

WESTOVER BRIDGE REHABILITATION



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Bridge Rehabilitation & Special Projects, Operations Division

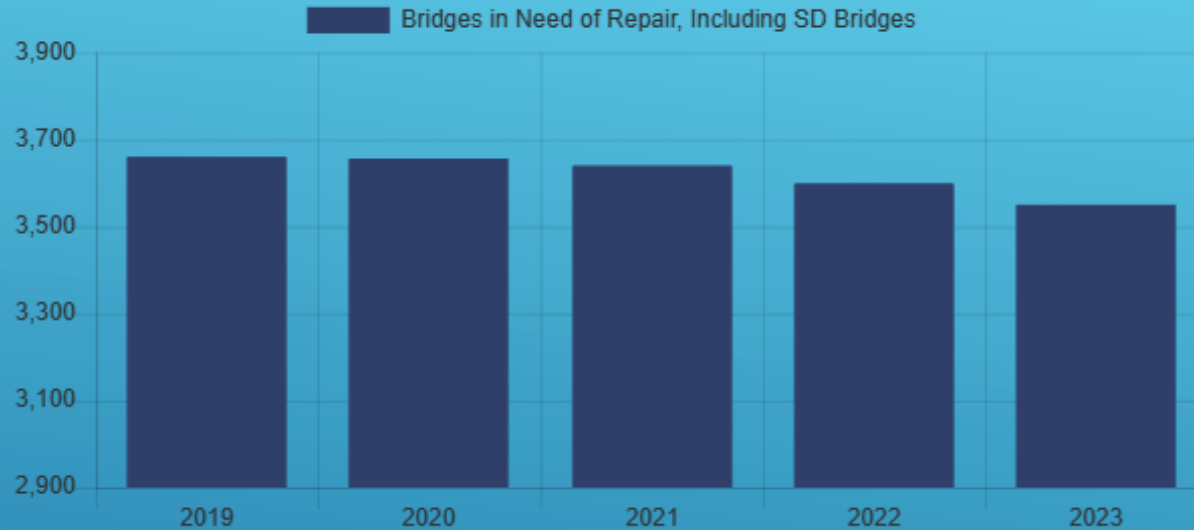
WVDOT

NATIONAL BRIDGE INVENTORY DATA (2023)

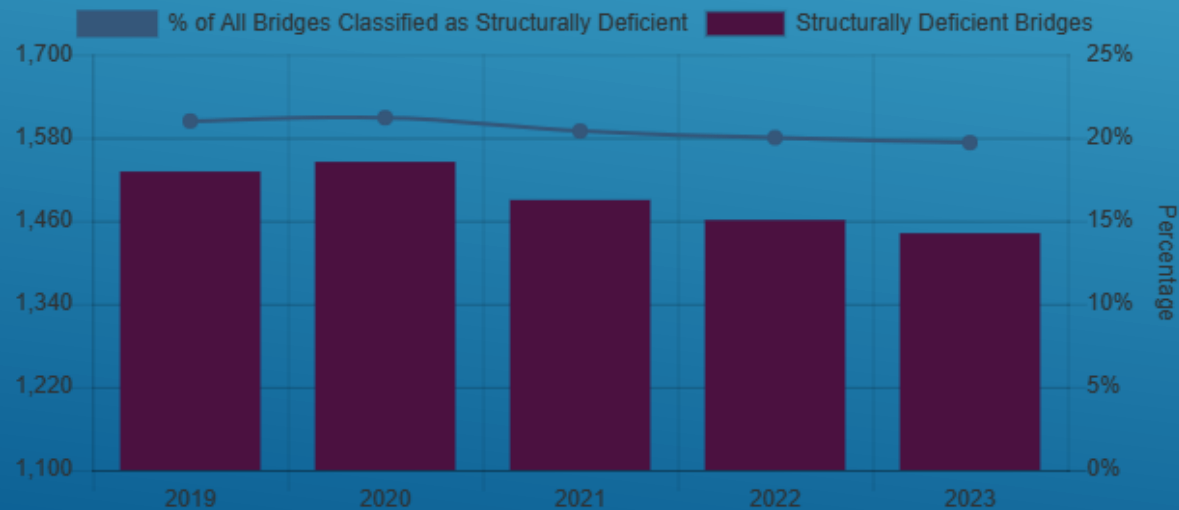
- West Virginia has **7323 bridges** in the state highway system
- The state has identified needed repairs on **3550 bridges – 48%**
- **1442 bridges** are classified as **structurally deficient – 19.7%**
(Structurally deficient means one or more critical bridge component is rated **poor** or **worse**)
- Placed **number 1** in the nation in **% of structurally deficient bridges**
- Placed **number 9** in the nation for **# of structurally deficient bridges**

NATIONAL BRIDGE INVENTORY DATA (2023)

Number of Bridges in Need of Repair including Structurally Deficient bridges



Number of Structurally Deficient bridges



NEW RIVER GORGE BRIDGE



Longest Steel Arch-Span in the Western Hemisphere. Opened to traffic in 1977
3030 ft long; Height: 876 ft

EAST HUNTINGTON BRIDGE



Cable Stayed Bridge. Opened to traffic in 1985.

BLENNERHASSETT BRIDGE



Network Tied Arch Bridge. Opened to traffic in 2008

SHENANDOAH RIVER BRIDGE



1400 ft Span Delta Frame Bridge. Open to traffic in 2012

JEFFERSON STREET BRIDGE



**Historic Concrete Arch Bridge, Fairmont, WV. Opened to traffic in 1921
(Underwent Major Rehab 30 Years ago)**

GLADE CREEK BRIDGE



**Deck Truss Bridge. Opened to traffic in 1988
2179 ft Long; 700 ft Height**

WESTOVER BRIDGE



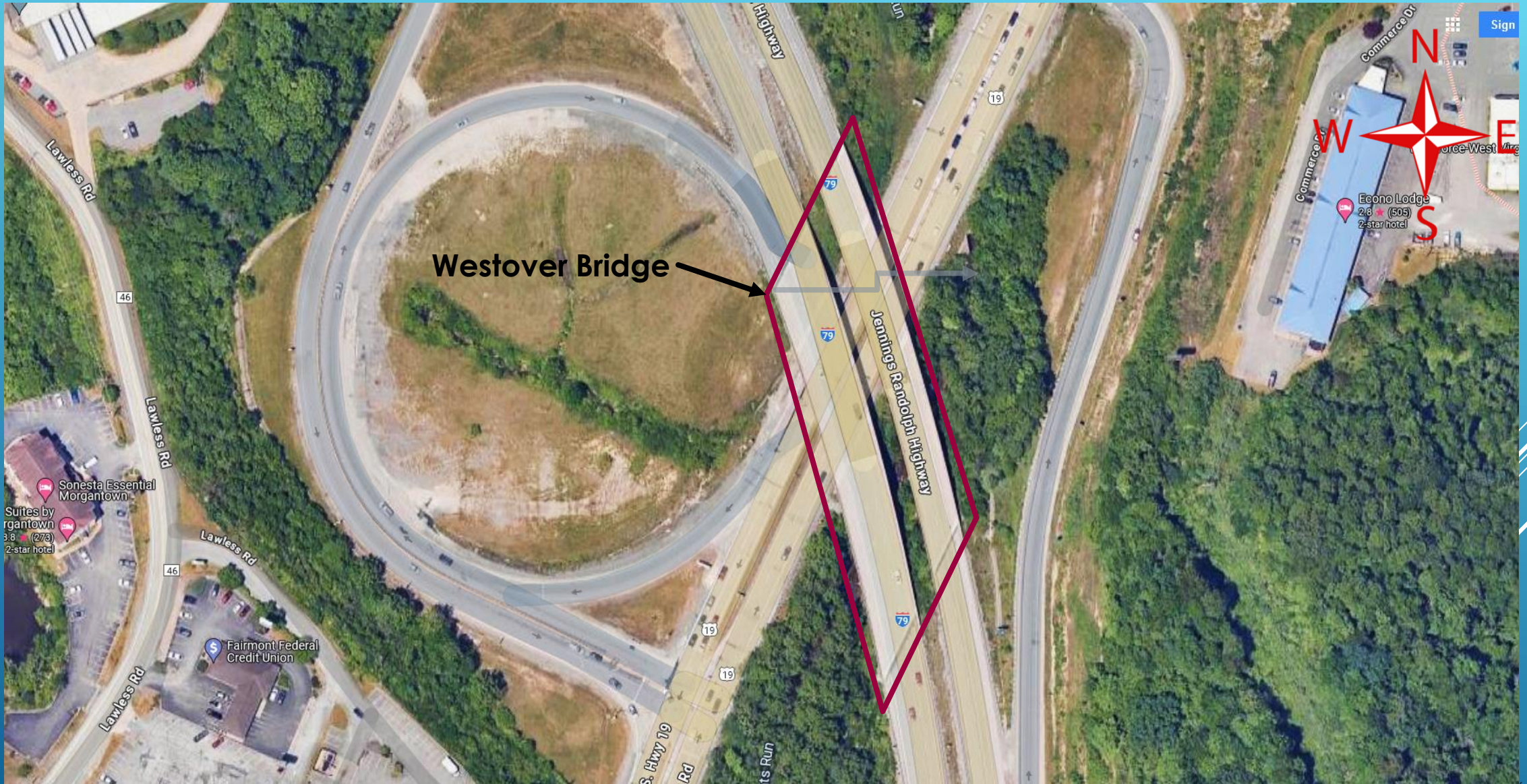
Side View



Street View

Overpass Structure – Concrete Deck, Steel Plate Girder Structure

WESTOVER BRIDGE



Bird's Eye View

BRIDGE FACTS

- Located in Town of Westover, Monongalia County, District 4
- I-79 Overpass Structure at Exit 152 (3rd Exit from the Pennsylvania Stateline)
- Structure Specifics ~
 - 4 Span Steel Girder Twin Structure (Total Length of Structure: 457'-10")
 - 8 Inch Concrete deck
 - Concrete abutments on spread footing supported on 2 rows of piles (front row battered)
 - Multi-Column Piers
 - Rocker bearings on the Piers
 - Structure built in 1969 (approximately 55 years old)
 - Design Consultant on Record: Michael Baker



