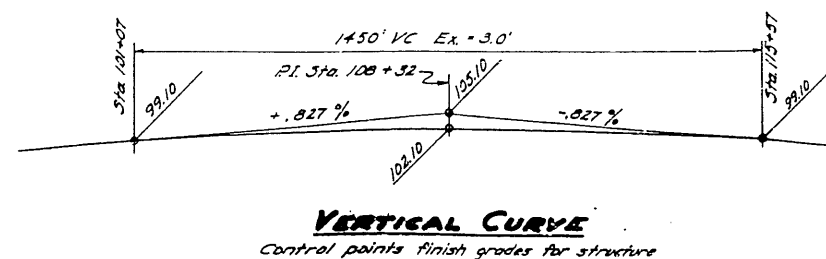


PLAN PLATE GIRDER SPANS



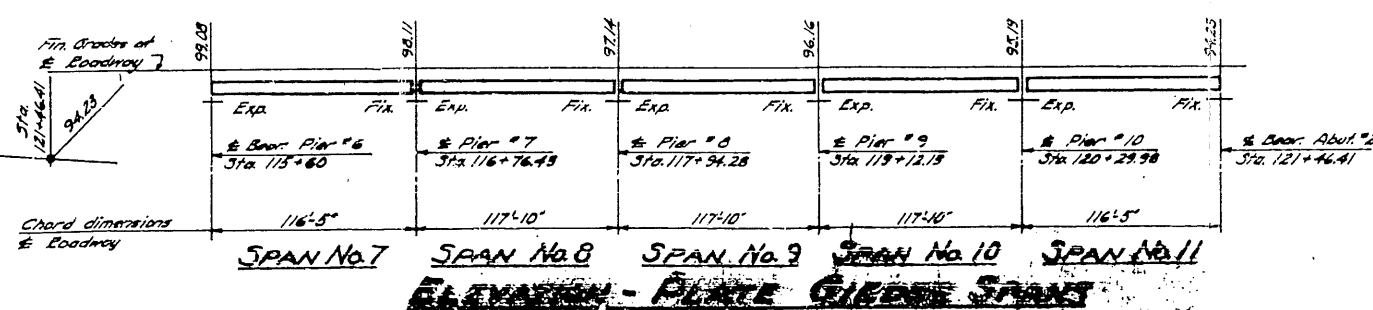
DOWN STREAM ELEV. - TRUSS SPANS

Scale: 1" = 50'-0"



VERTICAL CURVE

Control points finish grades for structure

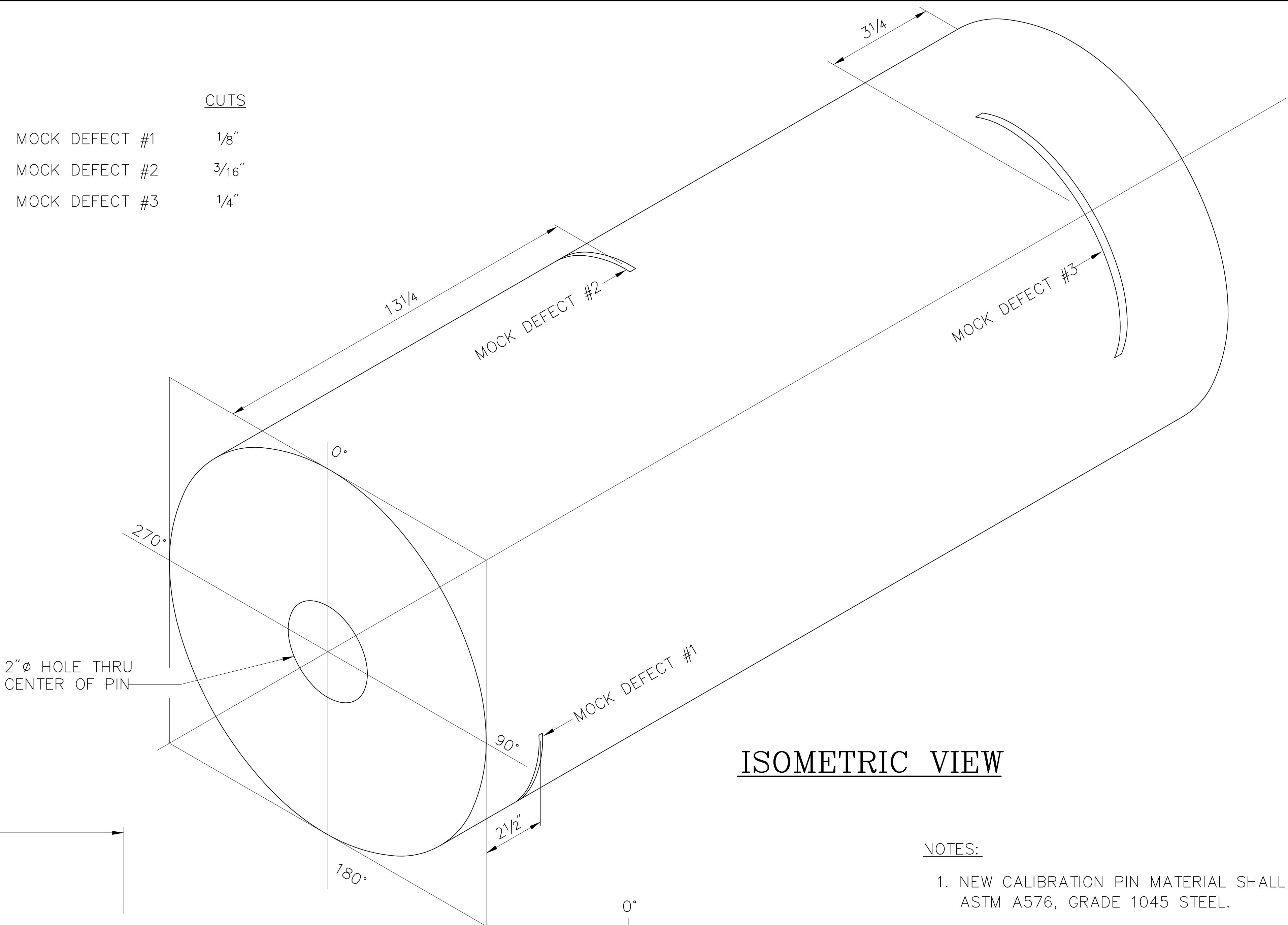


ELEVATION - PLATE GIRDER SPANS

MINIMUM UNDERCLEARANCE
Sus. Span #1 above top of rail = 26'-6"
Span #10 over Arsenal Street = 27'-0"
Sus. Span #3 over Howard St = 53'-6"

