The John James Audubon Bridge Project

Louisiana’s First Design/Build Project

Presented by Greg Shafer
Audubon Bridge

- General Overview
  - Project Overview
  - Parties Involved
  - Unusual Design Requirements
  - Project Innovations

- Project Implementation
  - Design Approach
  - Construction Means & Methods
Parties Involved

- LA DOTD is the owner of this bridge and are managing the construction with the Louisiana TIMED Program.
- Louisiana TIMED Managers (LTM) serve as an extension of the Louisiana Department of Transportation & Development (LA DOTD).
- Audubon Bridge Constructors was the design-builder. A JV of Flatiron, Granite and Parsons
The Project

Approach Bridges

Bridge 1
Bridge 2
Bridge 3
Bridge 4
Bridge 5
Bridge 6
Bridge 7
Bridge 8
Innovations

- Navigation Span
  - 1400 ft span required with 1280 ft navigational clearance
  - 1583 ft span provided with 1400 ft navigational clearance
- Tip grouted drilled shafts
- Triple corrosion protection on cable-stays
- Numerical simulation of wind climate
## Design Life

<table>
<thead>
<tr>
<th>Element</th>
<th>Design Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable-Stayed Bridge Structure</td>
<td>100 years</td>
</tr>
<tr>
<td>Other Bridge Structures</td>
<td>75 years</td>
</tr>
<tr>
<td>Stay Cables</td>
<td>75 years</td>
</tr>
<tr>
<td>Stay Cable Vibration Suppression System</td>
<td>25 years</td>
</tr>
<tr>
<td>Bearings (Pot)</td>
<td>20 years</td>
</tr>
<tr>
<td>Bearings (Elastomeric Pads)</td>
<td>30 years</td>
</tr>
<tr>
<td>Expansion Joints (Excluding Finger Joints)</td>
<td>10 years</td>
</tr>
<tr>
<td>Finger Joints</td>
<td>30 years</td>
</tr>
<tr>
<td>Paint System</td>
<td>20 years</td>
</tr>
</tbody>
</table>
Typical Section – Approach Roadway Bridges
Main Span Approaches
Span over USACOE Levee and Road
Cable-Stayed Unit

- Five-span unit
- 1583 ft main span (1400 ft required)
- 1463 ft navigational clearance (1280 required)
Composite Deck Cross-Section
Deck/Tower Articulation

- **Longitudinal Fixity**
  - Pier 1W & 2W – Fixed Bearing
  - Pier 1E – Lockup Device
  - Pier 2E – Sliding Bearing

- **Advantages**
  - Maintain flexibility for temperature movements
  - Spread longitudinal shear from wind to both towers
Dead Load Analysis

- Dead load analysis is non-linear
  - Non-linear cable elements
  - Non-linear beam elements
  - Non-linear soil springs

- Structure is “tuned” for dead loads
  - Deck built long to compensate for shortening
  - Cables installed short to compensate for stretch

- Staged Construction Modeling
  - Structure built one segment at a time
  - Precisely captures locked-in effects
  - Models time-dependent effects during construction
  - Required for tracking bridge geometry during construction
Wind Loads

- AASHTO static wind load pressures not appropriate for long-span structures

- Three components to wind loads
  - Mean static
  - Background
  - Dynamic (Buffeting)
  - Dynamic component obtained from buffeting analysis provided by wind specialists
Meteorological/Site Analysis

- Contract Approach
  - Collect site data for *one year*

- Revised Approach
  - Develop numerical simulation
  - Correlate model

- Benefit
  - Analyze known events
  - Time
Calibration of Numerical Simulation
Calibration Results

WRF vs Historical Records at River Bend Power Plant at 150 fts AGL

Historical data at River Bend Power Plant (UTC Time)

Historical River Bend
WRF Output at Bridge

Hurricane Katrina
Hurricane Rita
Sectional Model Tests
Sectional Model in Wind Tunnel
Construction Stage Modeling
Construction Stage Modeling
Special Stay Cable Load Cases

- **Cable Loss Analysis**
  - Extreme limit state
  - Cable loss in accordance with PTI Recommendations
  - 1.1DC+1.35 DW+0.75LLI+1.1Cable Loss
  - Structural Elements Design to prevent structural instability

- **Cable Replacement Analysis**
  - Strength limit state
  - In accordance with PTI Recommendations
  - 1.2DC+1.4 DW+1.5LLI+Cable Exchange
  - Adjust traffic pattern to control live load
  - Limit areas where cable replacement governs
Tower Foundations 1W & 1E

- 160’ x 64’ x 15’ Cap
- 7 by 3 pile group – 1 test pile
- 8’-0” diameter shafts
Tower Shafts

- 96” dia permanent casing
- 90” dia drilled shaft
- Pile tip Elev. -175 to -180
- Tip grouting
Tower

- 500’ high
- 136 cable stays
- Two crossbeams
- Tower top is Elev. 520
- Deck is Elev. 130
Tower and Cross-Beam Forms
Tower Cross Section

- Box sections for simple jump forming
- Cable anchorage on inside tower wall
Tower Cable Anchorages

- Steel anchorage trays for upper stays
- Concrete corbels for lower steep cables
- Crossbeams connected clear of anchorage zone
Composite Deck Cross-Section

- Economy
- Durability
- Accessibility
- Low maintenance
Stay System

- 7-Wire parallel strand
- Monostrand Jacking
- State-of-the-Art Corrosion Protection
  - Galvanizing
  - Grease
  - Strand PE
  - Coextruded HDPE Pipe
- Vibration suppression
Simultaneous Tower and Superstructure Erection

June 9, 2010
Erection of First Stay and Derrick

July 5, 2010
Support by First Temporary Bent

August 24, 2010
Support by Second Temporary Bent

October 3, 2010
Completion of Backspan and Transition Span

November 7, 2010
Mainspan Closure

December 28, 2010
Questions

http://flatironcorp.oxblue.com/jjab/