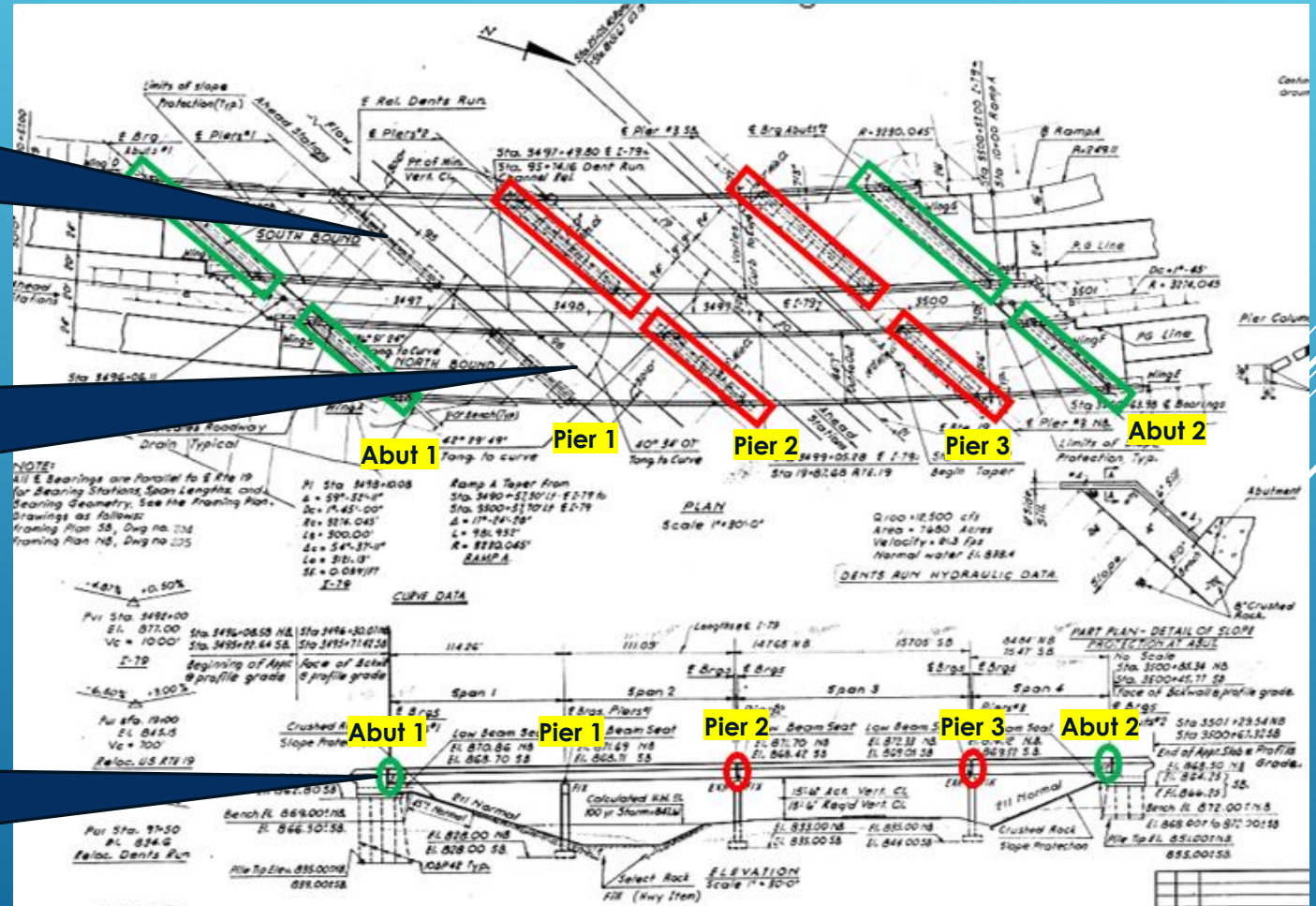
BRIDGE FACTS

Strip Seal Expansion Joints are found at ~ Abutments 1 & 2 (Green) and Piers 2 & 3 (Red)

Girders are continuous over Pier 1, but there are two beam ends at Piers 2 & 3 to accommodate the expansion joint.

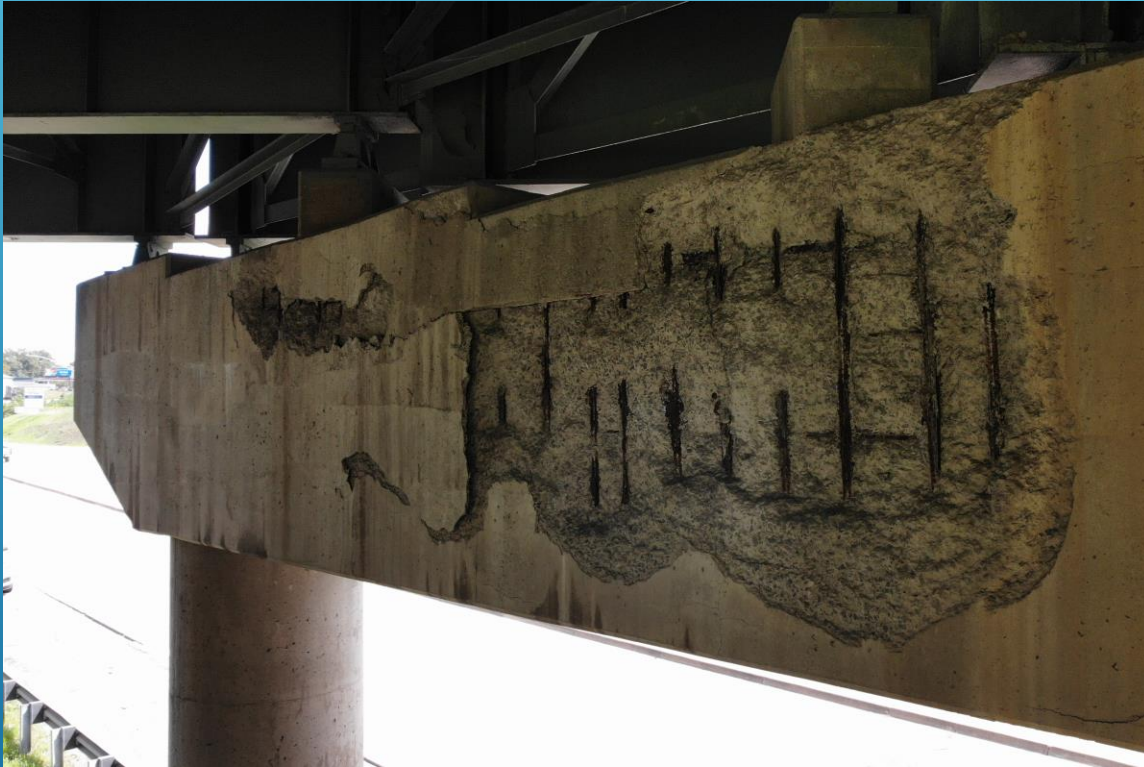
There is **one** continuous girder span plus **two** simple spans per beam line. In addition, there are splices to connect girders with varying plate sizes

Much of the problems associated with this bridge stem from **leaking expansion joints**



BRIDGE CONDITION – PIERS

EXTENT OF CONCRETE DAMAGE DUE TO LEAKING EXPANSION JOINTS



- Pier Caps exhibited Severe Spalling, exposed rebar with significant corrosion and section loss,
- Four out of the six piers in the twin structure were in a state of severe disrepair.
- Leaking expansion joints above these piers caused **De-icing Salt Saturation of concrete.**

BRIDGE CONDITION - PIERS

EXTENT OF CONCRETE DAMAGE DUE TO LEAKING EXPANSION JOINTS



- ◆ More of the same: Spalls, cracks, delamination, exposed rebar.
- ◆ Piers 2 & 3 were in very poor condition
- ◆ Pier 1 was in good condition. Why?

PIER 1 – PRISTINE CONDITION!



Pier 1 in NB & SB Structures are in pristine condition. Why?

- ◆ No deck joints are to be found at this Pier location.
- ◆ No leaking joints, no deicing salts and other run off, and
- ◆ It helped preserve the steel and concrete in this pier.

BRIDGE CONDITION - PIERS

EXTENT OF CONCRETE DAMAGE DUE TO LEAKING EXPANSION JOINTS



Pier columns, even though they are at a lower elevation, were not spared. Cracks, large spalls and extensive delam were detected in several columns.

BRIDGE CONDITION - PIERS

EXTENT OF CONCRETE DAMAGE DUE TO LEAKING EXPANSION JOINTS



- ◆ Severe deterioration of Bearing Pedestals.
 - ◆ Several of these had to be recast.
- ◆ To recast Pedestals, the girders had to be jacked individually under full traffic loading &
 - ◆ Rocker bearings reset etc.

BRIDGE CONDITION - PIERS

EXTENT OF CONCRETE DAMAGE DUE TO LEAKING EXPANSION JOINTS



- ◆ Completely deteriorated Pier Cap Cantilever in Pier 3 of the SB Structure (West Side cantilever).
- ◆ Cantilever supported the exterior beam that carried a significant percentage of the load on the entrance ramp to the I-79 SB Structure.
- ◆ Something had to be done. We decided to recast the cap overhang. To do that safely the beam would have to be jacked and a jacking frame needed to be built.

BRIDGE CONDITION - PIERS



- ◆ The ground was littered with broken pieces of concrete from these spalls and defects we have seen so far.



- ◆ Broken haunch. A safety hazard to vehicles on the underpass (US 19).
- ◆ Lack of reinforcing causes them to break apart and fall.
- ◆ If you see any during a routine inspection, just break off all loose pieces of haunch, just for the safety of the travelling public.

BRIDGE CONDITION - ABUTMENTS

EXTENT OF CONCRETE DAMAGE DUE TO LEAKING EXPANSION JOINTS



Large spall - A huge chunk of concrete cracked and about to fall off at the corner of Abutment 2, SB structure. Spalls found on all Abutment backwalls in general.



Numerous cracks. Cracks over .03 inches in width were sealed by an epoxy crack sealant.



Map cracking. Cracks were sealed off with concrete protective coating

Abutments were not spared of course but they appeared to be in better condition than the piers. Abutments were rated **'Fair'**.

BRIDGE CONDITION – STEEL SUPERSTRUCTURE

CONDITION OF STEEL GIRDERS AT SUPPORTS



Steel members (girders, crossframes, diagonals etc.) at the supports where expansion joints are located showed surface rust and section loss.



Peeling topcoat on the beam bottom flanges and diagonals. (Pier location)



Surface rust and minor section loss at Abutments.

BRIDGE CONDITION – STEEL SUPERSTRUCTURE

CONDITION OF STEEL GIRDERS IN THE SPAN



- ◆ Paint Peeling off in the bottom flanges of the girders in Span 3 (the span over the US 19). Quite extensive.
- ◆ Exhaust fumes from trucks travelling underneath on US 19 underpass probably had something to do with it. We decided to clean and paint at least the bottom flanges in span 3 and sections at the supports.
- ◆ Limited Cleaning and painting in this contract is a *temporary measure*. Bridge is due for a full clean and paint project.

BRIDGE CONDITION – DECK EXPANSION JOINTS



Typical Strip Seal Expansion Joint in this bridge.



