



US 84 Mississippi River Bridge

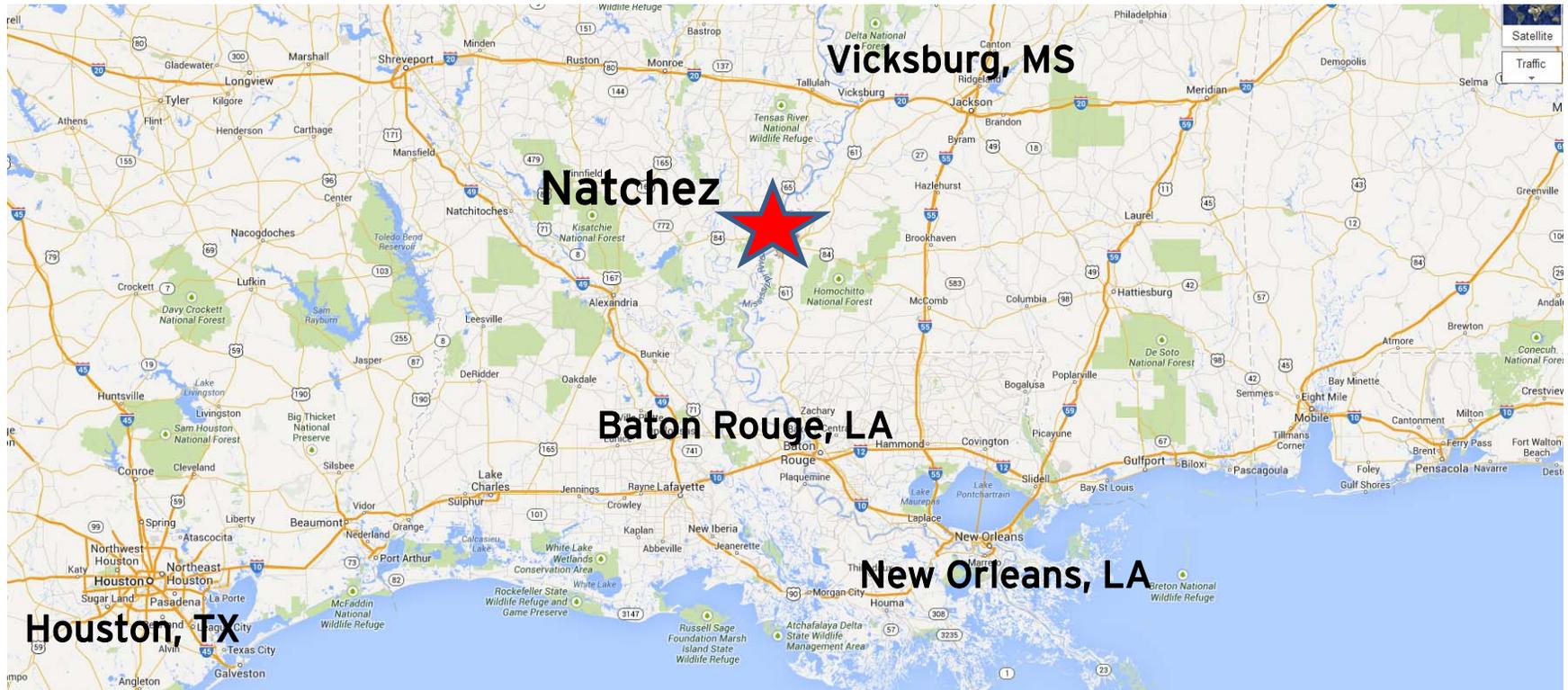
U29 And U49 Pin Rehabilitation

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HNTB

US 84 Mississippi River Bridge Pin And Link Replacement

Project Location



US 84 Mississippi River Bridge Pin And Link Replacement



Quick Facts

- WPA Project #1126
- Constructed 1940
- Built for: City of Natchez
- Total Cost
\$3,562,676.54
- Dravo Corp. – Sub.
- Bethlehem Steel – Sup.
- Toll removed 12 years after bridge opening (1952)
- Twin Bridge
Constructed in 1980's

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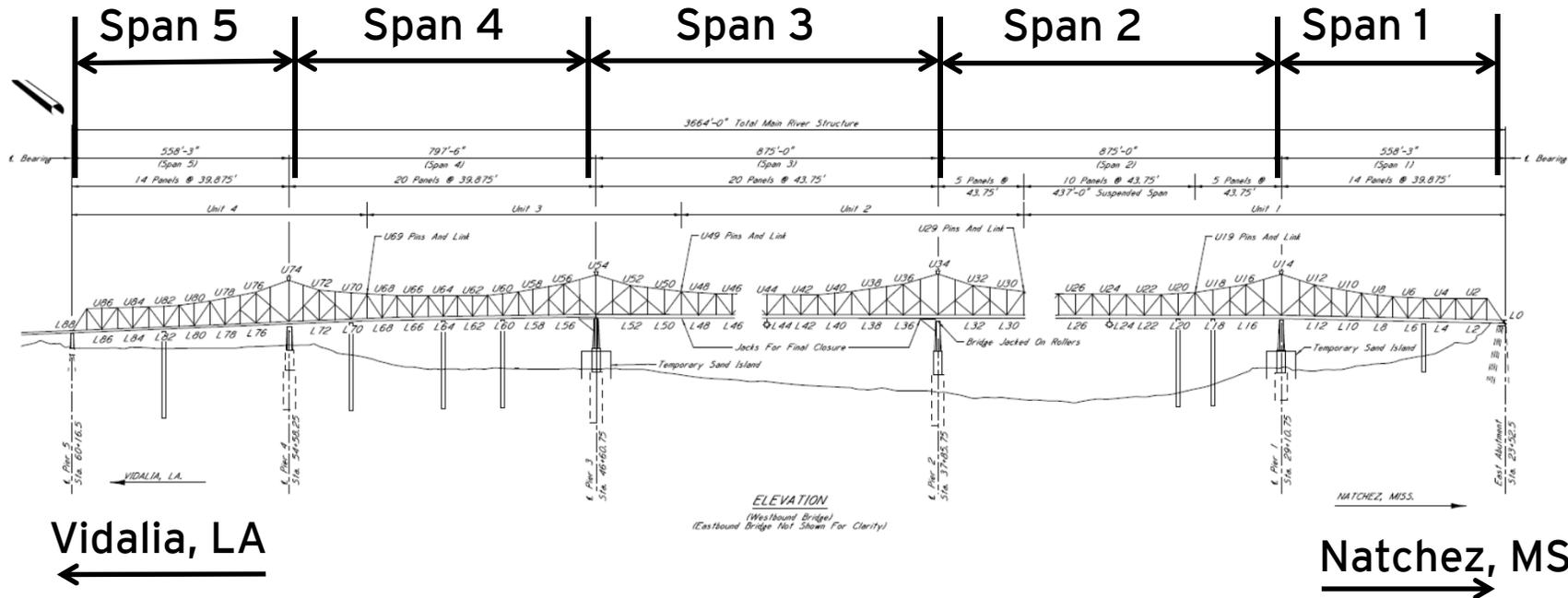