DESIGN - EVERETT	TRACE - CLARK
DETAIL -	CHECK -
BRIDGE - 5196	
STATE HIGHWAY COMMISSION	
BRIDGE DIVISION	
AUGUSTA BRIDGE	
OVER THE	
KENNEBEC RIVER	
IN THE CITY OF	
AUGUSTA	
KENNEBEC COUNTY	
GENERAL PLAN & ELEV. OF STRUCTURE	

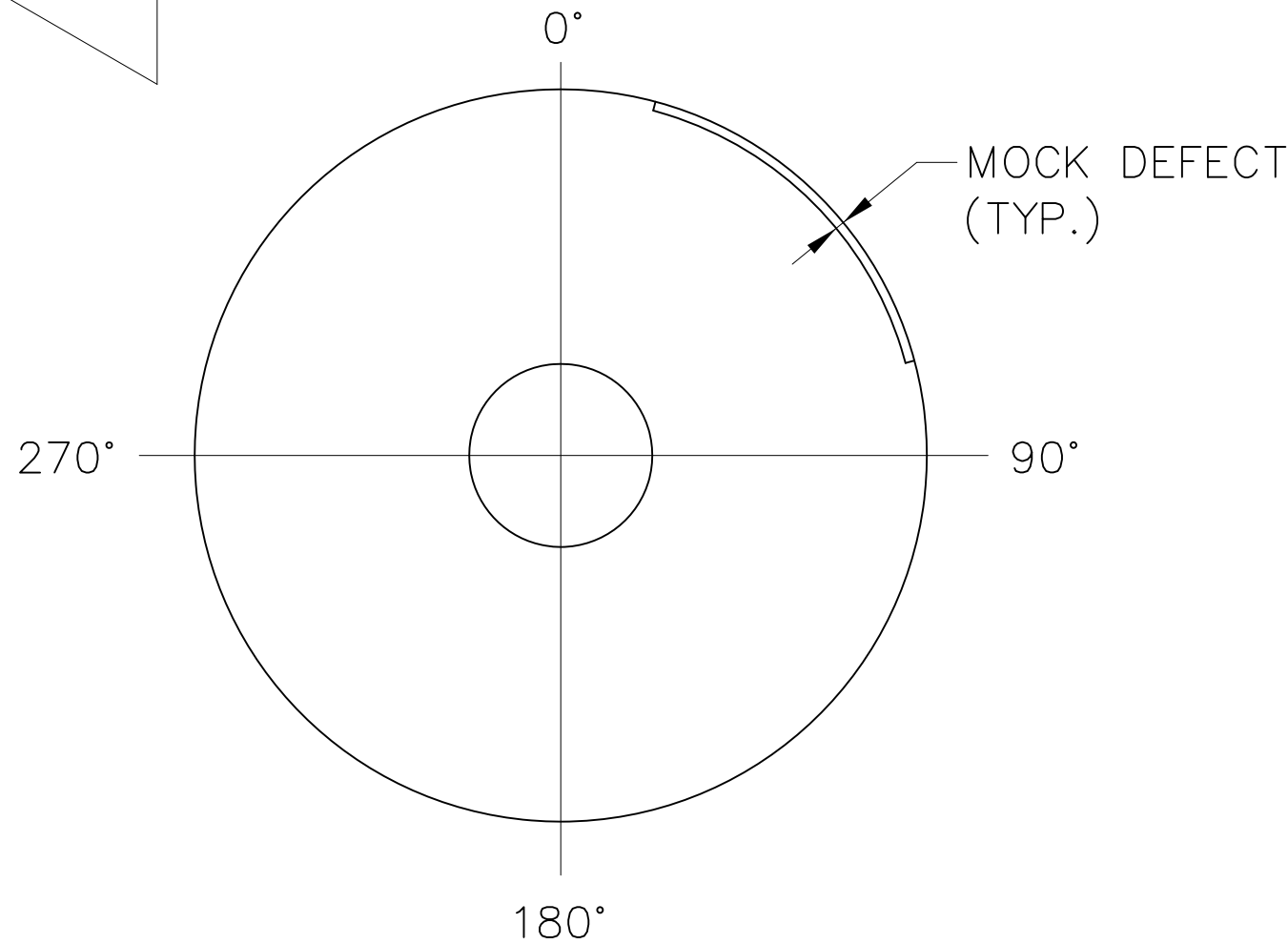
CUTS	
MOCK DEFECT #1	1/8"
MOCK DEFECT #2	3/16"
MOCK DEFECT #3	1/4"



