Cable Stay Replacement and Deck Rehabilitation of I-310 Luling - Hale Boggs Mississippi River Bridge

AASHTO SCOBS ANNUAL MEETING
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Louisiana Department of Transportation and Development (LA DOTD)
Opened in 1983, 1222 FT. MAIN SPAN, STEEL ORTHOTROPIC DECK, STEEL BOX GIRDERS, STEEL TOWERS, WEATHERING STEEL, 72 CABLES IN GROUPS OF 2 OR 4
Statement of Problem

- Rusting and water leakage in anchorages
- Cracking/splitting of cable cover pipes
- Signs of compromise in cables safety
- Wind-rain cable vibration issues
- Wearing surface over steel deck has reached its service life.
- LADOTD initiated a project for Structural Evaluation of the Stay Cables
Lower Anchorage
Upper Anchorage
Inspection, Condition Rating, and Life-Cycle-Cost Analysis
Assessment of Overall Integrity

Difference between design and measured profile

Cable Force Measurement
Anchorage Inspection
Cable Free Length Inspection
## Inspection findings

### Damage Severity Levels

<table>
<thead>
<tr>
<th>Severity Level</th>
<th>Status</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Satisfactory</td>
<td>Minor deterioration and anomalies noted</td>
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<tr>
<td>2</td>
<td>Poor</td>
<td>Deterioration of the protective elements and potential for degradation. Cables with this level of damages need to be routinely monitored and corrective action needs to be planned.</td>
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<tr>
<td>3</td>
<td>Critical</td>
<td>Deterioration or potential for deterioration of the main tension elements (steel wires) exists. Action (repair) is necessary. Cables with this level of damages shall be closely monitored until repairs are applied.</td>
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</tbody>
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Severity Level 3 - Critical, Damage Examples
Summary

- 40 out of 72 cables were rated critical
- All cables had at least damage Level 2
- Increasing rate of deterioration was evident
- Timely corrective action was needed
- Based on a Life-Cycle-Cost Analysis, public safety concerns, and importance of the bridge, LADOTD decided to replace all cables
Cable Replacement Design, and Construction
Cable Replacement Design

Objectives:
- Develop a cost effective design.
- Minimize impact on traffic.
- Analyze for live load, wind force, and construction load effects.
Replacement Cable Design

- Selected cable system
  Parallel Strand System with
  Individually Greased Sheathed Seven-wire Strands Encased in HDPE ribbed Cover Pipe
Replacement cable design

Parallel strand, preferred system

- Larger anchorage and cable envelope
  - Require modifications to existing structure
  - Increase wind load
  - Change aerodynamic characteristics

Old Cables; 103 to 307, ¼” wires

New Cables; 23,45,57,67, 0.62” strands

Additional 24 reference strand for follow-up inspections
Temporary cable design

Need for Temporary cables

- Uncertainty in cable condition
- Large cable group spacing
- Need to maintain traffic w/o load limits
Temporary cable design
Temporary Cables
Construction Sequence
Install Temporary Cables
Construction Sequence
Detension and lower cable
Construction Sequence
Modification of Anchorage Zones
Construction Sequence
Modification of Anchorage Zones
Construction Sequence
Modification of Anchorage Zones
Construction Sequence
Weld PE Pipe
Construction Sequence
Hoist PE Pipe
Construction Sequence Install Strand and Stress
Lower Ends and Anchorages
Upper Ends and Anchorages
Maintenance of Traffic
Cable Vibration Suppression Measures
Cable Vibration Suppression Measures

RIBBED HDPE PIPE – WIND/RAIN ISSUES
Background: Deck Wearing Surface

Original - (SMAC) Stone Matrix Asphalt Cement
   - Observed failure and delaminations of significant areas (1994)

1994 - (SMAC) Stone Matrix Asphalt Cement
   - 1st Rehab - Removed and replaced the area over 4 Travel Lanes
   - Applied a test section utilizing Polymer Modified Asphalt Cement (PMAC)

1999 - Observed failure and delaminations of significant areas
   - 2nd Rehab - Removed and replaced the area over 3 Travel Lanes utilizing PMAC
   - Applied a 320’ test section utilizing Conventionally Reinforced Concrete Pavement (CRCP) - Northbound Barrier to Barrier

2004 - Applied another 320’ test section utilizing Steel Fiber Reinforced Concrete (SFRC) - Southbound 2 Lanes
DECK OVERLAY AND REPAIR ITEMS:

(SEE OVERLAY REMOVAL AND REPLACEMENT DETAILS FOR MORE INFORMATION)

A) EXISTING ASPHALT OR CONCRETE OVERLAY TO BE REMOVED.

B) KEVLAR/GLASS FRP EPOXY UNDERLAYER SYSTEM & 3/8" FIBER REINFORCED CONCRETE OVERLAY TO BE PLACED.

C) THERMOPLASTIC PAVEMENT STRIPING.

D) REMOVE AND REPLACE BARRIER PROTECTIVE COATING SYSTEM.
Project Team (2002-2016)

- LA DOTD, PAUL FOSSIER, PROJECT MANAGER
- CABLE INSPECTION & REPLACEMENT
  - CTL GROUP
  - BRIDGE ENGINEERING SOLUTIONS (BES)
  - TRANSYSTEMS
  - ABMB
  - INTERNATIONAL BRIDGE TECHNOLOGIES (IBT)
  - KIEWIT, GENERAL CONTRACTOR
    - VSL, INC., STAY CABLE SUB-CONTRACTOR

DECK OVERLAY
- STRUCTURAL DESIGN & REHABILITATION (SDR)
- CEC, INC., GENERAL CONTRACTOR