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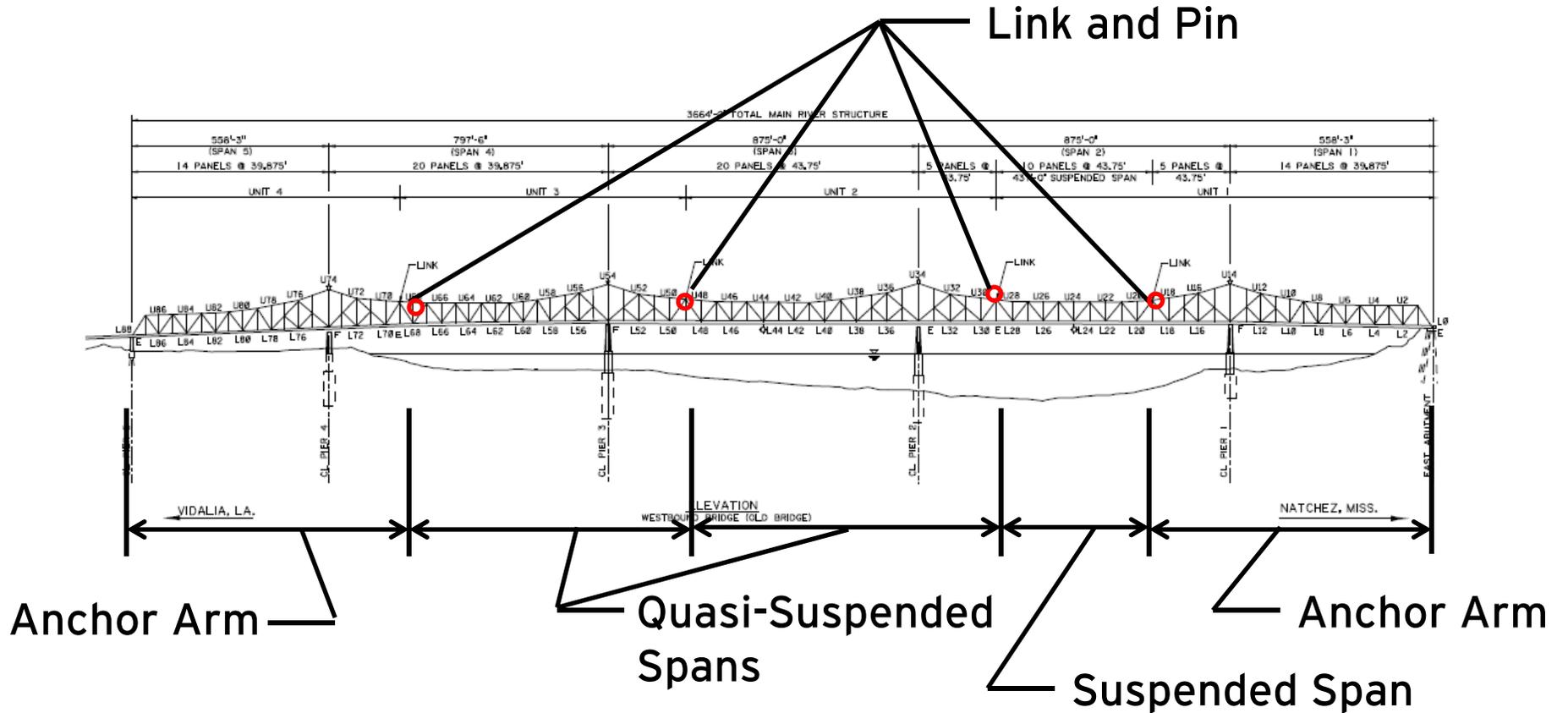
1940 Sequence Of Construction



- 5 Span truss bridge
- Main span (spans 2 & 3) = 875 ft
- Total length of truss = 3,664 ft