- ◆ Closeup View of Strip Seal. Holes in them caused the joint to leak.
- ◆ The seals are not meant to last the life of the bridge. They have to be replaced when they are worn out

OBTAINING CORE SAMPLES TO CHECK FOR SALT CONCENTRATION IN PIERS



OBTAINING CORE SAMPLES TO CHECK FOR SALT CONCENTRATION IN PIERS





REPAIR ITEMS

CONCRETE

Pier Repair:

- 1) **Extensive Concrete Repair** – Concrete Patching of spalled areas (Referenced by **Repair Types PC1, PC2 & PC3**)
- 2) **Pier Pedestal Reconstruction & Repair** – (Referenced by **Repair Type PRC**)
 - a) Select Pedestals were fully replaced
 - b) Others were repaired for spalls and cracks
- 3) **Pier Cap Cantilever Reconstruction** – Recasting of the pier cap cantilever on the Northwest corner of the SB Pier #3. (Referenced by **Repair Type CRC**)

Abutment Repair:

- 1) **Concrete Repair** – Vertical cracks (especially near weep holes), scattered map cracking and spalls in the breastwall and backwall. (Referenced by **Repair Types CS, PC1, PC2**)
- 2) **Recasting a large spall/delam** at the Northwest corner of Abutment 2 in the SB Structure. (Referenced by **Repair Type PC2**)
- 3) **Cleaning & Restoration of Abutment Seats** – Removal of excess construction material, dirt and debris lying on the seats (from previous repairs).



REPAIR ITEMS

STEEL

Steel Superstructure Cleaning & Painting:

Cleaning and painting was limited to bearing areas at Abutment 1, 2, Piers 2 & 3 and the bottom flanges of girders in span 3 that passes over US 19. (Referenced by **Repair Type C&P**)

Expansion Joint Replacement:

Strip Seal Expansion Joints at Abutments 1 & 2 and Piers 1 & 2 were replaced (Referenced by **Repair Type EJ**)

Concrete Protective Coating:

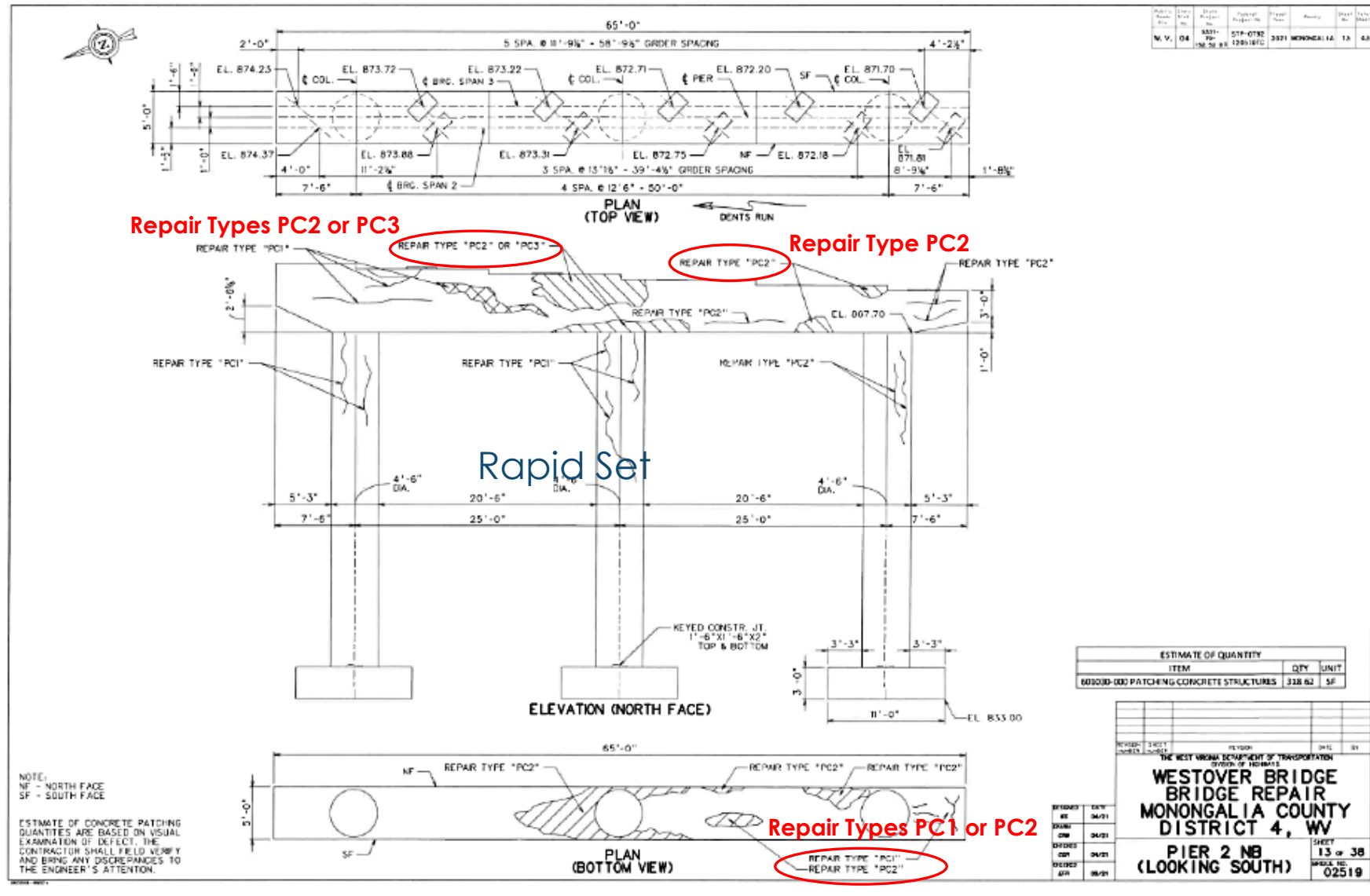
Application of Concrete Protective Coating on the substructure units that underwent repair - in this case Abutments 1 & 2 and Piers 2 & 3 in the NB & SB Structures.

PIER REPAIR

Concrete Repair

Concrete Patching of spalled and delaminated areas (Referenced by Repair Types PC1, PC2 & PC3)

- 1) Removal of all unsound concrete
- 2) Application of a cementitious bonding agent (Material Specs are given in SP 601)
- 3) Application of Rapid Set Cementitious Patching (Material Specs in SP 601)



Example Pier Repair Plan Sheet

Repair Types -

PC1 - Surface Spalls with no exposed rebars (Mild Defect)

PC2 - Spalls with exposed rebars (Moderate Defect)

PC3 - Large or full depth spalls with exposed rebars (Severe Defect)^{3/20XX}

PIER REPAIR

Plan No.	Sheet No.	Scale	Project No.	Project Name	County	Sheet No.	Total Sheets
W.V. 04	5031	1/8" = 1'-0"	079-0792	1205107C	DC1	MONONGALIA	20



NB PIER 3, NORTH FACE



NB PIER 3, BOTTOM OF PIER CAP BETWEEN MIDDLE COLUMN AND WEST COLUMN

Repair Type PC2

REPAIR TYPE "PC2"

Repair Type PC3

REPAIR TYPE "PC3"



NB PIER 3, NORTH FACE



NB PIER 3, BOTTOM OF PIER CAP BETWEEN EAST COLUMN AND MIDDLE COLUMN

Repair Type PC1

REPAIR TYPE "PC1"

DESIGNED	DATE	CHECKED	DATE
BY	04/21	BY	04/21
DATE	04/21	DATE	04/21
DATE	04/21	DATE	04/21
DATE	04/21	DATE	04/21
DATE	04/21	DATE	04/21

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

**WESTOVER BRIDGE
BRIDGE REPAIR
MONONGALIA COUNTY
DISTRICT 4, WV**

PIER REPAIR

SHEET 20 OF 38
PROJECT NO. 02519

PIER REPAIR CONCRETE PATCHING



Removal of Unsound Concrete

Use of a hand tool like a small hammer or pickax to determine the location and limits of unsound concrete that needed to be removed



Forming up to Pour Rapid Set

Attaching the form boards to place the Patching Material

PIER REPAIR (VIDEO)



Detection and Removal of Unsound Concrete in Pier Cap

32

9/3/20XX

PIER REPAIR

CONCRETE PATCHING



Formwork to Place Rapid Set Cementitious Patching Material in Pier Caps

PIER REPAIR (VIDEO)



Forming to pour Rapid Set Cementitious Patching

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9/3/20XX

PIER REPAIR

May 20, 2021

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT: S331-79-152.52 00

FEDERAL PROJECT: STP-0792 (205) DTC

FOR

SECTION 601

RAPID SET CEMENTITIOUS PATCHING

601.1 – DESCRIPTION:

ADD THE FOLLOWING SECTION

601.1.1 Rapid Set Cementitious Patching: The work shall consist of removing the existing concrete, power tool cleaning the exposed steel reinforcing bars, cleaning the bonding surfaces of the existing concrete to remain, replacing any damaged or severed reinforcing, and furnishing and placing Rapid Set Cementitious Patching Material at the locations indicated on the plans and any other location designated by the engineer. The Engineer will delineate the repair areas. The construction shall be in accordance with this Specification and in reasonably close conformity with the Plans or as established by the Engineer.

601.2 – MATERIALS:

ADD THE FOLLOWING SECTIONS

601.2.1 – RAPID SET CEMENTITIOUS PATCHING MATERIAL:

601.2.1.1: Rapid Set Cementitious Patching Material shall be a high early strength structural repair material capable of patching deep holes, shallow feathering, able to be poured in forms, and being troweled vertically or overhead. Material shall not shrink on cure, be self-priming, and be capable of providing a strong bond to concrete and steel reinforcing bars. It shall be a non-toxic product and clean up with water. This Rapid Set Cementitious Patching Material is also known as MG-Krete as manufactured by IMCO Technologies.

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May 20, 2021

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION FOR

STATE PROJECT: S331-79-152.52 00

FEDERAL PROJECT: STP-0792 (205) DTC

SECTION 601 BONDING AGENTS FOR CONCRETE

601.1-DESCRIPTION:

This specification describes the use of a bonding bridge (agent) between new portland-cement mortar or concrete and hardened portland-cement mortar or concrete.

601.1.1-QUALITY ASSURANCE:

601.1.1.1- Manufacturing qualifications: The manufacturer of the specified product shall have in existence a recognized quality assurance program and be ISO 9001 Certified, a program of training, certifying and technically supporting a nationally-organized Approved Contractor Program with a re-certification program of its participants for a minimum of 5 years.

601.1.1.2-Contractor qualifications: Contractor shall be an Approved Contractor of the manufacturer of the specified product, who has completed a program of instruction in the use of the specified coating material and provides a certification from the manufacturer attesting to its Approved Contractor status.

601.1.1.3-Installation: Install materials in accordance with all safety and weather conditions required by manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

601.2-MATERIALS:

601.2.1-Epoxy Resin: Epoxy resin/portland cement adhesive shall be as follows:

- 1) Component "A" shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
- 2) Component "B" shall be primarily a water solution of a polyamine.
- 3) Component "C" shall be a blend of selected portland cements and sands.
- 4) The material shall not contain asbestos.

1 of 4

▶ SPECIAL PROVISIONS 601

➔ Rapid Set Cementitious Patching

Rapid Set Cementitious Patching Material shall be high early strength structural repair material capable of patching deep holes, shallow feathering and able to be poured in forms. Also known as **MG-Krete**.

Contractor must meet Material Specifications listed in the SP

Min. material strength listed –

2500 psi @ 45 min;

5000psi @ 24 hrs. etc.

11,000psi @ 28 Days

➔ Bonding Agent

A Portland cement adhesive/epoxy resin that creates a bond between hardened old concrete and new Portland cement mortar.