ISOMETRIC VIEW



ELEVATION VIEW

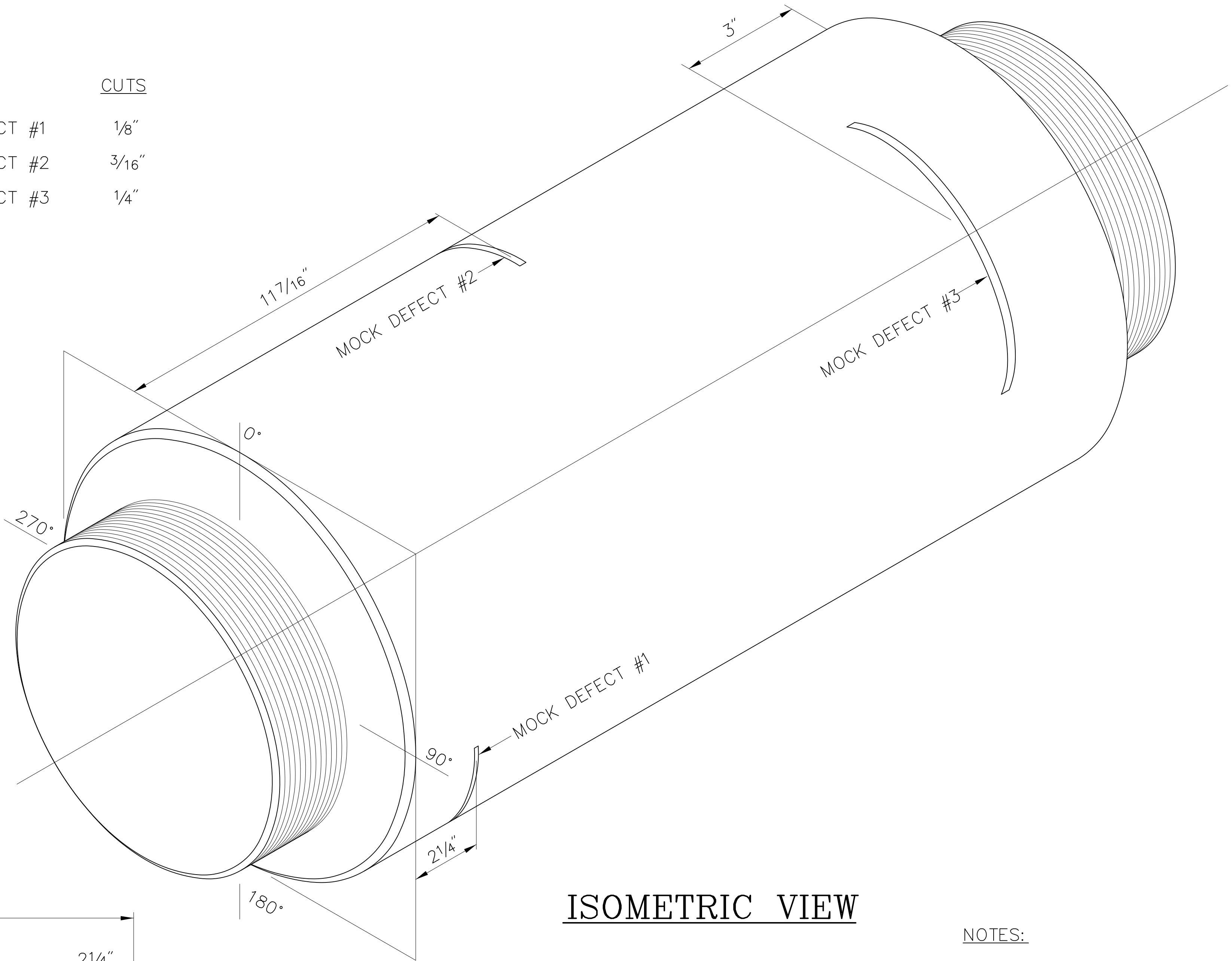


END VIEW

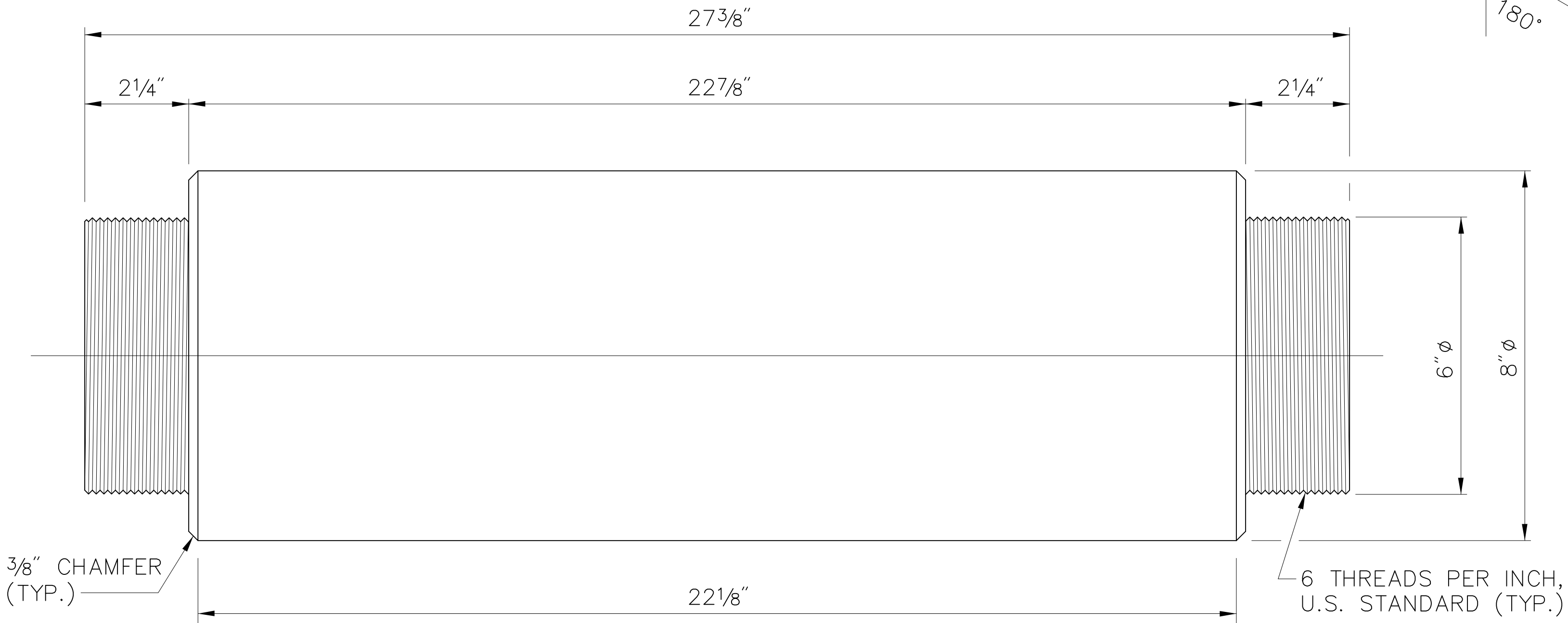
- NOTES:
- 1. NEW CALIBRATION PIN MATERIAL SHALL BE ASTM A576, GRADE 1045 STEEL.
 - 2. PIN MARK ON ORIGINAL SHOP DRAWING SHEET 1003 = mg.
 - 3. ORIGINAL PIN MATERIAL = CARBON STEEL, FORGED AND ANNEALED.
 - 4. ALL VIEWS ARE NOT TO SCALE.

STATE OF MAINE DEPARTMENT OF TRANSPORTATION					
PIN & LINK INSPECTIONS					
CALIBRATION PIN FABRICATION PLANS (1 OF 2)					
BRIDGE NO. 5196 AUGUSTA, ME.					
DESIGNED BY CDB	DATE 9/11	CHECKED BY TSB	DATE 9/11	PLOTTED: 09-29-2011	
DRAWN BY BJM	DATE 9/11	CHECKED BY TSB	DATE 9/11	SHEET 3 OF 7	