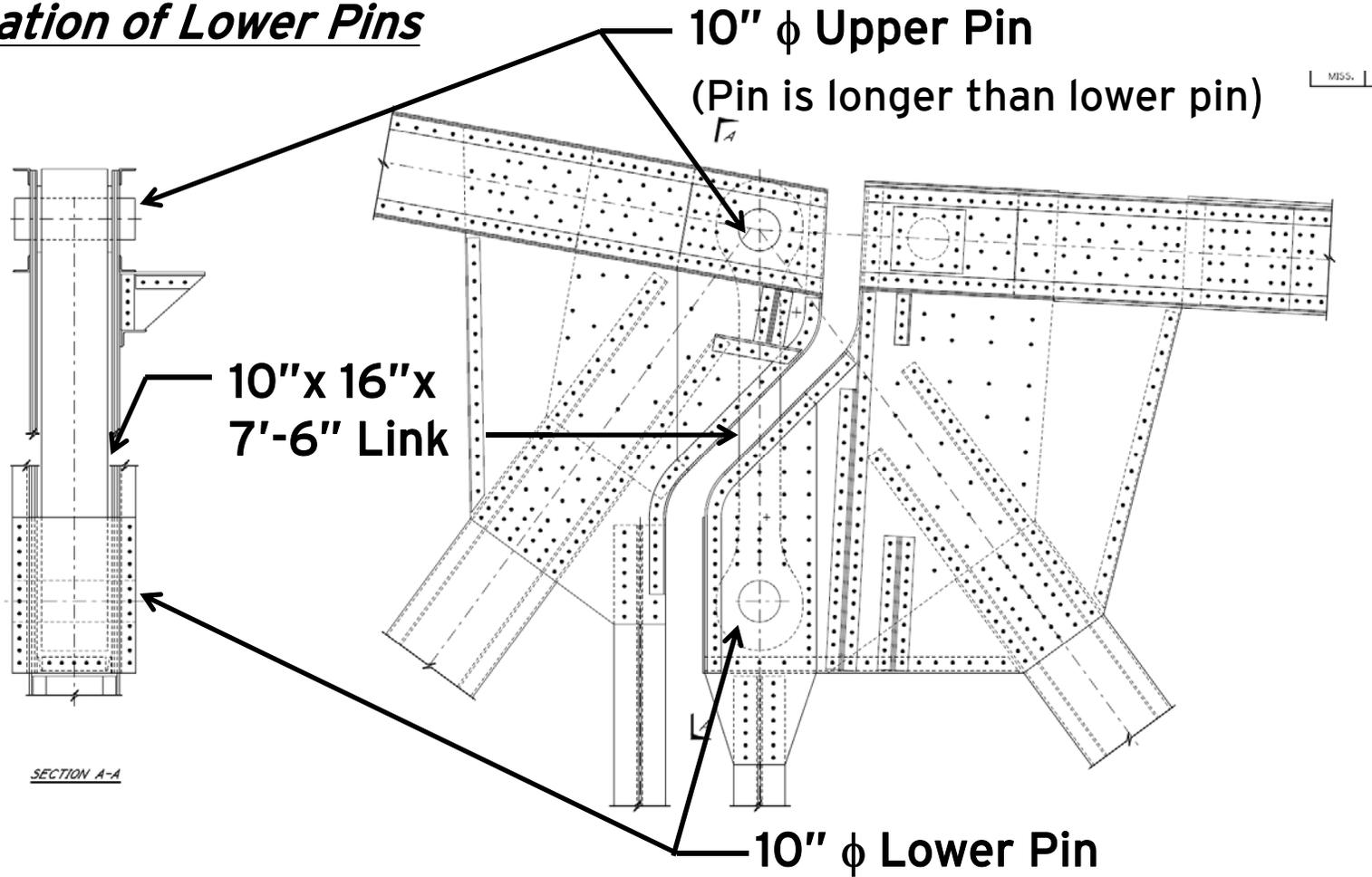
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Location of Pins



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Location of Lower Pins



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U49 Lower Pin

U49 Upper Pin



U49 Lower Pin

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U29 Lower Pin History (1995 - 2010)

- 1995 MDOT observed U29 Upstream Truss Lower Pin had shifted
 - Keeper that holds pin in place sheared off
 - Pin had rotated
 - Pin was close to flush with the gusset plates
- 1996 MDOT let a contract to reset U29 Lower Pin
 - Contractor was unsuccessful after 4 attempts
 - New Keeper installed and pin greased

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Lower Pin History

2010 In-Depth Inspection (HNTB)

- U29 Upstream Truss Lower Pin
 - Lower pin is flush with gusset
 - Welds between pin and gusset is broken
 - Pin is allowed to rotate about gusset
- U49 Downstream Truss Lower Pin
 - Keeper Sheared Off
 - U49 pin is flush with gussets.
 - Welds between pin and gusset broken
 - Pin is allowed to rotate about gusset

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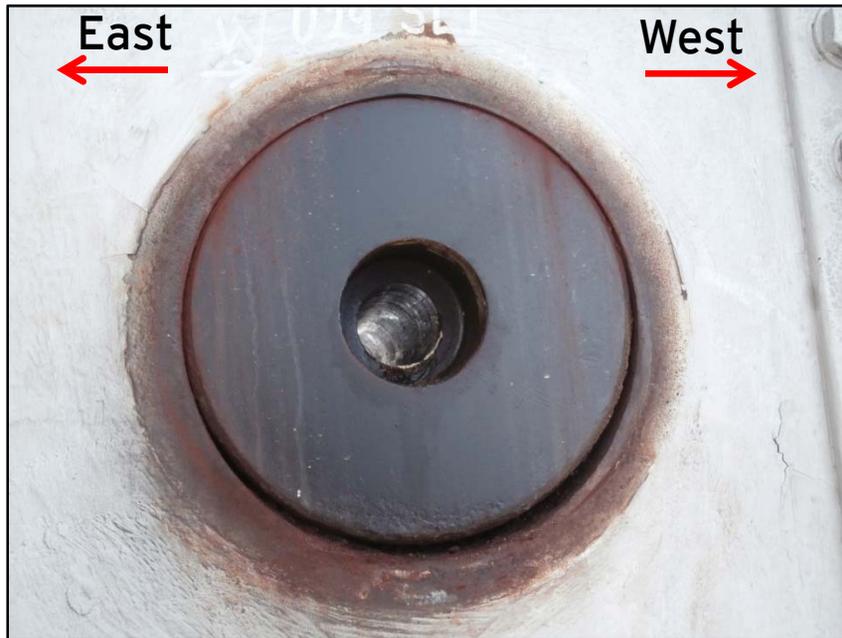
Lower Pin History

2010 In-Depth Inspection (HNTB)

- Ultrasonic Testing of Pins
 - Acoustic coupling observed between link and pin on both pins
 - Areas of high bearing
 - Pin is possibly frozen with link
 - Wear in gusset plates observed
 - Gap below lower pin observed
 - Finger joints are no longer flush
- Bulge in Gussets at Lower Pin observed (U49 and U29)

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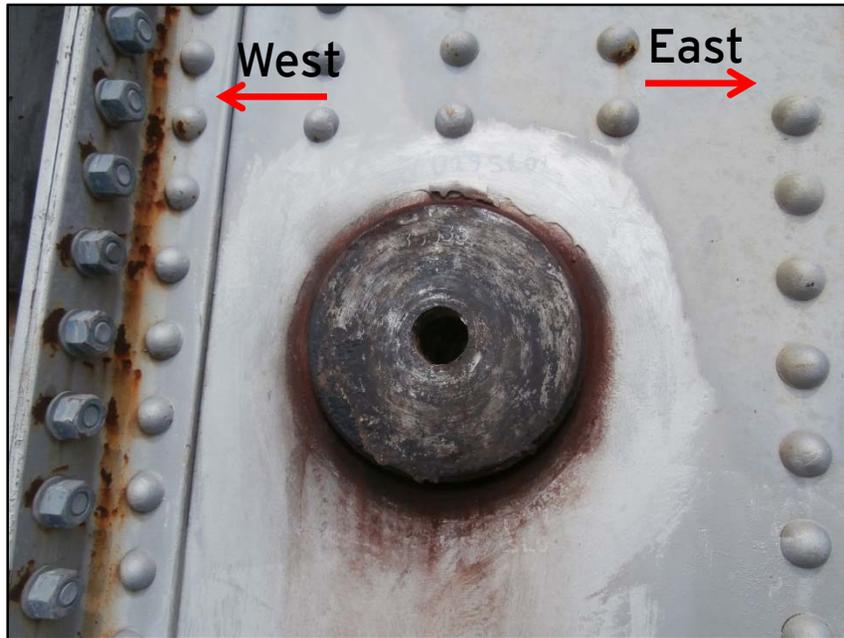
U29 Downstream Truss (Upstream Side)



1995	2010	2012
0.000" Rotated 2 ¾"	0.000"	-0.0625" (Ave.)