Contractor must meet material specs specified in the SP. Example: Compressive Strength, Splitting Tensile Strength, Bond Strength etc.

PIER REPAIR



Rapid Set Cementitious Mix



**Mixing Rapid Set Cementitious Patching Material
(on Site)**

PIER REPAIR (VIDEO)



Site Mixing of Rapid Set Cementitious Patching Material

PIER REPAIR (VIDEO)



Site Mixing of Rapid Set Cementitious Patching Material

PIER REPAIR



Problems with the Rapid Set Cementitious Mix caused sections of the patchwork to crumble. The District Construction Supervisors on the job rightly asked the contractor to take them off and reapply.

PIER REPAIR



Before



After

NB Pier 3 Cap

40
9/3/20XX

PIER REPAIR



Before



After

NB Pier 3 Column

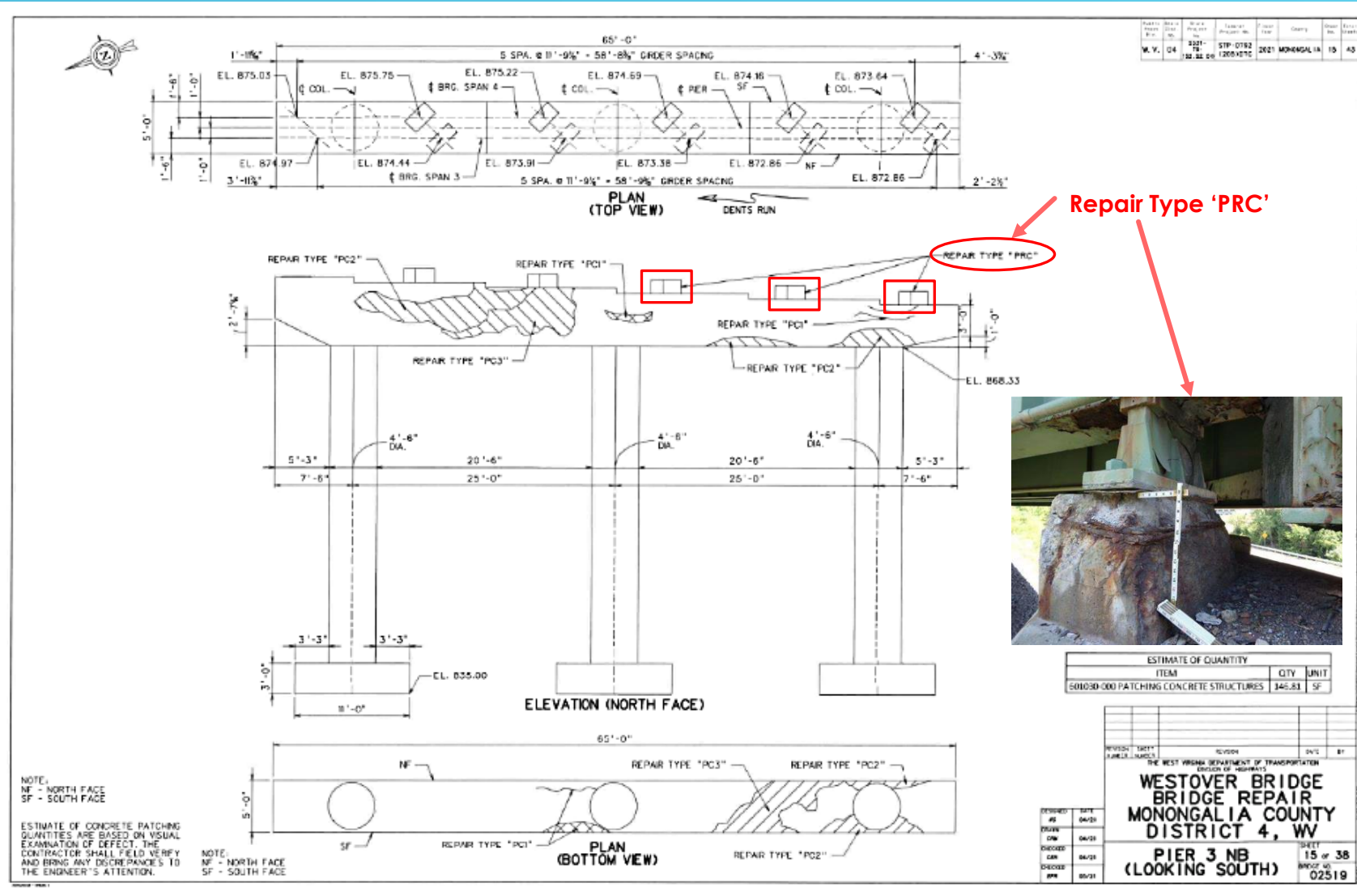
PIER PEDESTAL RECONSTRUCTION

Pier Pedestal Reconstruction

Removal and recasting of select pier pedestals on which the girders rested. (Referenced by **Repair Type PRC**)

- 1) Jack girders under which pedestals were to be replaced (accomplished by placing hydraulic jacks placed on top of the pier cap)
- 2) Completely remove badly deteriorated pedestals
- 3) Drill, grout and assemble new pedestal reinforcements
- 4) Cast new pedestal to original dimensions

A total of 5 pedestals out of 12 were replaced. The others were repaired for cracks and spalls.



Pedestals on Pier 3 NB & SB

PIER PEDESTAL RECONSTRUCTION



Before



After

NB Pier 3 Pedestal under Exterior Girder

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9/3/20XX

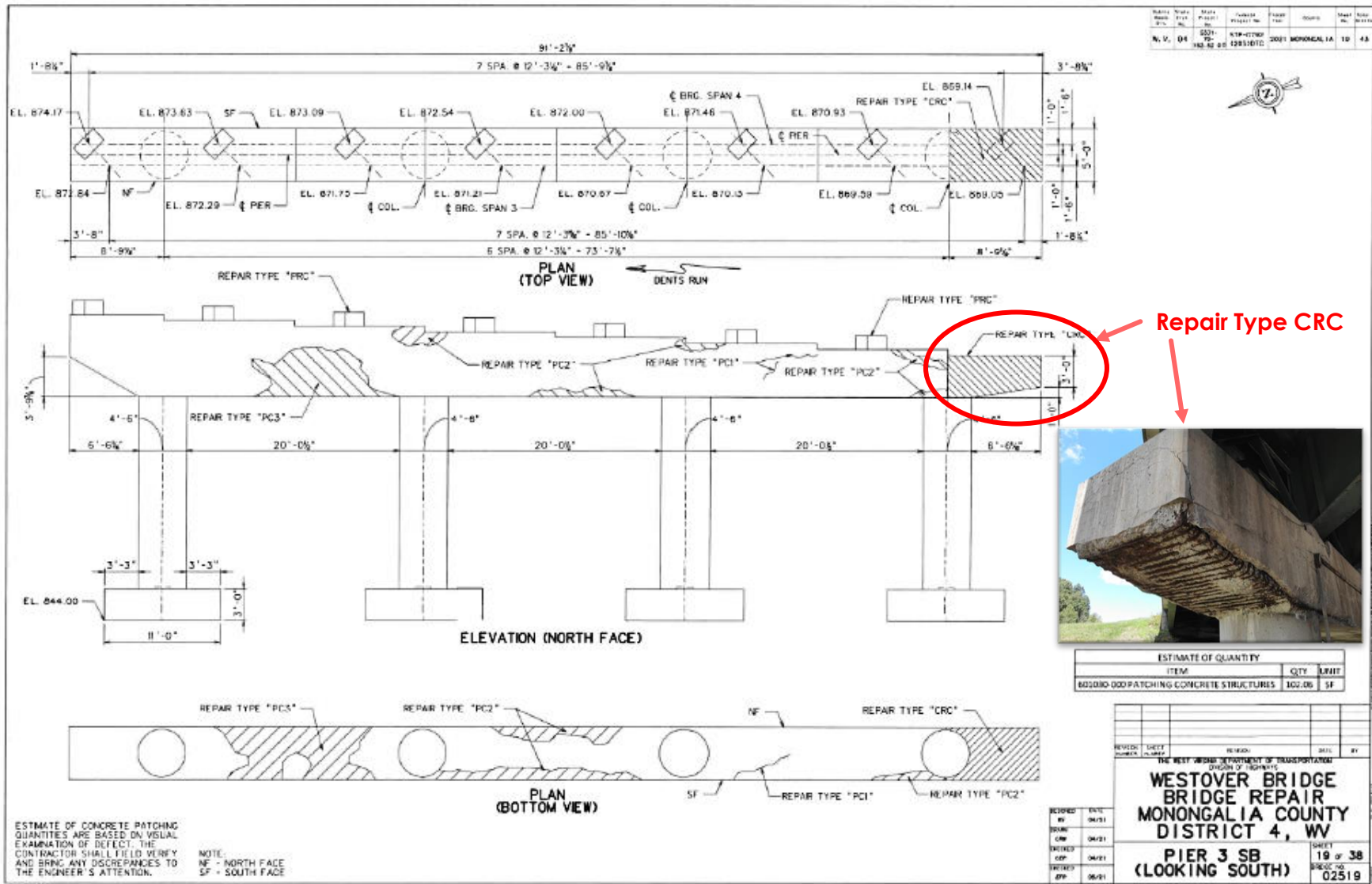
PIER CAP CANTILEVER RECONSTRUCTION

Pier Cantilever Reconstruction

Dismantling and reconstruction of the Pier 3 West Side Cantilever in the SB structure. (Referenced by **Repair Type CRC**)

- 1) Erect Jacking towers to sit jacks required to lift the exterior girder
- 2) Completely dismantle the Pier Cap Cantilever to the limits shown on the plan
- 3) Assemble rebar cage, tying new longitudinal reinforcements to existing rebars in the cap.
- 4) Cast new pier cap cantilever to original dimensions

Only one cantilever was totally dismantled and recast. The others were repaired for cracks, spalls and delamination.



