Sunshine Bridge Emergency Repair

2024
ALABAMA TRANSPORTATION CONFERENCE
2/6/2024

Chris B. Guidry, P.E.
LADOTD Asst. Bridge Design Administrator
OUTLINE

- Incident & Damages
- Repair
- Project Team
- Timeline
Incident
Sunshine Bridge over Mississippi River on LA70
Built 1963
ADT 17,100
10/12/2018, 1:41am
Barge Crane— owned by Marquette Transportation Company Gulf-Inland, LLC strikes lower chord of truss

Probable Cause – inadequate voyage planning; vertical clearance information used by the pilot didn’t reflect the actual clearance. (NTSB)
**West Channel**
725’/128.6’

**Main Channel**
750’/152.6’

**Damaged Location**
~130’
Damaged Bottom Chord L15 – L16
Compression Member
DL = 1.7 Million Pounds
(~142 Elephants)

Stringers
Floor beams
Damaged Laterals

12,000 pounds

Where did these elephants go after impact?
How many trapped in the damaged chord?
APPROXIMATELY 16” LATERAL DEFLECTION
<table>
<thead>
<tr>
<th>#</th>
<th>DATE</th>
<th>FT</th>
<th>LOCATION</th>
<th>DAMAGE DESCRIPTION</th>
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<tr>
<td>1</td>
<td>12-10</td>
<td>LT</td>
<td>2759-598 2</td>
<td>160+ misc. damages</td>
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49 locations

160+ misc. damages
Repair
Preparation work
Panel between L15 – L16 Shorten by ~ 3 3/8”
Two Repair Goals

- Restore Original Geometry
- Restore Load – 1700 k or 142
Repair Steps
1. Design, fabricate, and install jacking frame (load bypass system)
2. Apply jacking load to the estimated remaining comp. in the chord and then cut middle section of damaged chord
3. Heat straightening remaining ends
4. Jacking the structure to original geometry
5. Install replacement chord and splice ends
6. Transfer load from jacking frame to the replacement chord
Step 1a – Design Jacking Frame

2 - Inboard Strut HSS 12x12
1 - Outboard Strut W14x342

Jacking System Capacity = 1.5 x 1,700,000 lbs = 2,550,000 lbs
Installation Procedure
50+ Steps

2 - 500 Ton Jacks

1000 Ton Jack

DAMAGED LATERAL L16-M15 REMOVAL STEPS

51) SECURE LATERAL L16-M15 TO STRINGERS USING TWO BEAM CLAMPS.
52) RIG SEGMENT OF LATERAL TO BE CUT AND HOOK TO CARRY DECK CRANE POSITIONED ON BRIDGE DECK.
53) CREATE DOGBONE STRAIN RELIEF PER DETAIL 2 IN LATERAL APPROXIMATELY 3 FT FROM L16 END
54) ADJUST JACK PRESSURES PER PROCEDURE
55) SEVER LATERAL
56) UNBOLT LATERAL AND REMOVE SEGMENT
Step 1b – Install Jacking Frame
Step 2 – Cut Damaged Chord
Step 3 – Heat Straightening
Step 4 – Jacking Structure to Original Geometry

Jacking Up to 2.1 Million Pounds at 50k increments. Critical, Slow, and Long Process 100+ Steps
Jacking Monitoring System
Step 5a – Install Replacement Chord
Step 5b – Splice Ends
Step 6 – Transfer Load from Jacking System to New Chord
Panel between L15 – L16 Shorten by ~ 3 3/8”
Prior to Repair
Green – Upstream
Pink – Downstream

After Repair
Gold – Upstream
Purple – Downstream

Geometry Restored

L16

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<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
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<tr>
<td>Start Point: -440' 10 5/8&quot;</td>
<td>-31' 0&quot;</td>
<td>129' 9 7/8&quot;</td>
</tr>
<tr>
<td>End Point: -440' 6 13/16&quot;</td>
<td>-31' 0&quot;</td>
<td>129' 11 7/8&quot;</td>
</tr>
<tr>
<td>Delta: 0' 3 13/16&quot;</td>
<td>0' 0&quot;</td>
<td>0' 2&quot;</td>
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<th>Z</th>
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<tr>
<td>Start Point: 104' 2 3/4&quot;</td>
<td>144' 10 7/8&quot;</td>
<td>-4' 8&quot;</td>
</tr>
<tr>
<td>End Point:   104' 2 1/16&quot;</td>
<td>144' 10 7/8&quot;</td>
<td>-4' 7 3/16&quot;</td>
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Where did these elephants go after impact?
How many trapped in the damaged chord?
Load Restored
- Bridge Damage $6.7 M; Crane Damage $8,500
- Bridge closed for 49 days, significant traffic impact
- No pollution or injuries
After 49 days (working 24/7)
Sunshine Bridge Reopened to Traffic on 12/1/18
Timeline

- 10/12/2018 (Day 1) Sunshine Bridge was Hit and Closed
- 10/12/2018 (Day 1) Survey, Inspection, Repair Concept Started
- 10/20/2018 (Day 9) Crane Barge and Temp. Access in Place
- 10/22/2018 (Day 11) Repair Concept Verified on Site and Finalized
- 10/26/2018 (Day 16) Primary Work Platform Installed
- 11/04/2018 (Day 24) Jacking Frame Design and Shop Drawings Completed
- 11/08/2018 (Day 28) Jacking Frame Fabricated and Shipped
- 11/13/2018 (Day 32) Jacking Frame Installed
- 11/17/2018 (Day 36) Damaged Chord Removed
- 11/25/2018 (Day 45) Heat Straightening Completed
- 12/01/2018 (Day 49) Replacement Chord in Place; Geometry and Load Restored; Bridge Reopened to Traffic!
Lessons Learned

- Thermal loads must be considered in the design of jacking system (300k-400k).
- Heat straightening of impact damaged member is more challenging than heat damaged member.
- 3D scanning is a very useful tool in damage documentation, conflict/clash detection, and checking geometry during jacking.
- Attaching new members to existing damaged/distorted members and gusset plates requires tremendous preparation effort (templates, filler plates, accurate measurements, etc.).
Project Team
Damage Assessment, Inspection, Structural Analysis and Monitoring, CEI, & QC/QA
BDI - Instrumentation

Jacking/Load Bypass System, Jacking/Repair Procedures & Jacking Monitoring

Work Platforms, Replacement Chord, Bottom Lateral & Misc. Repair

Topo Survey, Laser Scanning/Damage Documentation, Conflict and Clash Detection, Movement and Displacement Monitoring during Jacking

Project Engineer, Communication and Coordination
GPI

Prime Contractor
COASTAL BRIDGE

Jacking Sub-Contractor
CEC, INC.

Jacking Framing Fabricator
AREA SHEET METAL

Heat Straightening
DAN R. DALTON

Replacement Chord and Misc. Steel Fabricator
COASTAL METAL WORKS LLC

Industrial Solutions Inc. – Secondary Work Platforms

Thomas Industrial Coatings – Painting

Southern Synergy – Roadway Work

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT
Thank you !