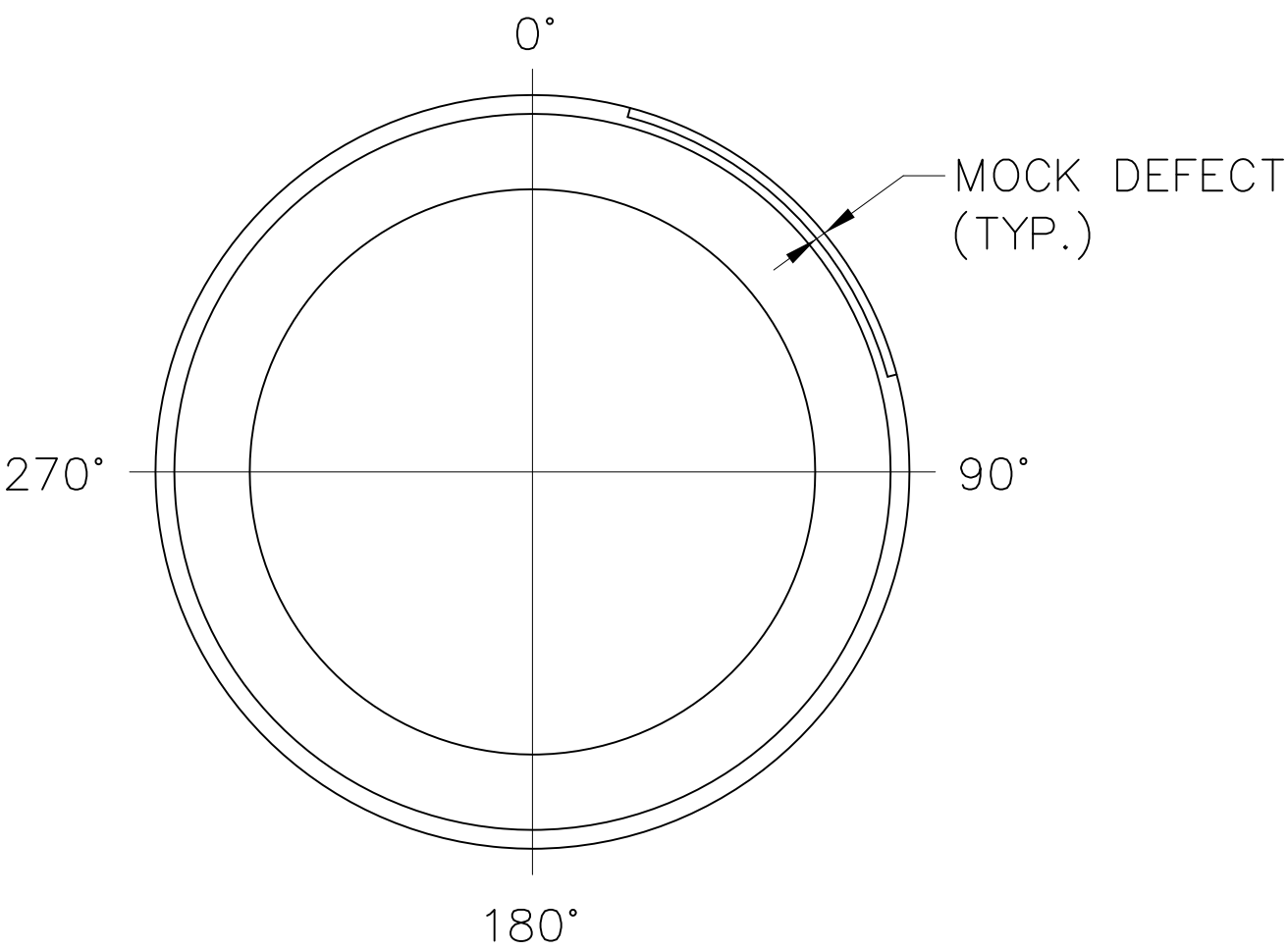
	CUTS
MOCK DEFECT #1	1/8"
MOCK DEFECT #2	3/16"
MOCK DEFECT #3	1/4"



ISOMETRIC VIEW



ELEVATION VIEW



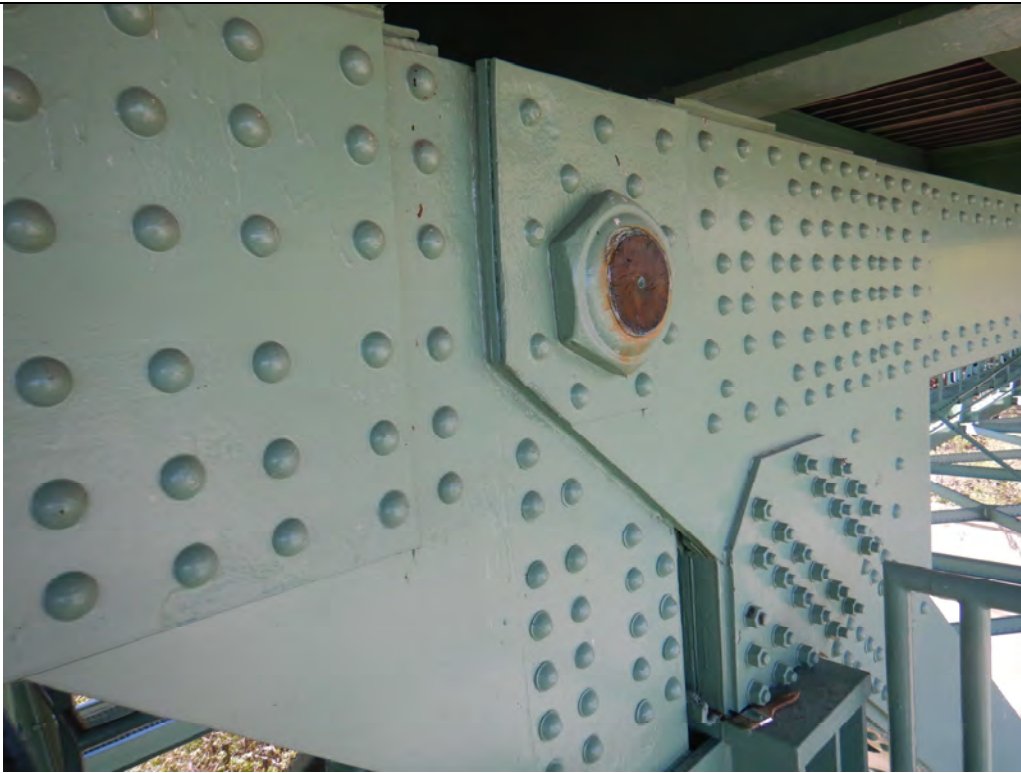
END VIEW

- NOTES:
- 1. NEW CALIBRATION PIN MATERIAL SHALL BE ASTM A576, GRADE 1045 STEEL.
 - 2. PIN MARKS ON ORIGINAL SHOP DRAWINGS = X3 AND X7.
 - 3. ORIGINAL PIN MATERIAL = CARBON STEEL, FORGED AND ANNEALED.
 - 4. ALL VIEWS ARE NOT TO SCALE.