SB Pier 3 West Side Cantilever

PIER CAP CANTILEVER RECONSTRUCTION



Jacking Tower (North Side of Pier)



Jacking Tower (South Side of Pier)

SB Pier 3 Cantilever supporting Exterior Girder Line

45

9/3/20XX

PIER CAP CANTILEVER RECONSTRUCTION



New Rebar Cage in Place for Cantilever Pour

46

9/3/20XX

PIER CAP CANTILEVER RECONSTRUCTION



Concrete pour completed and new cantilever tarped to let it cure

PIER CAP CANTILEVER RECONSTRUCTION



Before



After

ABUTMENT REPAIR

Concrete Repair

Concrete Patching of spalled areas (Referenced by **Repair Types PC1, PC2 & PC3**)

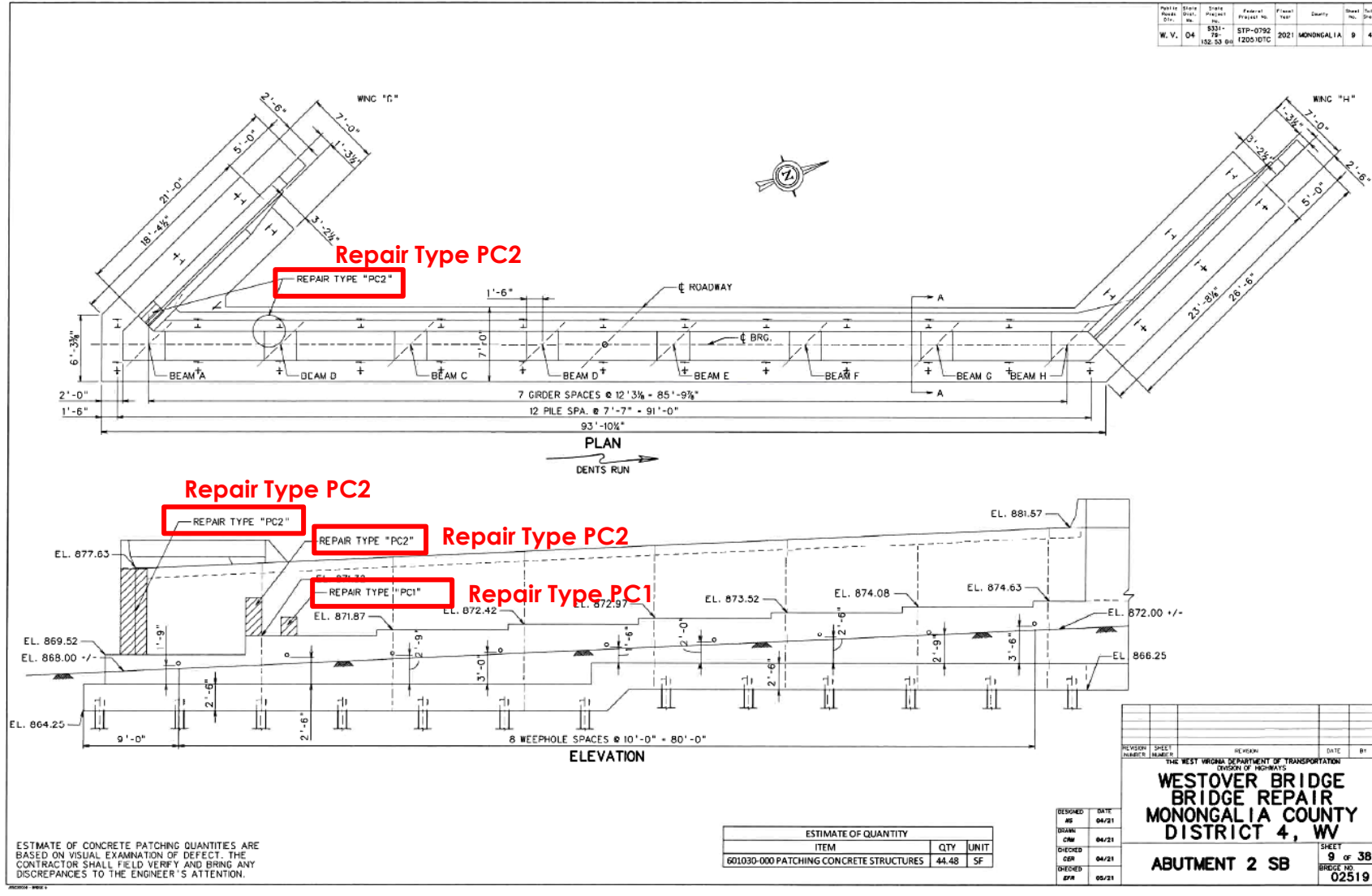
- 1) Removal of all unsound concrete
- 2) Application of a cementitious bonding agent (Material Specs are given in SP 601)
- 3) Application of Rapid Set Cementitious Patching (Material Specs in SP 601)

Repair Types –

PC1 – Surface Spalls with no exposed rebars (Mild Defect)

PC2 – Spalls with exposed rebars (Moderate Defect)

PC3 – Large or full depth spalls with exposed rebars (Severe Defect)

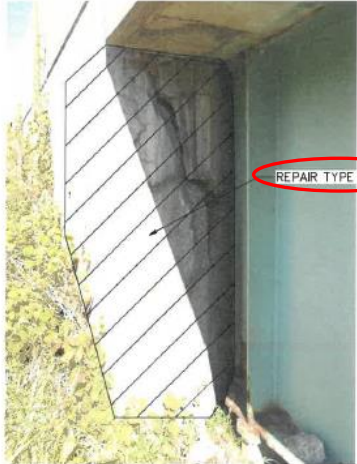


SB Abutment 2

49
9/3/20XX

ABUTMENT REPAIR

Public Works Div.	State Dist. No.	Date Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	04	5211-79-182.52	STP-0752 (2005)OTC	2021	MONONGALIA	10	43



Repair Type PC2



Repair Type PC2

ABUTMENT 2 SB (SOUTHWEST CORNER OR UPSTREAM END)

ABUTMENT 2 SB (SOUTHWEST CORNER OR UPSTREAM END)

ABUTMENT REPAIR NOTES:

ALL FOUR ABUTMENTS HAVE VERTICAL CRACKS OF VARYING SIZES AND SCATTERED MAP CRACKING THE BREASTWALL AND BACKWALL, MOST OF WHICH ARE LOCATED AT THE WEEP DRAINS. IN ADDITION, THE SOUTHWEST CORNER (OR UPSTREAM END) OF ABUTMENT 2 (SB) HAS MASSIVE SPALL AND DELAMINATION SURROUNDED BY WIDE CRACKS. EXCESS CONSTRUCTION MATERIAL AND DEBRIS ARE FOUND ON THE BRIDGE SEATS.

SPALLS, DELAMINATIONS, AND WIDE CRACKS LEADING TO CHUNKS OF CONCRETE SEPARATING SHALL BE REPAIRED BY CONCRETE REPAIR TYPES PC1 & PC2 DEPENDING ON THE NATURE OF THE DEFECT. (SEE CONCRETE REPAIR DETAIL AND REPAIR PROCEDURE FOR REPAIR TYPES LISTED). CONCRETE PATCHING MATERIAL SHALL CONFORM TO SPECIAL PROVISION 601, RAPID SET CEMENTITIOUS PATCHING.

ALL CRACKS 0.03 INCHES IN WIDTH OR GREATER IN ABUTMENT 1 & 2 (SB & NB) SHALL BE SEALED IN ACCORDANCE WITH SPECIAL PROVISION SECTION 601, CONCRETE CRACK SEALING. THE CRACK SEALING MATERIAL SHALL BE ROADWARE 10 MINUTE CONCRETE MENDER.

AFTER ALL CONCRETE PATCHWORK REPAIR AND CRACK SEALING IS COMPLETED AND THE MATERIALS CURED, THE EXPOSED SURFACES OF THE ABUTMENTS SHALL BE CLEANED THOROUGHLY. EXCESS CONSTRUCTION MATERIAL, DEBRIS, DEICING SALTS ACCUMULATED ON THE BRIDGE SEAT SHALL BE PRESSURE WASHED THOROUGHLY. AFTER THE CLEANING OPERATION IS DONE, THE EXPOSED SURFACES OF THE ABUTMENTS SHALL RECEIVE AN APPLICATION OF CRYSTALLINE PENETRATING SEALER, IN ACCORDANCE WITH SECTION 711, PAINTS, COATINGS, OILS AND INKS CONCRETE SEALER.

PAYMENT FOR CONCRETE PATCH REPAIR, CONCRETE CRACK SEALING AND THE APPLICATION OF CRYSTALLINE PENETRATING SEALER SHALL BE COVERED UNDER BID ITEM 601030-000, PATCHING CONCRETE STRUCTURES.

Repair Type PC2



ABUTMENT 2 BACKWALL (at BEAM B) SB STRUCTURE

DESIGNED	DATE	<p>THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS</p> <p>WESTOVER BRIDGE BRIDGE REPAIR MONONGALIA COUNTY DISTRICT 4, WV</p> <p>ABUTMENT REPAIR</p>	<p>SHEET 10 of 38 BRIDGE NO. 02519</p>
DRAWN	04/21		
CHECKED	04/21		
APPROVED	05/21		
DATE			

ABUTMENT REPAIR

SPECIAL PROVISIONS 601

→ Concrete Crack Sealing

Work consists of thoroughly cleaning out all cracks greater than .03 inches and injecting a Concrete Crack Sealing Material, also known as **Roadware 10 Minute Mender**, into these cracks.

Repair Type: CS

May 20, 2021

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT: S331-79-152.52 00
FEDERAL PROJECT: STP-0792 (205) DTC

FOR

SECTION 601
CONCRETE CRACK SEALING

601.1 – DESCRIPTION:

ADD THE FOLLOWING SECTION

601.1.1 Concrete Crack Sealer: The work shall consist of cleaning all cracks and furnishing and placing a Concrete Crack Sealing Material at the locations indicated on the plans and any other location designated by the Engineer. The construction shall be in accordance with this Specification and in reasonably close conformity with the Plans or as established by the Engineer.

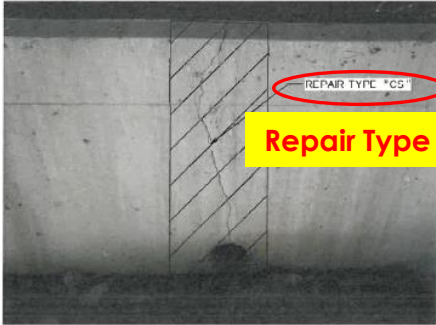
601.2 – MATERIALS:

ADD THE FOLLOWING SECTIONS

601.2.1 – CONCRETE CRACK SEALING MATERIAL:

601.2.1.1: Concrete Crack Sealing Material shall be a high penetration two part hybrid urethane material that combines with sand to form a tough instant polymer concrete. This crack sealing material is also known as Roadware 10 Minute Concrete Mender and manufactured by Roadware Incorporated. This material shall be capable of sealing vertical or horizontal cracks. Material shall have an extremely low viscosity and properties that allow deep penetration into concrete, not shrink on cure and be resistant to chemical attack.

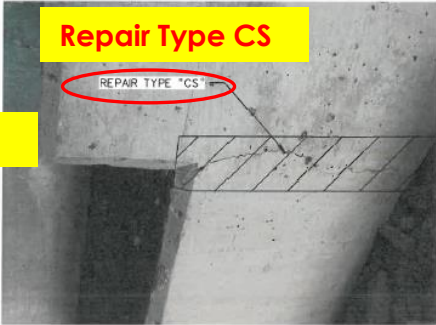
Public Road Dist. No.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V. 04	531-79-152.52 00	STP-0792 (205) DTC		2021	MONONGALIA	11	43



Repair Type CS

REPAIR TYPE "CS"


ABUTMENT 2 - NB (TYP.)