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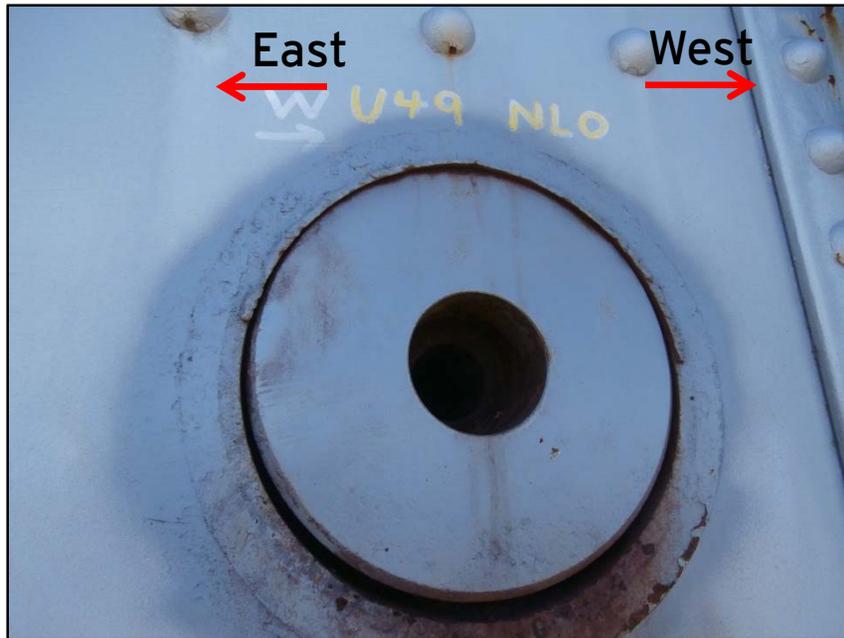
U29 Downstream Truss (Downstream Side)



1995	2010	2012
1.000" Rotated 2 3/4"	1.000"	1.0625" (Ave.)

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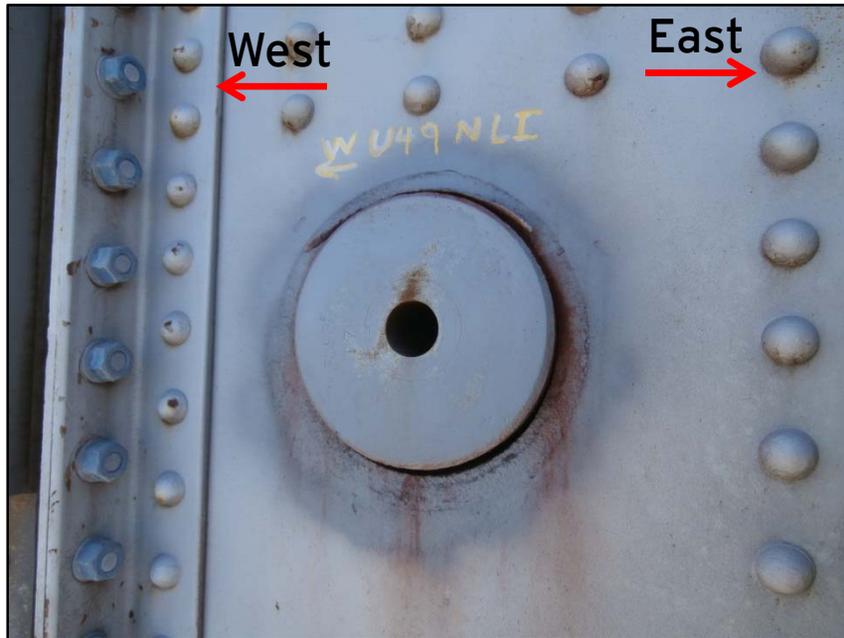
U49 Upstream Truss (Upstream Side)



1995	2010	2012
Not measured	0.0625"	0.028" (Ave.)

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U49 Upstream Truss (Downstream Side)



1995	2010	2012
Not measured	0.8125"	1.008" (Ave.)

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1996 U29 Pin Rehabilitation Project



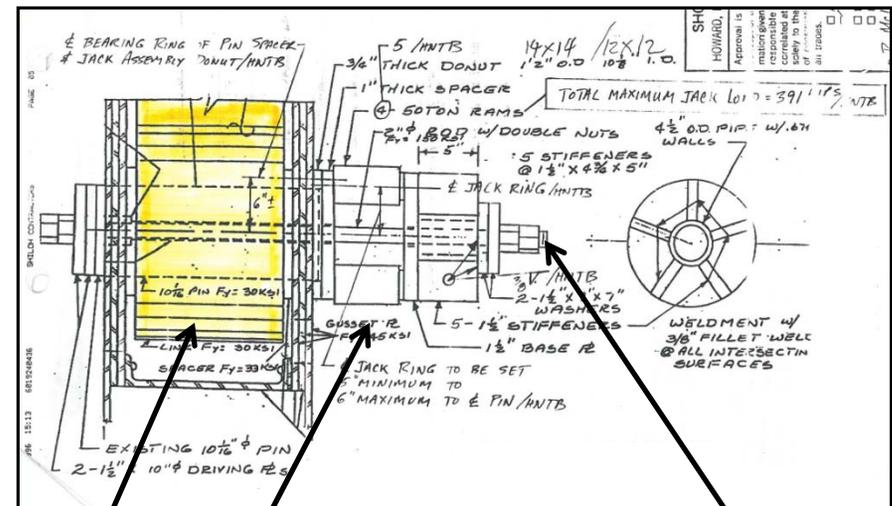
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1996 U29 Pin Rehabilitation Project (Contractor's Plan A)

- Installed 2" PT rod through the pin, placing jack compression blocks on the rod and jacking the pin with 4 jacks