STATE OF MAINE DEPARTMENT OF TRANSPORTATION					
PIN & LINK INSPECTIONS					
CALIBRATION PIN FABRICATION PLANS (2 OF 2)					
BRIDGE NO. 5196 AUGUSTA, ME.					
DESIGNED	BY CDB	DATE 9/11	CHECKED	BY TSB	DATE 9/11
DRAWN	BY BJM	DATE 9/11	CHECKED	BY TSB	DATE 9/11
PLOTTED: 09-29-2011					SHEET 4 OF 7



Appendix B – Inspection Photographs



Location: *Span No. 2, Pin X3, Upstream*

Description: *Upstream end. Note rust stains around the pin.*



Location: *Span No. 2, Pin X3, Upstream*

Description: *Upstream end. Note bent and cracked bracket pad due to the movement in the pin connection.*



Location: Span No. 2, Pin X3, Upstream

Description: Downstream end. Note painted over section loss on the exterior gusset plate and rust stains on the pin.



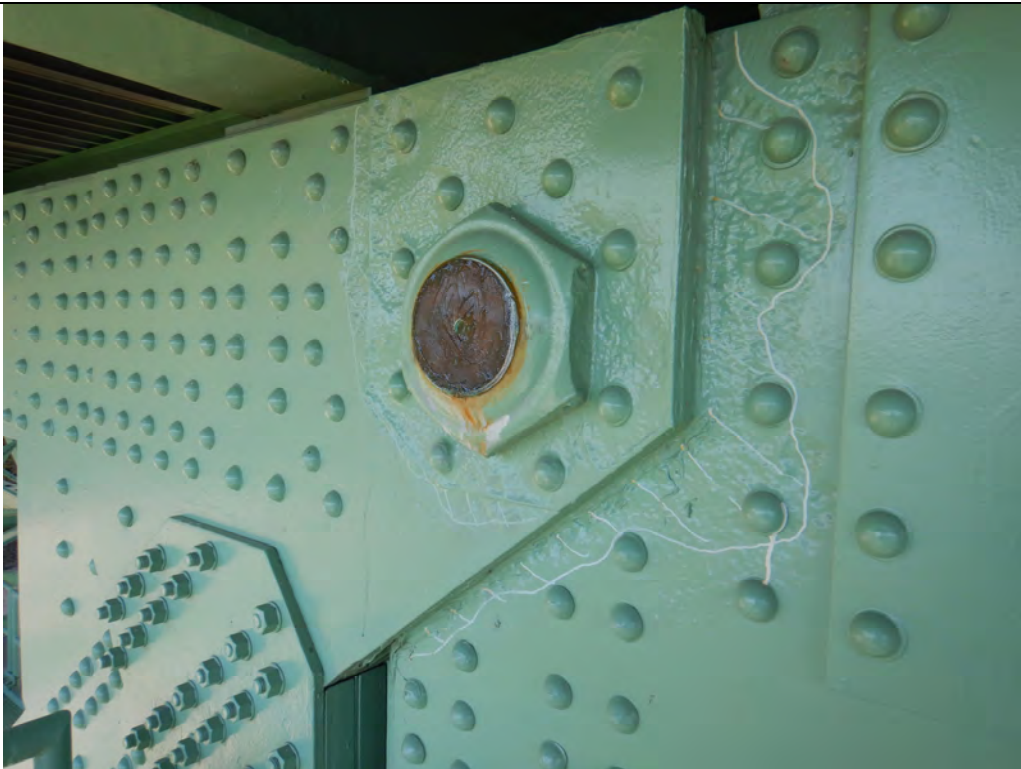
Location: Span No. 2, Pin X3, Upstream

Description: Top of connection looking down. Note minor pitting on top of pin.



Location: *Span No. 2, Pin X3, Downstream*

Description: *Upstream end. Note moderate pitting (up to 3/16" deep) of connection plates.*



Location: *Span No. 2, Pin X3, Downstream*

Description: *Downstream end. Note minor pitting (up to 1/8" deep) of connection plates.*



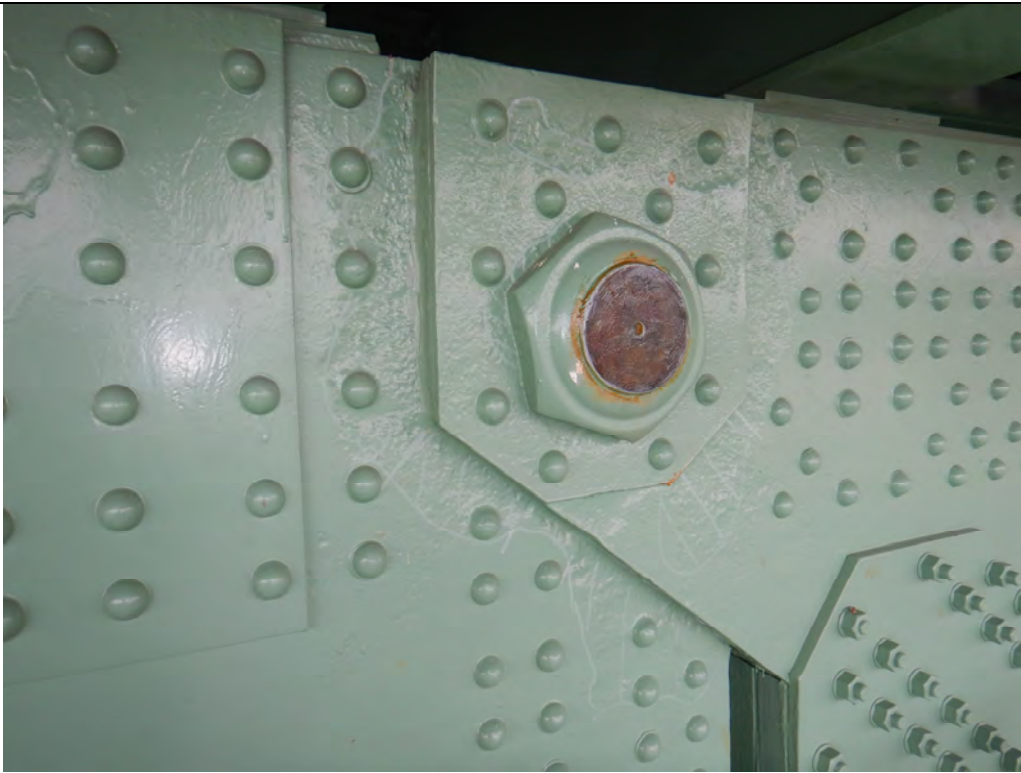
Location: Span No. 2, Pin X3, Downstream

Description: Upstream end. Close up view of typical 1/8" deep pitting. Note pack rust behind between the steel plate warping the corner edges of the end gusset plate outward.