Repair Type CS

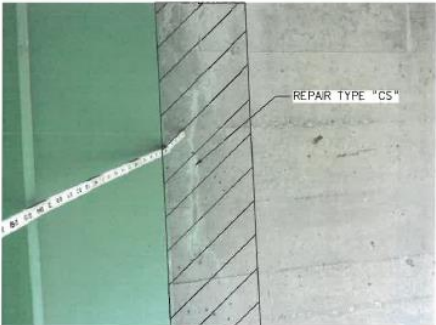
REPAIR TYPE "CS"

ABUTMENT 2 - NB (TYP.)



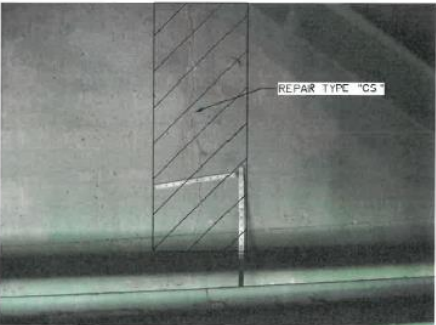
REPAIR TYPE "CS"

HAIRLINE MAP CRACKING IN ABUT. 1 BREASTWALL (SB STRUCTURE)




REPAIR TYPE "CS"

HAIRLINE CRACKING IN ABUT. 1 BACKWALL (SB STRUCTURE)



REPAIR TYPE "CS"

HAIRLINE MAP CRACKING IN ABUT. 1 BREASTWALL (SB STRUCTURE)



REPAIR TYPE "CS"

VERTICAL CRACKING IN ABUT. 2 BREASTWALL (SB STRUCTURE)

REPAIR TYPE "CS" - CONCRETE CRACK SEALING

PROCEDURE:

THIS REPAIR TYPE SHALL BE USED TO SEAL CRACKS IN THE ABUTMENT BREASTWALL AND BACKWALL. IN THE STATED LOCATIONS DESIGNATED AS REPAIR TYPE "CS" THE CONTRACTOR SHALL:

1. IDENTIFY CRACKS 0.03 INCHES IN WIDTH OR GREATER TO BE SEALED INDIVIDUALLY WITH LOW VISCOSITY HIGH PENETRATION CONCRETE CRACK SEALING MATERIAL IN ACCORDANCE WITH SPECIAL PROVISION 601, CONCRETE CRACK SEALING.
2. AFTER CRACKS HAVE BEEN IDENTIFIED FOR INDIVIDUAL SEALING, CLEAN THE CRACKS, FURNISH AND PLACE CRACK SEALING MATERIAL, ALSO KNOWN AS ROADWARE 10 MINUTE CONCRETE MENDER.
3. ONCE ALL INDIVIDUAL CRACKS 0.03 INCHES OR GREATER IN WIDTH HAVE BEEN SEALED AND THE SEALING MATERIAL CURED, THE ENTIRE ABUTMENT FRONT FACE SHALL RECEIVE AN APPLICATION OF A CRYSTALLINE PENETRATING SEALER MEETING THE SPECIFICATIONS IN SECTION 711; PAINTS, COATINGS, OILS AND INKS-CONCRETE SEALER, CLEANING AND SURFACE PREPARATION PRIOR TO THE APPLICATION OF THE CONCRETE SEALER SHALL BE IN ACCORDANCE WITH THAT SECTION. AT A MINIMUM, THE SURFACE TO RECEIVE APPLICATION OF THE SEALER SHALL BE THOROUGHLY CLEANED FREE OF DUST, DIRT, LAITANCE, OILS, WAX AND OTHER FOREIGN MATTER.

VERTICAL CRACKING IN ABUT. 2 BREASTWALL (SB STRUCTURE)

DESIGNED BY	DATE	REVISION NO.	REVISION	DATE	BY	
OW	04/21					
CHECKED BY	DATE	THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS WESTOVER BRIDGE BRIDGE REPAIR MONONGALIA COUNTY DISTRICT 4, WV				
OW	04/21					
APPROVED BY	DATE	SHEET	11 of 38			
		BRIDGE NO.	02519			

Example Plan Sheet with Photos of defects and Repair call-outs.

ABUTMENT REPAIR CONCRETE PATCHING



Forming up and applying Rapid Set
Cementitious Patching Mix

ABUTMENT REPAIR



Before



After

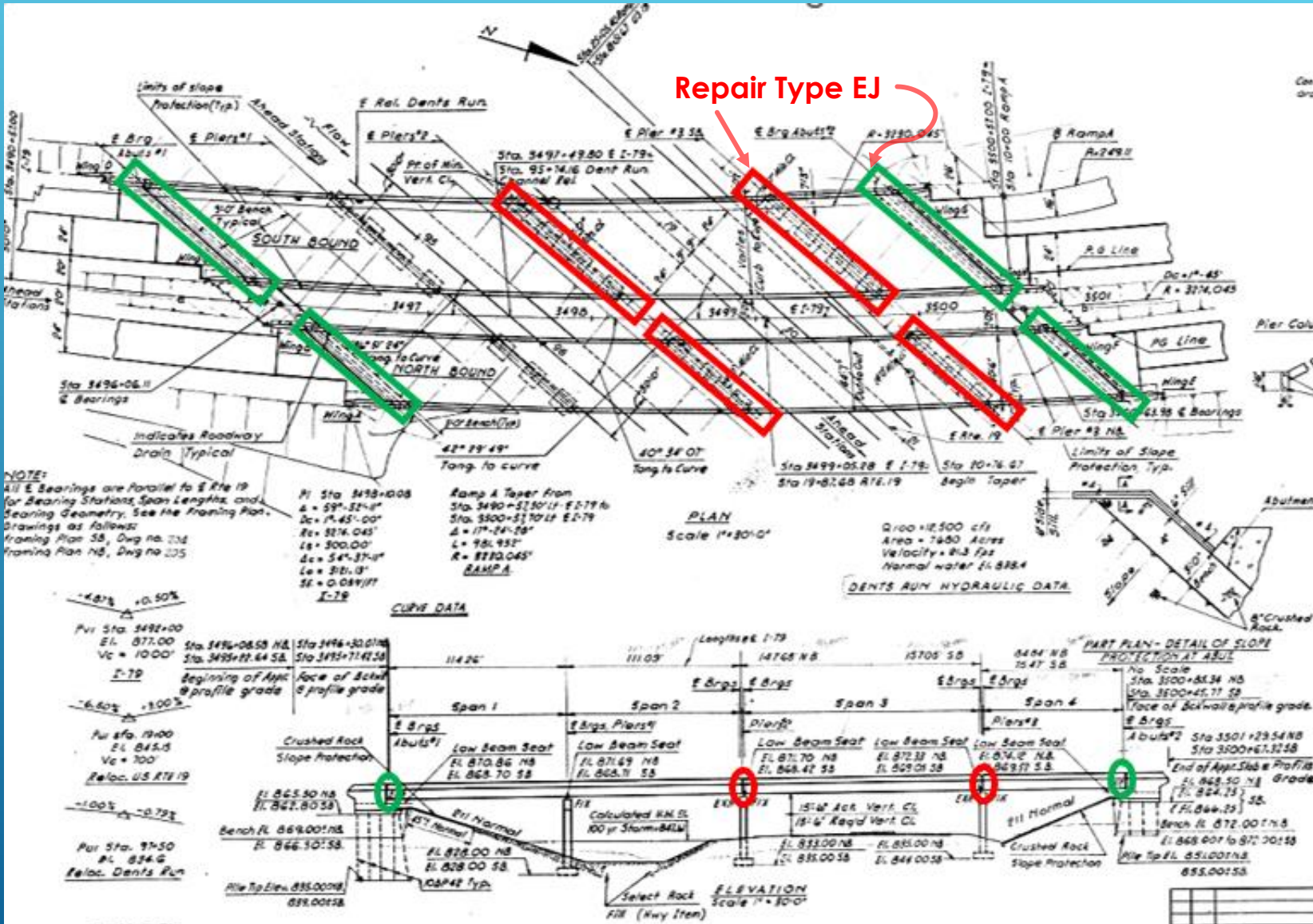


Before



After

STRIP SEAL EXPANSION JOINT REPLACEMENT



Expansion Joint Replacement

Work involves replacing all strip seal joints in the deck (Referenced by **Repair Type EJ**)

- 1) Remove existing deck, parapet and abutment backwall to the limits shown on the plans
- 2) Remove existing expansion joint in its entirety
- 3) Reset rocker bearings.
- 4) Install new strip seal expansion joint assembly
- 5) Cast adjacent deck and abutment backwall sections to original dimension in accordance with SP 627.

A total of 8 expansion joints were replaced. That amounted to 620 LF of expansion joints.

STRIP SEAL EXPANSION JOINT REPLACEMENT

May 20, 2021

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SPECIAL PROVISION

FOR
STATE PROJECT NUMBER: S331-79-152.52 00
FEDERAL PROJECT NUMBER: STP-0792(205)DTC

FOR
SECTION 627
STRIP SEAL EXPANSION JOINT ASSEMBLY

627.1 – DESCRIPTION:

The work shall consist of removing the existing expansion joint assembly, and/or of furnishing and placing Modified Class K Concrete and a new strip seal assembly at the locations indicated on the plans. The construction shall be in accordance with this Specification and in reasonably close conformity with the Plans or as established by the Engineer.

627.2 – MATERIALS:

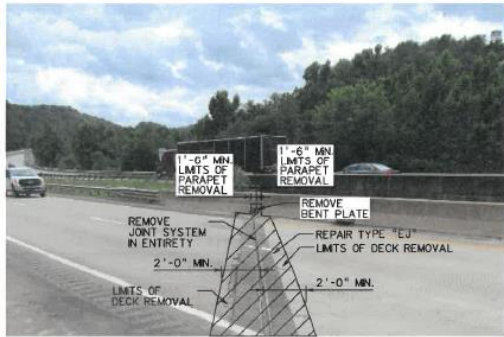
627.2.1 - Strip Seal Gland: The strip seals shall not be any part of the load bearing riding surface and shall be recessed below the normal riding surface throughout the normal limits of joint movement. They shall have a shape, which promotes self-removal of foreign material during normal joint operation. Special conditions such as doglegs, tees, and crosses shall be shop fabricated in a mold under heat and pressure.

The strip seals glands shall meet the material requirements of Section 708.2 of the Specifications.

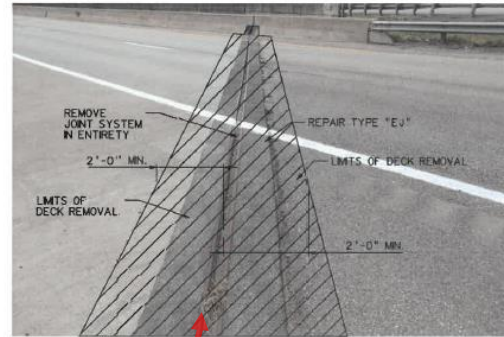
627.2.2 - Steel Products: All steel components of the strip seal assembly shall meet AASHTO Designation M270 and the requirements of Section 615 of the Specifications unless otherwise noted herein or in the plans.

The steel retainers shall have a shape suitable to mechanically lock the sealing element in place to form a watertight seal throughout the normal movement cycle. The steel retainers shall allow the sealing element to be replaced from the bridge deck surface without removal of the retainers.