Results

- Jacking assembly jacked to 6,100 psi
- 1st attempt, PT rods failed and landed in Mississippi River
- 2nd attempt, PT rods failed
- No horizontal movement in pin was noted



Pin Jacks PT Rod

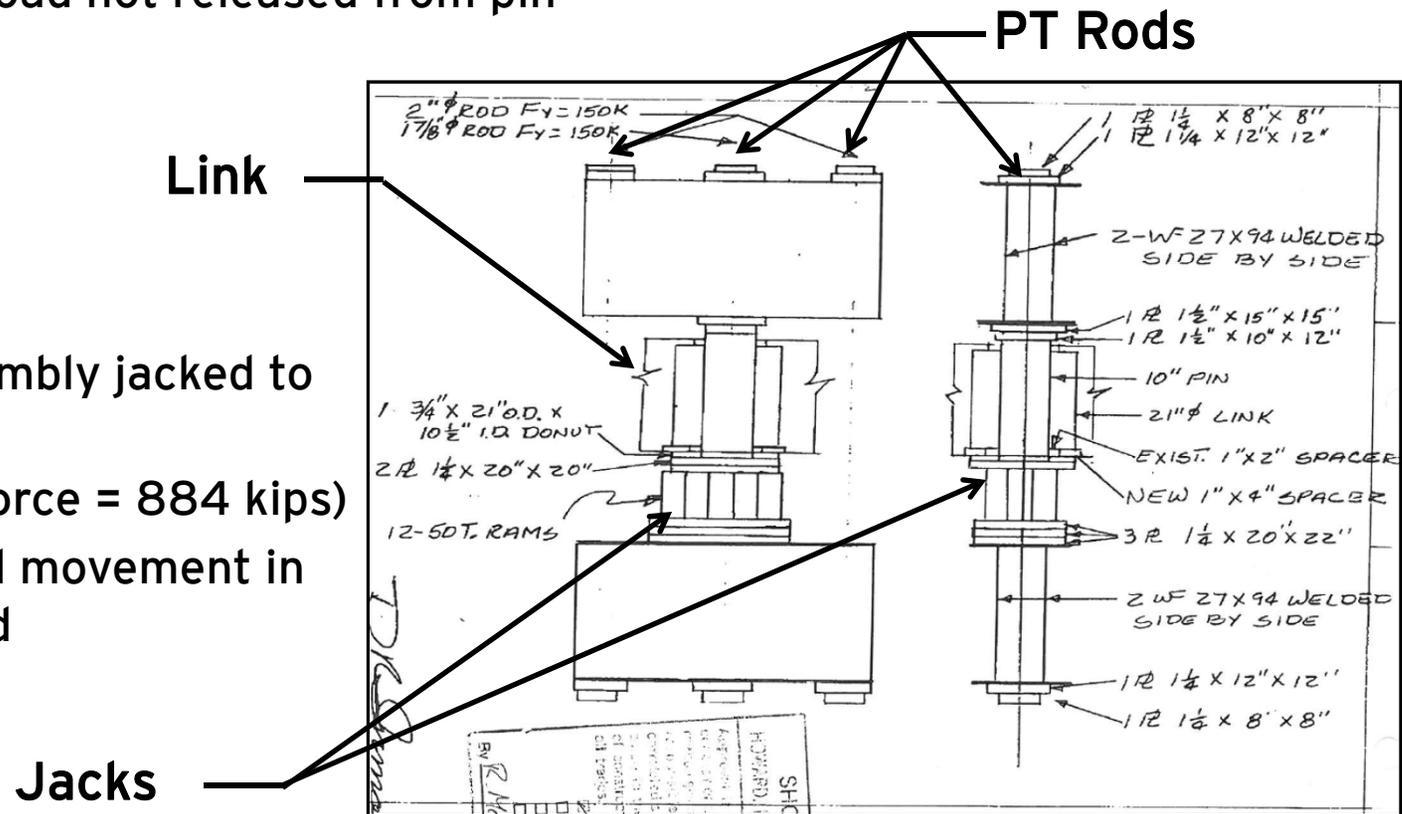
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1996 U29 Pin Rehabilitation Project (Contractor's Plan B)

- Increase jacking assembly to include 10 jack rams and 3 rods
 - Vertical load not released from pin

Results

- Jacking assembly jacked to 8,000 psi
- (Horizontal force = 884 kips)
- No horizontal movement in pin was noted



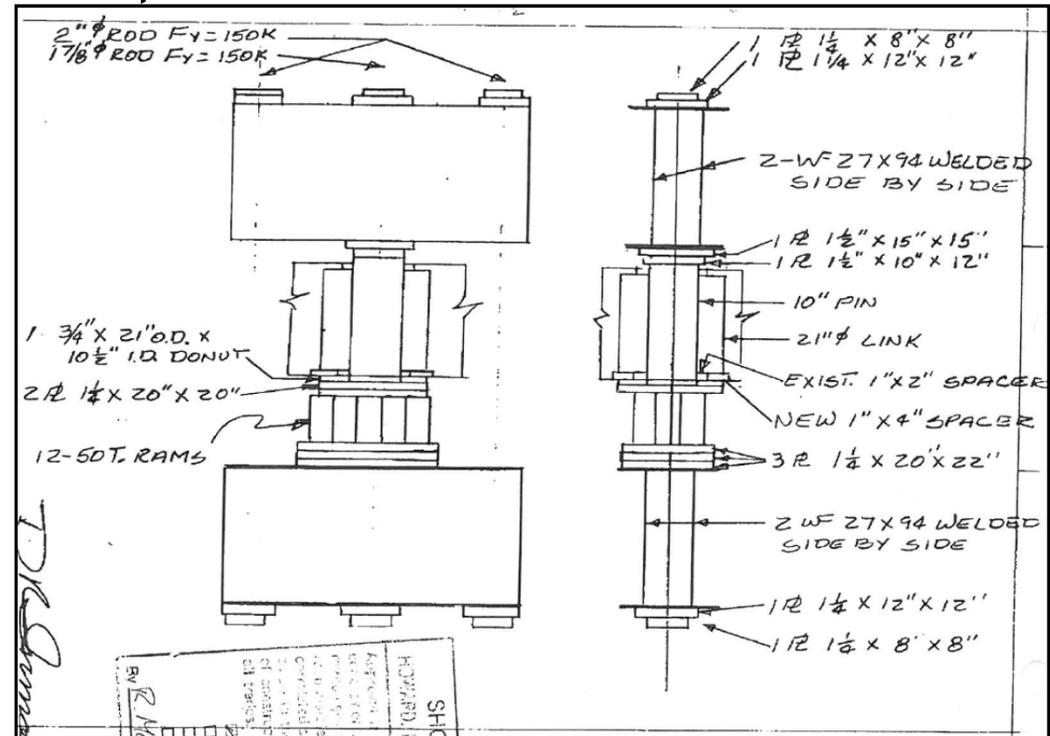
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1996 U29 Pin Rehabilitation Project (Contractor's Plan C)