Location: Span No. 2, Pin X3, Downstream

Description: Bottom of connection looking up. Note minor pitting on the bottom of the pin at both ends and adjacent connection plates.



Location: Span No. 4, Pin X7, Upstream

Description: Upstream end.



Location: Span No. 4, Pin X7, Upstream

Description: Upstream end. Note section loss adjacent to the pin connection and warped plates due to significant pitting between the gusset plates.



Location: Span No. 4, Pin X7, Upstream

Description: Upstream end. Note the bracket pad has shifted up to 1/8".



Location: Span No. 4, Pin X7, Upstream

Description: Downstream end. Note section loss and rust staining adjacent to the pin connection.



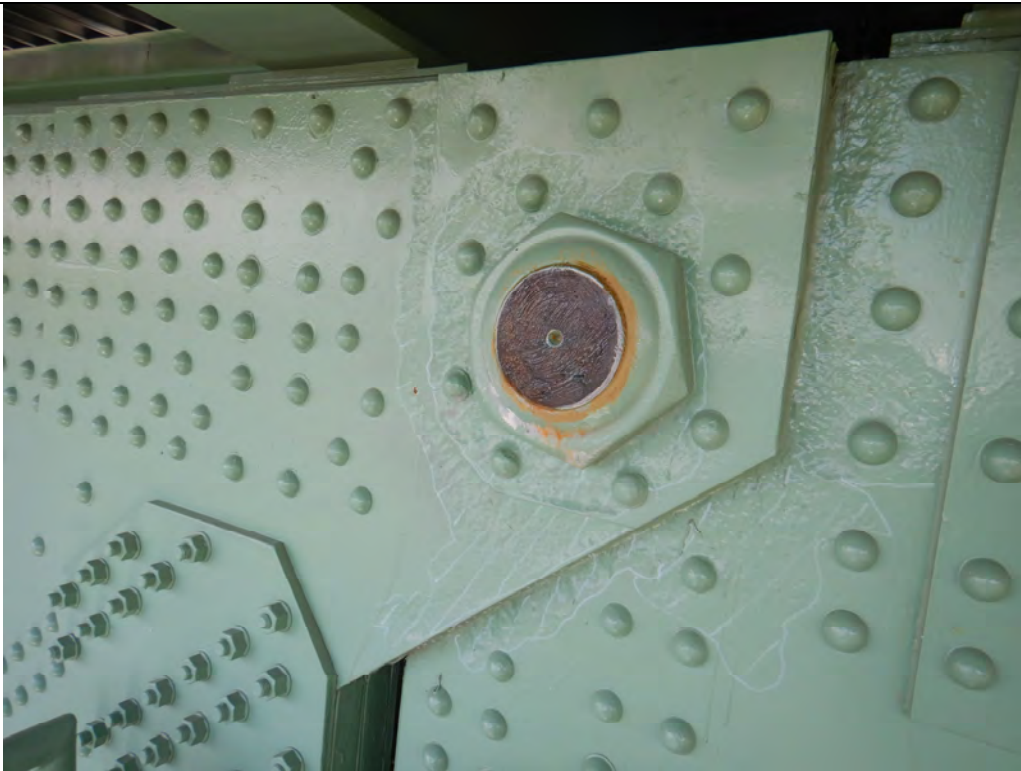
Location: Span No. 4, Pin X7, Upstream

Description: Downstream end. Close up of the warped plates adjacent to the pin connection.



Location: Span No. 4, Pin X7, Upstream

Description: Top of connection looking down. Note minor pitting on pin and interior plates.



Location: *Span No. 4, Pin X7, Downstream*

Description: *Downstream end.*



Location: *Span No. 4, Pin X7, Downstream*

Description: *Upstream end.*



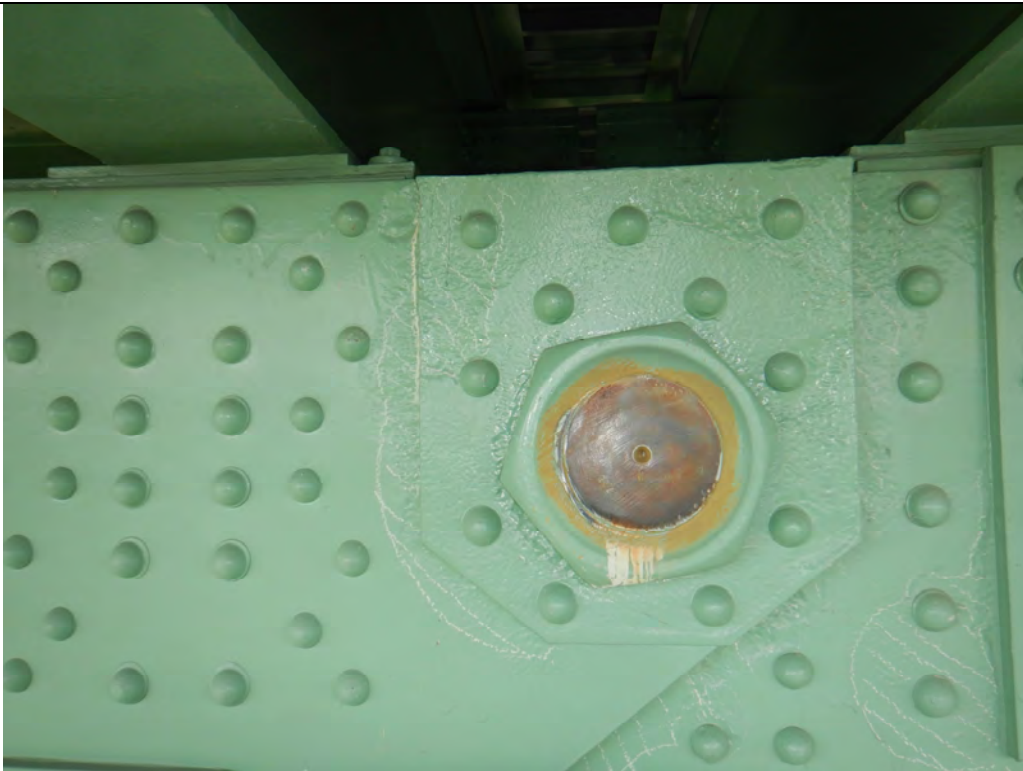
Location: *Span No. 4, Pin X7, Downstream*

Description: *Downstream end. Note warping of plates. Plates have been sealed and repainted since previous inspection. Rust beginning to form between the plates indicating new corrosion.*



Location: *Span No. 4, Pin X7, Downstream*

Description: *Top of connection looking down. Note corrosion on pin and interior plates.*



Location: *Span No. 6, Pin X3, Upstream*

Description: *Upstream end.*



Location: *Span No. 6, Pin X3, Upstream*

Description: *Downstream end.*



Location: Span No. 6, Pin X3, Upstream

Description: Upstream end. Note the bracket pad has shifted up to 1/8".