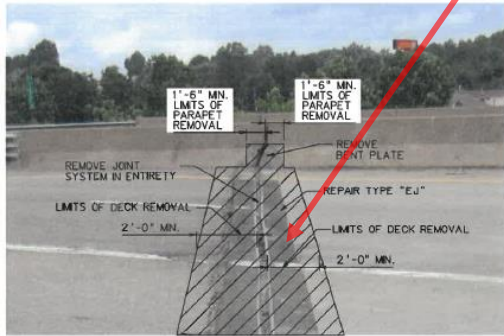
Public	State	State	Federal	Fiscal	County	Sheet	Total
W. V.	04	S331-79-152.52 00	STP-0792(205)DTC	2021	MONONGALIA	33	43



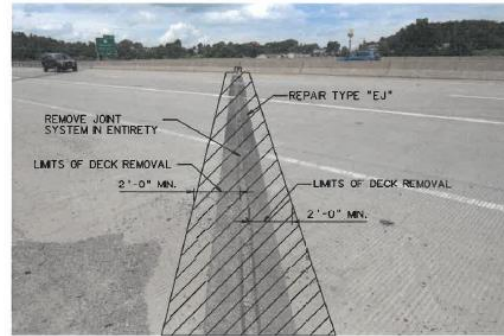
OVERALL VIEW OF EXPANSION JOINT ABUTMENT NO. 1 NORTHBOUND



OVERALL VIEW OF EXPANSION JOINT ABUTMENT NO. 2 NORTHBOUND



OVERALL VIEW OF EXPANSION JOINT ABUTMENT NO. 1 SOUTHBOUND



OVERALL VIEW OF EXPANSION JOINT PIER 3 SOUTHBOUND

Repair Type EJ

DESIGNED	DATE	BY
OPW	04/21	
CHECKED	DATE	BY
OPW	04/21	
APPROVED	DATE	BY
OPW	04/21	

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
**WESTOVER BRIDGE
BRIDGE REPAIR
MONONGALIA COUNTY
DISTRICT 4, WV**
**DECK EXPANSION
JOINT REPAIR**

SHEET	33	OF	38
BRIDGE NO.	02519		

STRIP SEAL EXPANSION JOINT REPLACEMENT

REPAIR TYPE "EJ" DECK EXPANSION JOINT AT ABUTS. 1 & 2 (NB & SB)

REPAIR TYPE "EJ" DECK EXPANSION JOINT AT PIERS 2 & 3 (NB & SB)

Public Work Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V. 04	R331-79 (182.02.01)	STP-0798 (2051DTC)	2021	MONONGALIA	35	43

EXPANSION JOINT ANCHOR DETAIL

EXPANSION JOINT REPLACEMENT DETAIL

Location	Length of Strip Seal Expansion Joint (LF)
Abutment 1 NB	66
Pier 2 NB	66
Pier 3 NB	66
Abutment 2 NB	66
Abutment 1 SB	89
Pier 2 SB	89
Pier 3 SB	89
Abutment 2 SB	89
TOTAL	620

NOTES:

THE NEW STRIP SEAL ASSEMBLY SHALL ALLOW FOR 2 INCHES OF POTENTIAL MOVEMENT AT EACH ABUTMENT.

THE DECK SHALL BE SAWCUT AT LIMITS OF REMOVAL SHOWN ON THE DECK. ALL CONCRETE USED TO RECAST DECK AND ABUTMENT SECTIONS SHALL BE MODIFIED CLASS K CONCRETE AS PER SPECIAL PROVISION 627 AND SHALL BE INCIDENTAL TO ITEM 627016-001, REMOVE AND REBUILD EXPANSION JOINT.

ANY MODIFICATIONS TO THE BARRIER TO ACCOMMODATE AND/OR PLACE THE PROPOSED EXPANSION DEVICE SHALL BE INCIDENTAL TO ITEM 627016-001, REMOVE AND REBUILD EXPANSION JOINT.

ALL EXPANSION DAM STEEL SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M318. WEATHERING STEEL SHALL NOT BE PERMITTED. THE APPLICATION OF GALVANIZING SHALL BE 2 OUNCES PER SQUARE FOOT OF SURFACE IN AREAS WHERE FIELD WELDING IS REQUIRED DUE TO SPLICING. GALVANIZING SHALL BE REMOVED PRIOR TO WELDING AND REAPPLIED AT THE SAME PREVIOUS THICKNESS.

ONE #5 EPOXY COATED REBAR SHALL BE PLACED THROUGH EACH HOLE IN THE ANCHOR PLATE ON BOTH THE DECK AND ABUTMENT BACKWALL. THIS WORK SHALL BE INCIDENTAL TO ITEM 627016-001, REMOVE AND REBUILD EXPANSION JOINT.

COST OF MATERIAL AND ALL WORK RELATED TO REMOVAL AND REBUILDING EXPANSION JOINT SHALL BE INCIDENTAL TO ITEM 627016-001, REMOVE AND REBUILD EXPANSION JOINT.

DESIGNED	DATE
MS	04/21
DRAWN	
CW	04/21
CHECKED	
GR	04/21
APPROVED	
EF	05/21

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

**WESTOVER BRIDGE
BRIDGE REPAIR
MONONGALIA COUNTY
DISTRICT 4, WV**

**DECK EXPANSION
JOINT REPAIR**

SHEET **35** OF **38**
PROJECT NO. **02519**

Strip Seal Expansion Joint Detail

STRIP SEAL EXPANSION JOINT REPLACEMENT



Before



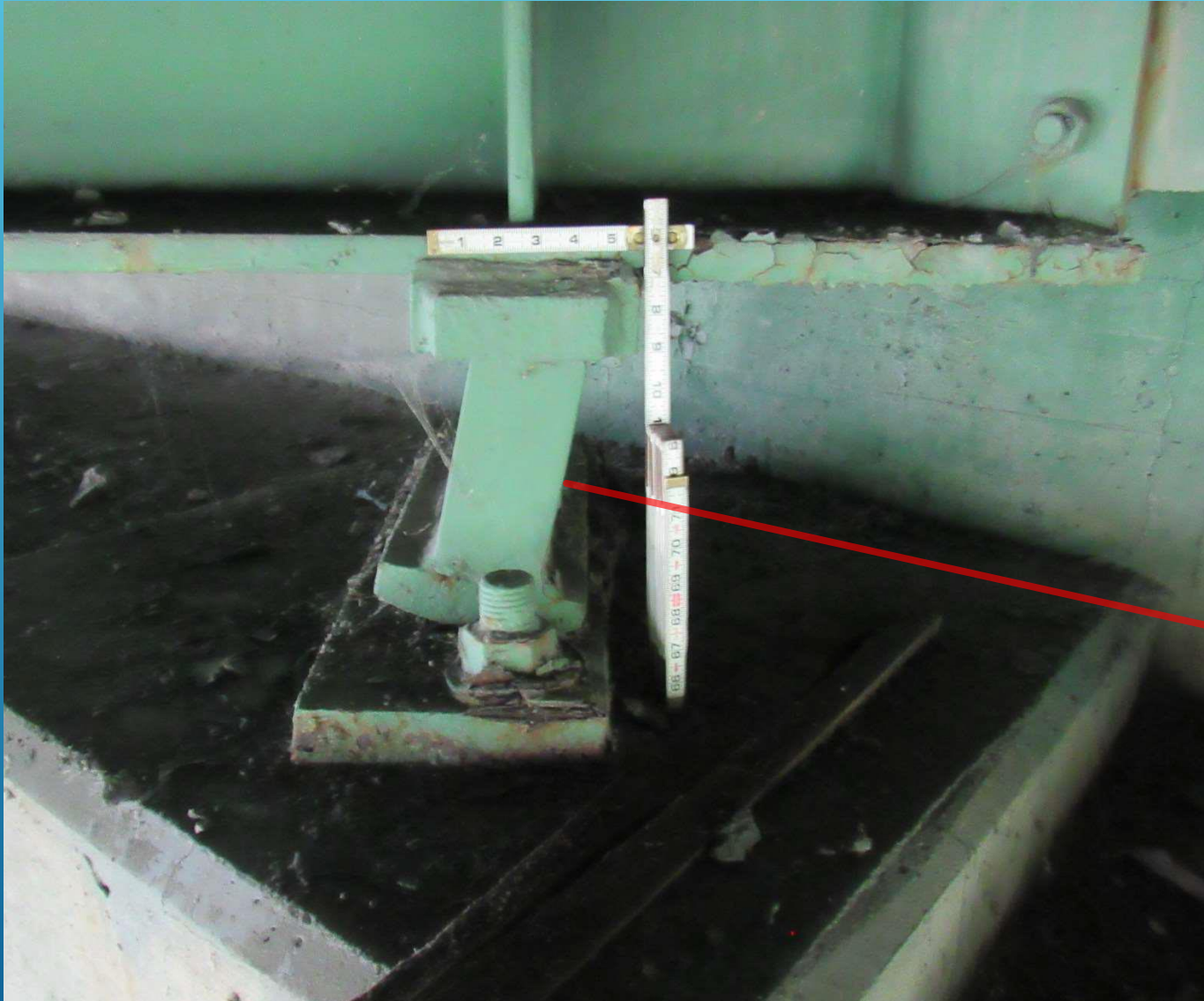
Pier



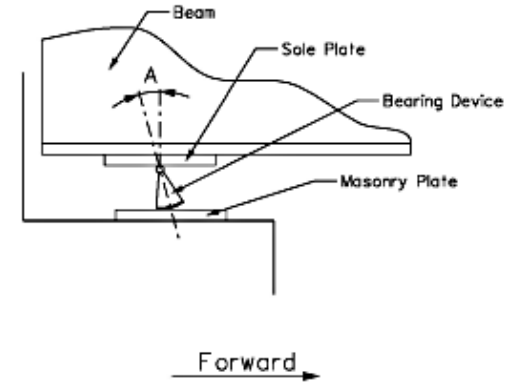
Abutment

After

ROCKER BEARING RESET



Rocker Bearing



Year	2015	2017	2019			
Air Temp						
Steel Temp	85°	82°	76°			
	Angle	Angle	Angle	Angle	Angle	Angle
Beam 1	+ 4.4°	+ 5°	3.60°			
Beam 2	+ 4.8°	+ 5°	4.35°			
Beam 3	+ 5.1°	+ 5°	4.80°			
Beam 4	+ 6.5°	+ 8°	7.65°			
Beam 5	+ 7.7°	+ 9°	8.90°			
Beam 6	+ 10.9°	+ 11°	11.40°			
Beam 7	+ 11.2°	+ 11°	11.90°			
Beam 8	+ 12.8°	+ 14°	13.85°			

(+) Movement: Expanded Position

(-) Movement: Contracted Position

Note: Degree of tilt obtained using a digital protractor.