- Increase the number of jacking assembly to include 12 jack rams and 5 jacking rods
 - Vertical load not released from pin

Results

- Jacking assembly jacked to 10,000 psi
- (Horizontal force = 1,325 Kips)
- No horizontal movement in pin was noted



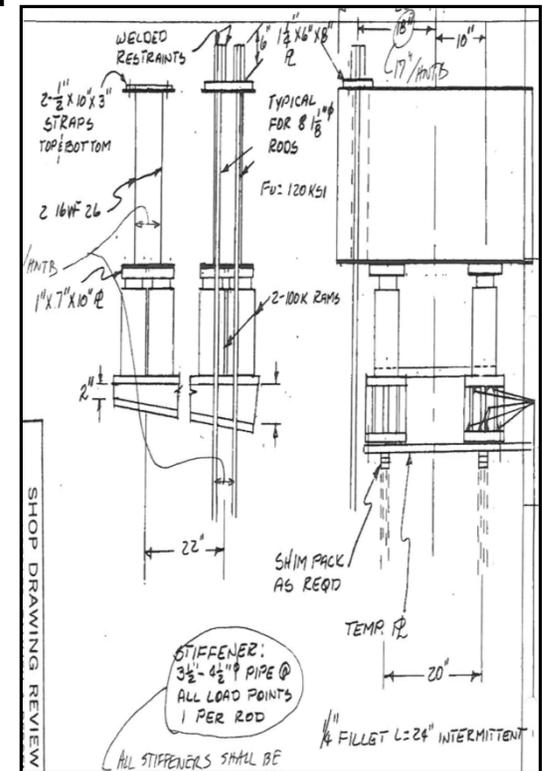
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1996 U29 Pin Rehabilitation Project (Contractor's Plan D)

- Basic concept was same as shown in contract plans
- 8 Jack rams and 8 Jack rods in vertical position and 7 Jack rams and 3 Jack rods in horizontal position
- Relieved dead load stress in the pin-link system
- Horizontal re-alignment of pin was unsuccessful

Results

- Total Vertical Force = 733 kips to 830 kips
(Design plan vertical dead load force = 656 kips)
- Total Horizontal Force = 727 kips
- Applied Horizontal Force > Estimated Vertical DL
Therefore, assumed pin is jammed in the link



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1996 U29 Pin Rehabilitation Project (Lessons Learned)

- Vertical load must be removed from Pin and Link
 - Contractor should not have been allowed to reset pin without releasing the vertical load
- Traffic will affect load in link and pin
 - Traffic was allowed on bridge during pin resetting
- Unsure if all load was removed from the link
 - No means to ensure load was removed
 - Excessive vertical PT force might put the link in compression
- Contractor did not attempt to rotate pin
 - Rotating pin in direction of grooves might have helped

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Pin Rehabilitation Project 2014

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Pin Rehabilitation Options

Considered 3 options (Option 3 chosen)

Option 1 - Restrain and Monitor

- Low cost option that is less intrusive

Option 2 - Reset Pins

- Repeat of the 1996 attempt

Option 3 - Replace Pin

- Replace lower pin but not link

Option 4- Replace Lower and Upper Pins and Links

- Remove and replace existing pin with new pin and hexagonal recessed nuts
- Option Chosen by MDOT and Louisiana DOTD

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Background

Replacing U29 and U49 Lower Pins

- Not many successful examples of resetting or replacing highway truss pins
 - Railroads have successfully completed pin replacements but pins typically do not have as much dead load as highway bridges
- Most examples are stringer/ girder pins
- Key to success is locking joint and creating a bypass

Gay Street Bridge (Knoxville, TN)

- Spandrel arch truss bridge
- Replaced 125 pin joints and gussets
- Created a pin bypass
- Regional steel contractor awarded project
- Bridge Closed during rehabilitation



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*Pin Rehabilitation Option 4 - **Replace** Link and Pins*

- Create bypass
 - Lock Joint from moving
- Remove link and pins
- Install new link and pins
- Remove bypass