Location: Span No. 6, Pin X3, Upstream

Description: Upstream end. Note warping of plates. Plates have been sealed and repainted since previous inspection. No seals are broken which indicates the warping has not increased.



Location: *Span No. 6, Pin X3, Upstream*

Description: *Interior plates and pin.*



Location: *Span No. 6, Pin X3, Downstream*

Description: *Downstream end. Note minor corrosion of plates and rust stains around the pin.*



Location: *Span No. 6, Pin X3, Downstream*

Description: *Upstream end. Note minor corrosion of plates and rust stains around the pin.*



Location: *Span No. 6, Pin X3, Downstream*

Description: *Upstream end. Close up of pitting of plates.*



Location: Span No. 6, Pin X3, Downstream

Description: Top of connection looking down. Note corrosion on pin and interior plates.



Location: Span No. 4, Pin mg, Upstream, Upper

Description: Downstream end of pin. Note the corrosion on the face of pin and link plate. Also note the gap between the pin and link plate.



Location: Span No. 4, Pin mg, Upstream, Upper

Description: Upstream end of pin. Note the corrosion on the face of pin and link plate. Also note the gap between the pin and link plate.



Location: Span No. 4, Pin mg, Upstream, Upper

Description: Downstream end. Note the pitting of the exterior link plate and connection plate.



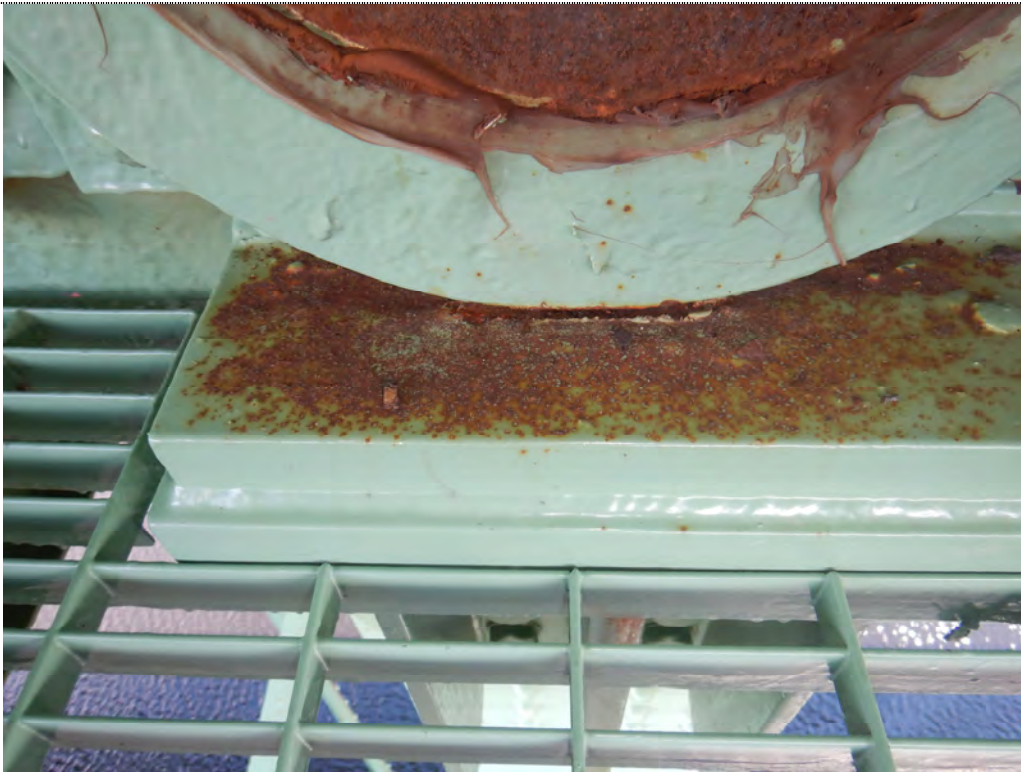
Location: Span No. 4, Pin mg, Upstream, Lower

Description: Downstream end of pin. Note the corrosion on the face of pin, link plate and cap plate. Note pitting of the exterior link plate. Also note the gap between the pin and link plate.



Location: Span No. 4, Pin mg, Upstream, Lower

Description: Upstream end of pin. Note the corrosion on the face of pin and link plate, the gap between the pin and link plate, and the link plate resting on the bottom catch plate.



Location: Span No. 4, Pin mg, Upstream, Lower

Description: Upstream end of pin. Close up look at the link plate in contact with the bottom catch plate.



Location: Span No. 4, Pin mg, Upstream, Lower

Description: Upstream. Note plates have shifted approximately 9/16". The plates have also warped due to previously arrested pitting.



Location: Span No. 4, Pin mg, Upstream, Lower

Description: Interior link plates and pin. Note the corrosion and minor section loss at the pin and link plate. Also note the gap between the top of the pin and the hole in the link plate.



Location: Span No. 4, Pin mg, Downstream, Upper

Description: Upstream end. Note the corrosion on the face of pin and link plate and the gap between the pin and link plate.



Location: Span No. 4, Pin mg, Downstream, Upper

Description: Upstream end of pin. Note the corrosion on the face of pin and link plate and that the face of link plate is out from the end of the pin by approximately 3/8".



Location: Span No. 4, Pin mg, Downstream, Upper

Description: Upstream end. Close up view of gap between pin and link plate. Maximum gap is approximately 5/8".



Location: Span No. 4, Pin mg, Downstream, Upper

Description: Upstream end. Note the necking in the through bolt likely caused by the bending of the link plate.



Location: Span No. 4, Pin mg, Downstream, Upper

Description: Interior link plates. Note the pitting around the link plate/pin connection area.



Location: Span No. 4, Pin mg, Downstream, Lower

Description: Upstream end of pin. Note the corrosion on the face of pin and link plate and that the plates have shifted approximately 1". The plates have also warped due to previously arrested pitting.



Location: Span No. 4, Pin mg, Downstream, Lower

Description: Upstream end. Close up view of gap between pin and link plate. Maximum gap is approximately 5/8".



Location: Span No. 4, Pin mg, Downstream, Lower

Description: Downstream end of pin. Note the corrosion on the face of pin and link plate and pitting of the link plate. Also note the gap between the pin and link plate.