Bearing Position at Abutment 1

Rocker Bearing Tilt in Abutment 1

CLEANING AND PAINTING

Cleaning and Painting

Work involves painting the girder bottom flanges in Span 3 (over US 19) and 5 ft sections at beam ends including all steel superstructure elements at the supports beneath the expansion joints. (Referenced by **Repair Type CP**)

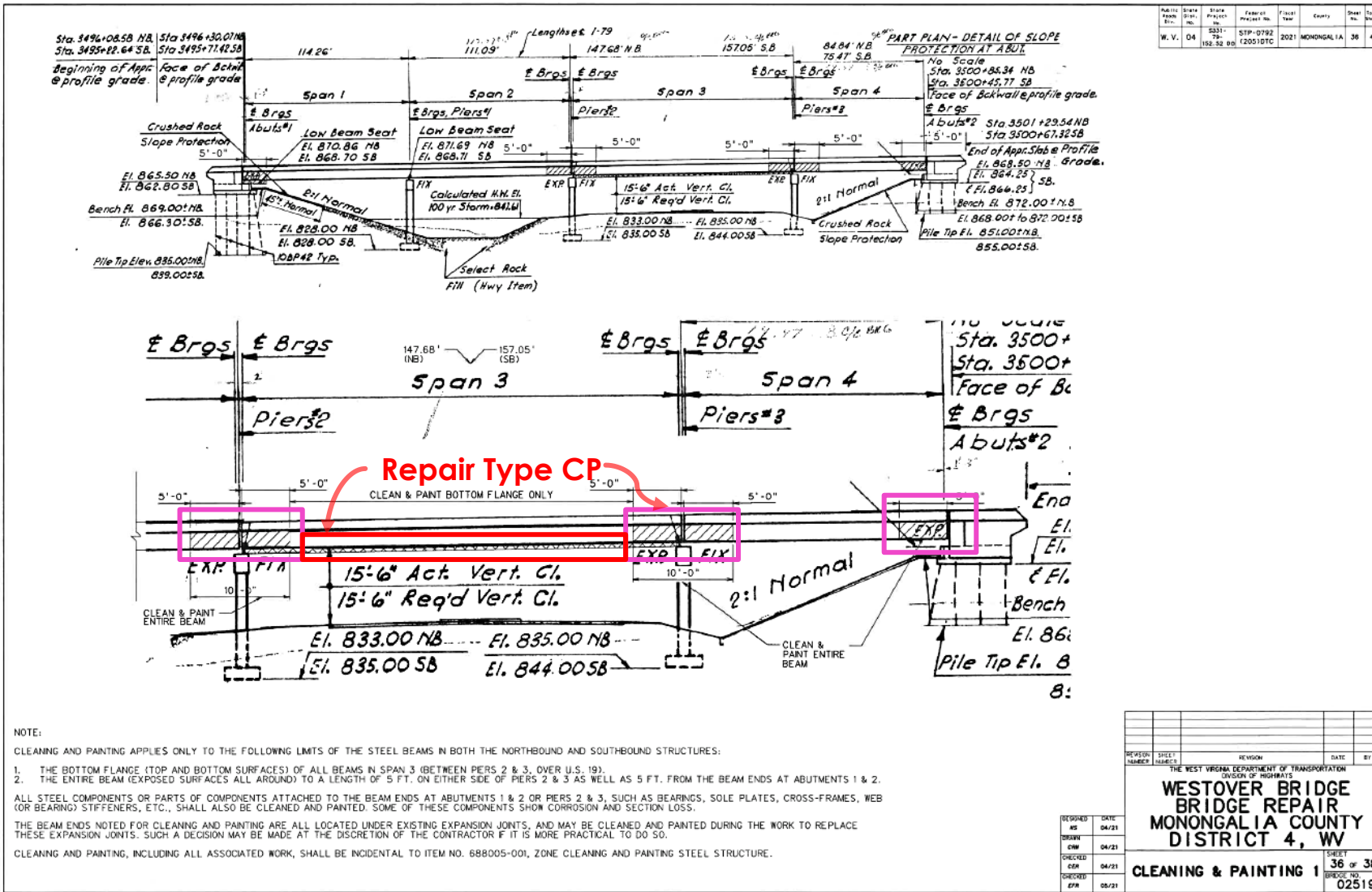
- 1) Provide proper containment for cleaning & painting operations
- 2) To the limits shown in the plans, thoroughly clean steel surfaces using power tools, hand tools & pressure washing.
- 3) Once completely dry, apply a two-coat paint system.

Bridge contained lead. Best lead containment practices were required to be followed by the contractor.

59

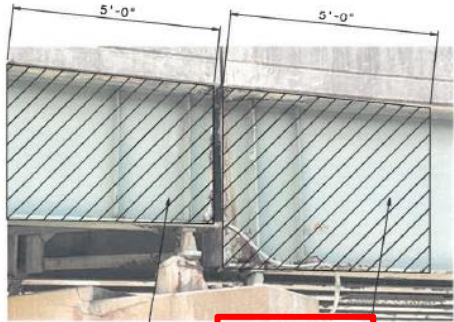
9/3/20XX

Span 3 over US 19 & 5 ft sections @ the supports

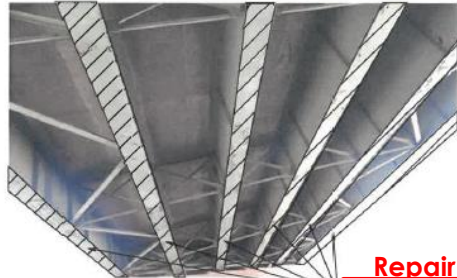


CLEANING AND PAINTING

Public Road Dist.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	04	8331-76-152.22.00	STP-0792 (20510)EC	2021	MONONGALIA	38	43



REPAIR TYPE "C&P" — REPAIR TYPE "C&P" — **Repair Type CP**
 LIMITS OF CLEANING AND PAINTING AT PIER LOCATION (TYP. @ PIER 2 & 3)



Repair Type CP
 REPAIR TYPE "C&P"
 BOTTOM FLANGE CLEANING AND PAINTING IN SPAN 3 (BETWEEN PIERS 2 & 3 OVER U.S. 19, TYP.)



REPAIR TYPE "C&P" — **Repair Type CP**
 CLEANING AND PAINTING LIMITS



Repair Type CP
 REPAIR TYPE "C&P"
 CLEANING AND PAINTING NEAR PIER 2 NB

DESIGNED BY	DATE	CHECKED BY	DATE
AT	04/21	OW	04/21
OW	04/21	OW	04/21
OW	04/21	OW	04/21
OW	04/21	OW	04/21

REVISION	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
 DIVISION OF HIGHWAYS
**WESTOVER BRIDGE
 BRIDGE REPAIR
 MONONGALIA COUNTY
 DISTRICT 4, WV**

CLEANING & PAINTING 3 SHEET **38** OF **38**
 BRIDGE NO. **02519**

CLEANING AND PAINTING



Work in Progress

- Proper Lead containment procedures
 - Tarps
 - Drainage troughs or catchment basins
- Power tool cleaning and vacuuming or Pressure washing
- Epoxy Mastic Paint 9/3/20XX
- Safe disposal of runoff

CLEANING AND PAINTING



Before

After

CONCRETE PROTECTIVE COATING



Uncoated Repair Surface



Coated Repair Surface

- Two-fold purpose of Concrete Protective Coating –
- 1) Aesthetics
 - 2) Impervious Coating for the concrete unit

POST REPAIR



POST REPAIR



POST REPAIR



Presented

POST REPAIR



POST REPAIR



POST REPAIR



POST REPAIR PHOTOS



POST REPAIR (VIDEO)



POST REPAIR (VIDEO)



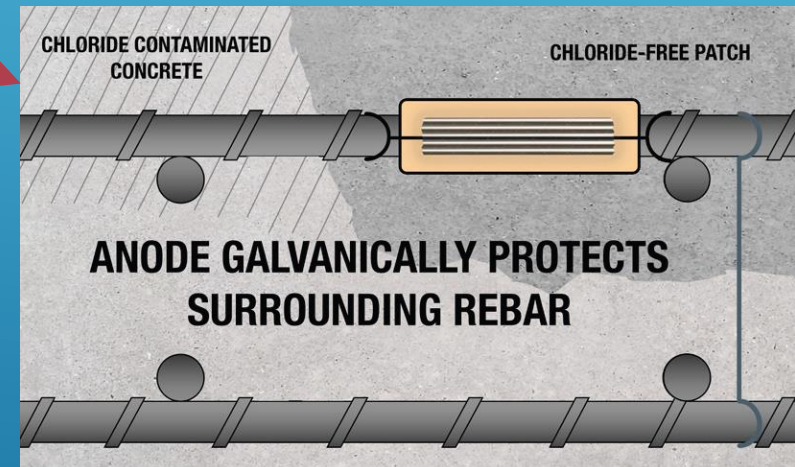
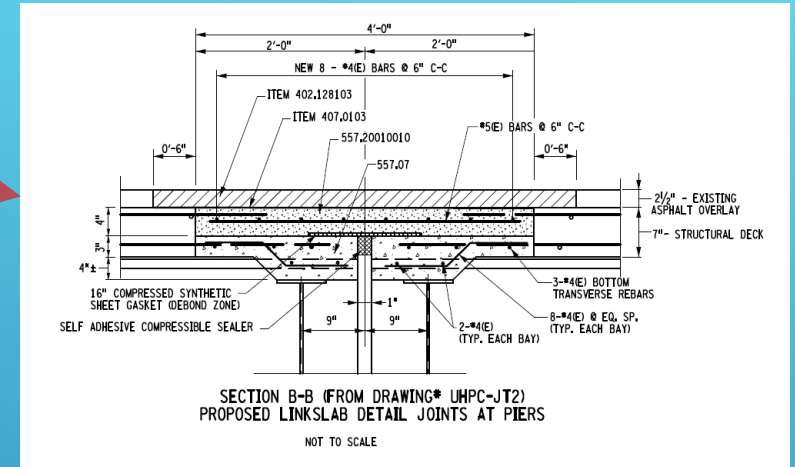
9/3/20XX

CONCLUSIONS AND LESSONS LEARNED

- Much of the problems associated with deterioration of bridge elements can be attributed to **poor drainage**.
- **Compressions Seals** and **Strip Seals** do **NOT** last forever
 - They have to be maintained during their working life span (on average 10-15 years)
 - Power washed to keep them clean and **free of dirt and debris**
 - Water tested intermittently for **leaks**. Leaking seals must be replaced immediately
- **For new Bridge design** (Small to mid span category - up to 600 ft)
 - **Use integral or semi-integral design**. They eliminate expansion joints.
 - **Avoid intermediate expansion devices**
- **Do Not ignore** Leaking Joints. They are a silent killer

FOR FUTURE CONSIDERATIONS

- Eliminate expansion joints with **Link Slabs**
 - Not implemented here due to ~
 - **Significantly increased cost**
 - **Maintenance of Traffic issues on a busy Interstate**
- Use of **Cathodic Protection** for Substructure units
 - Not implemented here due to ~
 - **Prohibitive cost.**
 - Working within a **limited budget**
- **Full Clean & Paint** of the Superstructure Steel
 - Not implemented because of ~
 - **A limited Budget.**



QUESTIONS?



Thank
you



Contact
Email: Nimal.Suhir@wv.gov