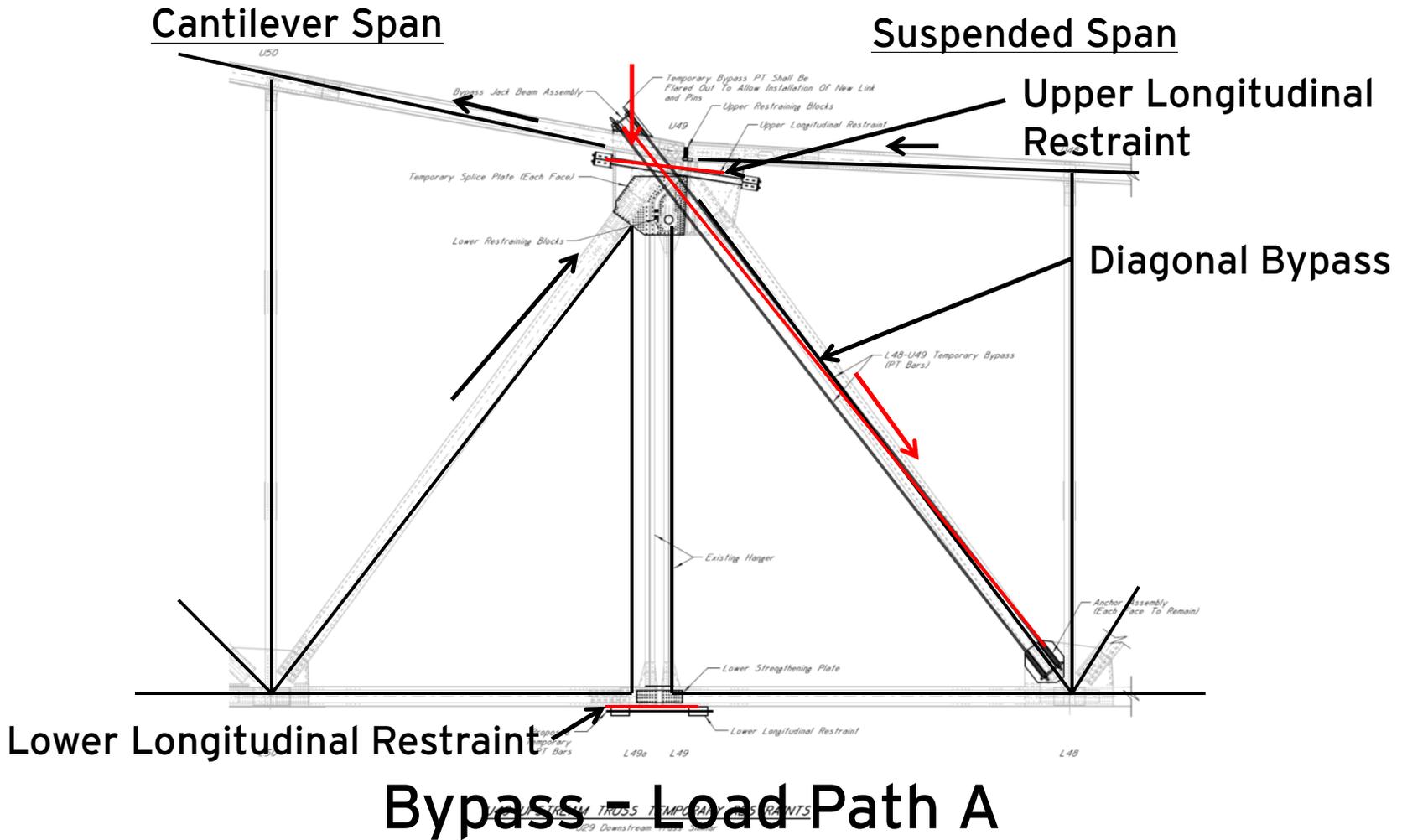
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*Pin Rehabilitation Option 4 - **Replace** Link and Pins*

- Create bypass
 - Lock joint from moving
- Remove link and pins
- Install new link and pins
- Remove bypass
- Bridge to be closed to traffic during replacement
 - Low ADT
 - Two way traffic on new bridge

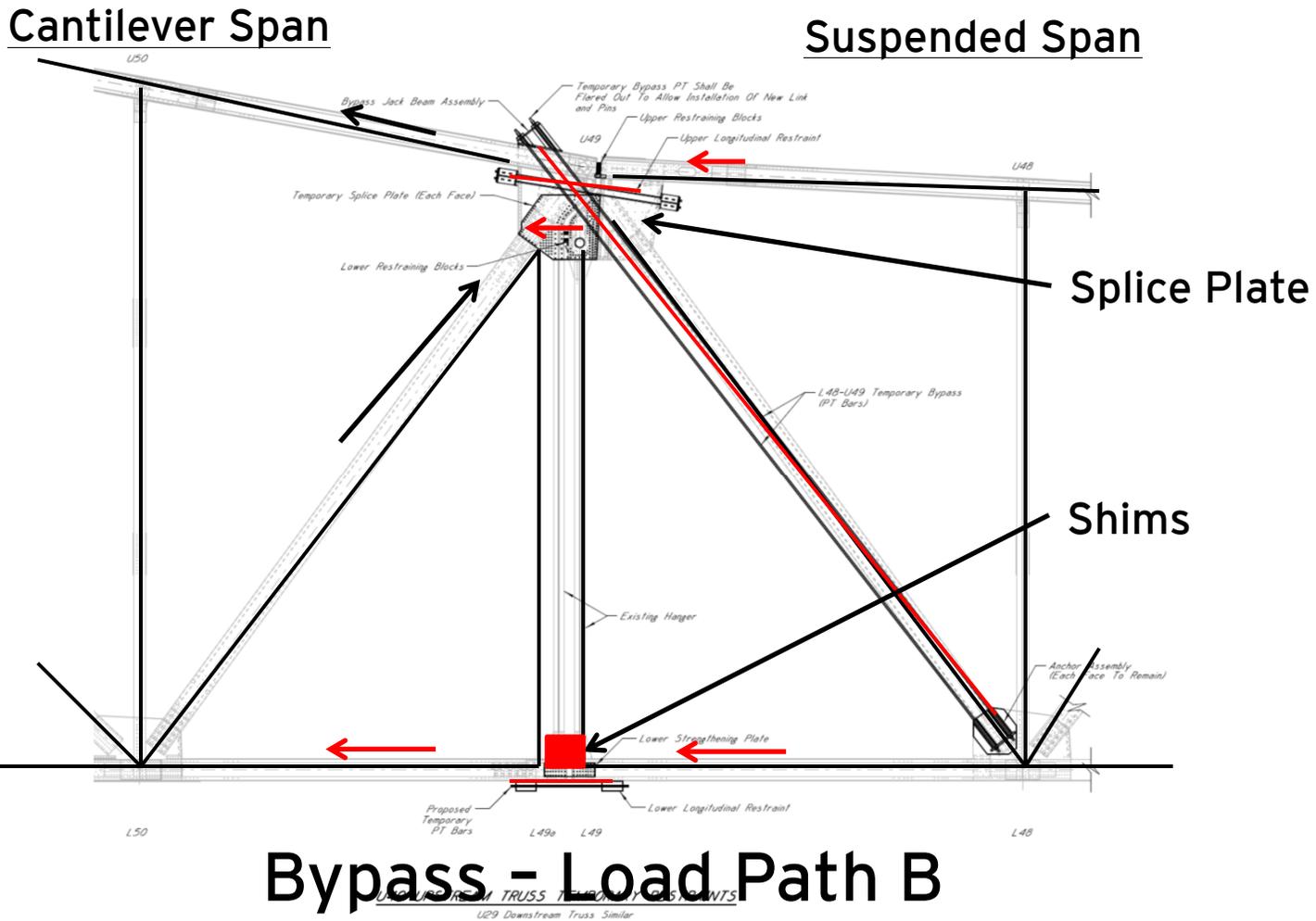
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Pin Rehabilitation Option 4 - **Replace Link and Pins**