Location: Span No. 4, Pin mg, Downstream, Lower

Description: Interior link plates. Note the corrosion and minor section loss at the pin and link plate. Also note the gap between the top of the pin and the hole in the link plate.

Appendix C – Non-Destructive Test Reports



AERIAL NDT INSPECTION, INC.
P.O. Box 1386 · Milton, NH 03851
Phone: 603-652-9092 Fax: 603-652-9093

BRIDGE ULTRASONIC EXAMINATION REPORT

BRIDGE INFORMATION

Customer Name	Address
VHB	500 Southborough Dr. Suite 105B South Portland, ME 04106
Bridge Name & Number	Date of Inspection
Memorial 5196	05/12/2021-05/13/2021
Bridge Location	
Route 127 Augusta, ME	
Number of Pins Tested	
10	

TEST DATA

Test Procedure #	Instrument	Model #
Coastal Inspection Services, Inc. Procedure #16A Rev.1	Krautkramer	USN 58L
Transducer	MHZ	Angle
0.75"	2.25	0°
.50"	2.25	14°
Calibration Standard	Part Material	
Augusta 27.375" Pin w/Mock Defects	Carbon Steel	
Augusta 26.5" Pin w/ Mock Defects	Carbon Steel	
Name of Inspector(s)	Level	
R.Scott Shanaman	II	

Signature *R. Scott Shanaman*

Disclaimer: Test results documented in this report reflect conditions that existed at the time of inspection and do not purport to set forth all hazards, nor to indicate that other hazards do not exist. By issuing these reports neither the company nor any of its employees make any expressed or implied warranty concerning the activities described in this report. Neither the company, nor its employees shall be liable in any manner for any consequential personal injury, death, property damage or loss of any kind arising from or connected with this inspection or failure to inspect.

Bridge UT Report

Bridge Name/Location: Augusta Memorial #5196

Pins	Accept	Reject	Notes
Span 2: PX3 upstream PX3 downstream	2		No recordable indications noted. All pins were scanned from both ends for 100% coverage.
Span 4: PX7 upstream PX7 downstream	2		No recordable indications noted. All pins were scanned from both ends for 100% coverage.
Span 4: PMG upstream (upper) PMG upstream (lower) PMG downstream (upper) PMG downstream (lower)	4		No recordable indications noted. Scanned from both ends. No recordable indications noted. Scanned from both ends. Slight indication of wear shoulder approx. 1/16" deep at the bottom of the upper pin. Could only test upper pin from the upstream end, unable to remove downstream cover plate. No recordable indications noted in lower pin.
Pin Rods	4		No recordable indications. Backwall Echo @ 35.00" Avg.
Span 6: PX3 upstream PX3 downstream	2		No recordable indications noted. All pins were scanned from both ends for 100% coverage.

Photographs:



Appendix D – Significant Findings Memo



To: Mr. Benjamin Foster, P.E.
State Bridge & Structures
Maintenance Engineer

Date: May 26, 2021

Memorandum

MaineDOT WIN #: 022035.21 State Wide – Assignment Letter 7

VHB Project #: 55373.00

From: Robert Blunt, P.E.
Senior Project Manager

Re: 2021 MaineDOT Pin & Link Inspections
Augusta Memorial Bridge No. 5196
Significant Findings

This memo summarizes VHB's significant findings from the May 12-13, 2021 Pin & Link Inspection of the Augusta Memorial – Bridge #5196. The Augusta Memorial Bridge was built in 1948 and crosses the Kennebec River in Augusta. The bridge consists of 11 spans, 5 of which are deck trusses. The fracture critical pin & link connections are in span 4.

VHB engaged Aerial NDT Inspections, Inc. to perform ultrasonic testing of the pins as part of our detailed inspection of the pins and link plates. The ultrasonic testing found that the wear on the circumference of the pins noted in the previous pin and link inspections has increased slightly where the link plates are in contact with the pins compared to the previous inspection. At most of the exterior upstream and downstream link plates the gap between the edge of the pin hole in the link plate and the circumference of the pin has increased compared to the previous inspection. The increase in the size of this gap is most likely caused by the wear on the pin and corresponding wear of the link plate at the contact area in the pin hole. An increase in pin wear and gap size has been noted in each of the previous cycles of the pin and link inspections and is not an immediate structural concern.

During the inspection, VHB observed that the upstream exterior link plate on the North (upstream) Truss was resting on and wearing into the top of the suspended span retainer below, as shown in the photos below. The 2017 Fracture Critical Report also noted this contact between the bottom of the upstream exterior link plate. The paint in the contact area between the suspended span retainer and the gusset plate is worn off and wearing in.



500 Southborough Drive
Suite 105B
South Portland, ME 04106-6928
P 207.889.3150

The ultrasonic testing required the removal of the nuts and cap plates at the pin and link connections. In general, the tops of the pins are worn at the contact points at the top center of the top pins. At the upstream end of the top pin at the North (upstream) Truss, the bottom gap between the edge of the pin hole in the link plate and the circumference of the pin has decreased slightly from $1\frac{1}{16}$ " to $\frac{1}{2}$ " since the last inspection in 2016, indicating that this link plate may be lifting off the pin because the bottom of it is in contact with the suspended span retainer.

After the bottom pin cap plate was removed to perform the ultrasonic testing, VHB noticed evidence of movement of the upstream exterior link plate at the North Truss under live load. The team then tapped the upstream exterior link plate with a two-pound hammer. Based on the tonal differences between this upstream exterior link plate and the other three link plates at this pin and link connection, it appears that some load sharing may be occurring between the suspended span retainer below and the upstream exterior link plate. The suspended span retainer is designed to support the suspended span in the event of a pin or link plate failure so the noted contact between the upstream exterior link plate and the suspended span retainer is not an immediate structural concern. However, having the suspended span retainer partially support the suspended span for the long term is not recommended because it limits the free movement of the pin and link connection.



Top Pin



Bottom Pin

RECOMMENDATIONS

Based on on-site discussions May 14 and 21, 2021 with MaineDOT Bridge Maintenance and the VHB inspectors, the following actions are recommended:

- o Annually monitor the pin and link clearances and the gap between the bottom of the link plates and the suspended span retainers.
- o Replacement of the pin and links plates in all the pin and link connections.
- o Consider analyzing the truss for the existing condition assuming some amount of load re-distribution is occurring through the contact of the link plates with the suspended span retainer.
- o Consider replacement of all the pins throughout the structure, while a contractor is mobilized to this location for replacement of the pins and link plates in the pin & link connections.

CC: Ron Taylor