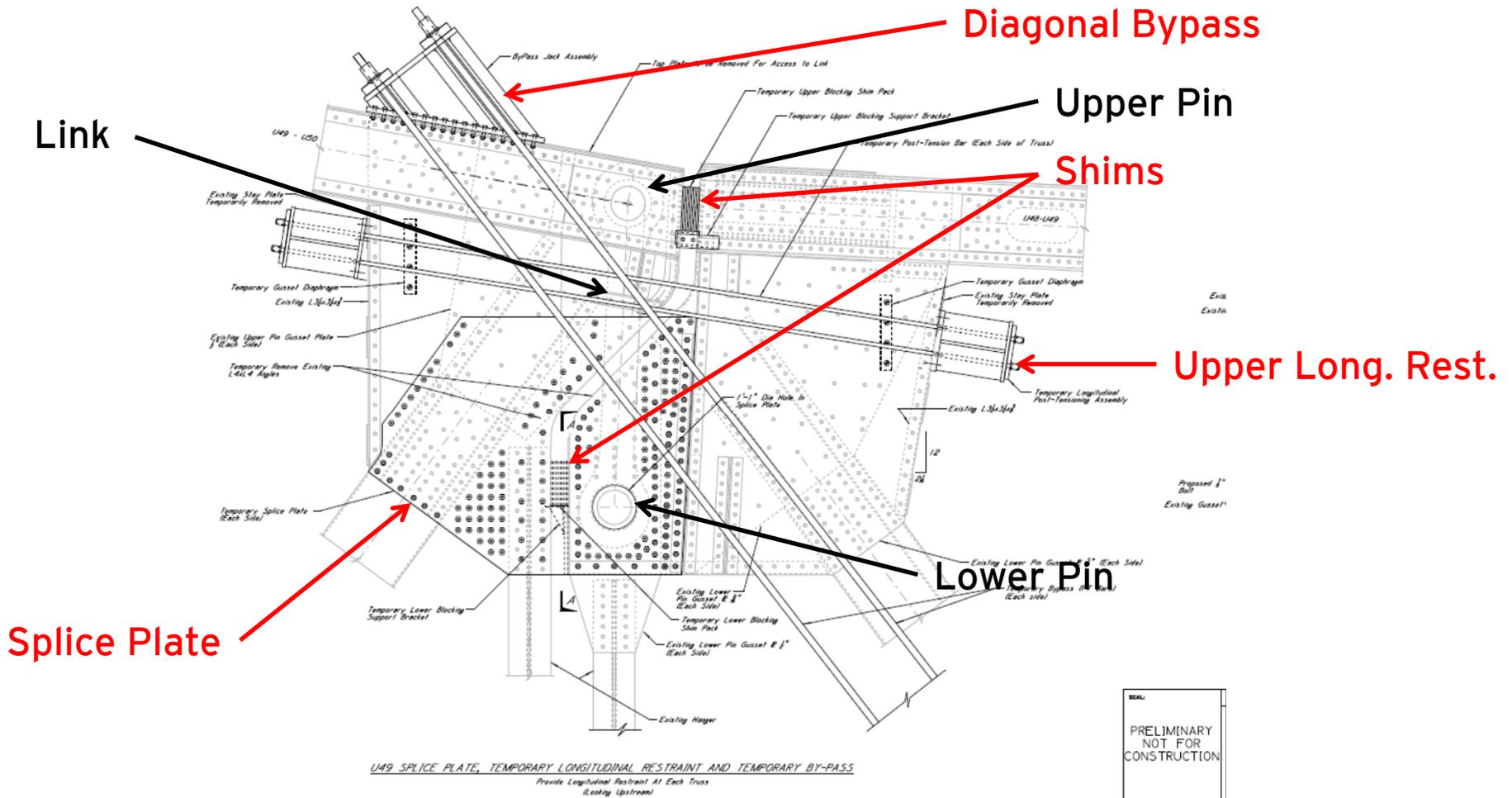
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Pin Rehabilitation Option 4 - **Replace Link and Pins**



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Pin Rehabilitation Option 4- *Replace Link and Pins*



MEAL
PRELIMINARY
NOT FOR
CONSTRUCTION



US 84 Mississippi River Bridge Pin And Link Replacement

*Pin Rehabilitation Option 4- **Replace** Link and Pins*

Suggested Sequence Of Construction

1. Install & tension upper and lower longitudinal restraints
2. Install & tension diagonal bypass
3. Install splice plate
 - a) Use template and field drill holes
4. Remove pin and link
 - a) Bore pins past existing gusset
 - b) Cut link from top to remove any remaining load
5. Install new pin and link

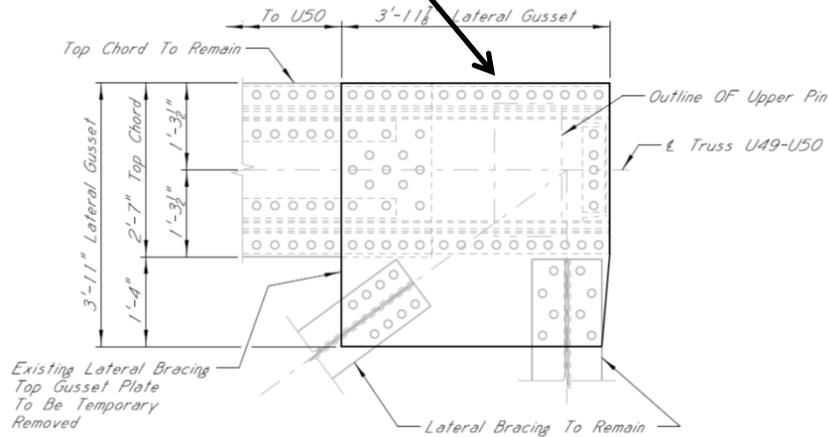
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Pin Rehabilitation Option 4 - **Replace** Link and Pins

Remove Link and Pins

Remove plate

- Remove top lateral plate
- Cut Link from the top



EXISTING U49 UPSTREAM PLAN VIEW
LATERAL BRACING TOP GUSSET PLATE REMOVAL



Remove plate

Link

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*Pin Rehabilitation Option 4 - **Replace** Link and Pins*

Construction

- Two Tier Selection
 - Tier I - Contractor Request for Qualifications
 - Advertised 5/19/14
- Shortlist Contractors (min of two)
 - September 11, 2014
- Submission of Bids
 - October 28, 2014
- Pin Replacement
 - Spring/ Summer 2015
 - Target Completion date July 2015

US 84 Mississippi River Bridge Pin Rehabilitation

Questions ?

