The I-10 Gulf Corridor

- Approximately 2,460 miles of Interstate 10 connect the West Coast to the East Coast
- Extends from SR1 (Pacific Highway) in Santa Monica, California and runs to Jacksonville, Florida
- The I-10 Wallace Tunnel and Mobile Bayway comprise a nationally recognized restriction to travel that emerges as routine gridlock on holiday and seasonal beach and tourist travel periods.
I-10 Mobile River Bridge and Bayway Corridor

- 10 mile project, 5 interchanges, approach roadway improvements
- 7.5 miles of 2-lane EB and WB bayway (two additional lanes in each direction)
- 11,300 ft. of HLA and 2,500-2,700 ft. main span unit (three lanes in each direction)

Bayway Alternatives Study

Storm Surge Bridge Impacts

- Design Parameters
  - Storms, Surge, Waves
  - Levels I, II, and III
- Force/Moment Computations
  - Low frequency (wave frequency)
  - High frequency (slamming)
- Need to consider Sea Level Rise over structure lifetime

AASHTO 2008 and HEC-25 Vol 2
Guide Specifications for Bridges Vulnerable to Coastal Storms

- Vertical Load for 2017, 2067, 2117
  - 100-yr Storm in 2117
  - Vertical Load for 2017, 2067, 2117

Target Performance Level

- Critical/essential Strength Limit State should be used. Performance levels:
  - "Service Immediate"
    - Sufficiently undamaged, stable and aligned for rescue and recovery after cursory inspection
    - Backfill behind abutments can be sacrificial
  - "Repairable Damage"
    - Some repairs needed to go in service
    - Owner specifies outage duration
    - Load posting can be considered
    - Pre-positioned replacement spans may be used to meet outage limit

Summary of Substructure Retrofits – 2 Pile Bents

<table>
<thead>
<tr>
<th>Retrofit Type</th>
<th>Storm / SLR 2017</th>
<th>Storm / SLR 2067</th>
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<tbody>
<tr>
<td>25yr, SLR 2017</td>
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<td>50yr, SLR 2067</td>
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<td>100yr, SLR 2017</td>
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Summary of Substructure Retrofits – 3 Pile Bents

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Superstructure Retrofits Measures

1. Superstructure to Substructure Uplift – Cable Restrainers
2. Prestressed Beam Shear Capacity – FRP Wraps at Ends of Beams
3. Span Replacement
4. Restrain only

Bayway Preferred Alternative

High Level Approach Alternatives Study
Bridge Type Selection Process

- Four Step Process which Involves Developing and Analyzing Numerous Bridge Concepts
- Step 1 – Develop Preliminary Bridge Concepts
- Step 2 - Develop 3 Bridge Type Alternatives
- Step 3 – Develop Preferred Bridge Alternative for TS&L
- Step 4 – Final Design

Design Guidelines/Constraints

- Bridge Structural Configuration
- Union Hall
- Local Streets - Construction Phasing
- County Jail
- Tie-in To Bayway
- Bridge Height
- DEIS Environmental Commitments

Design Approach

- Identify Girder Types to be Studied
- For Girders not commonly used by ALDOT research and review details and practices from other Owners including their project Experience.
- Establish Preliminary Span Layouts Maximizing each Structure Type Strengths

High Level Approach Spans Alternatives

- Guidelines used for comparative analysis:
  - ALDOT’s Structural Design Criteria
  - Alternatives that minimize maintenance costs and increase durability
  - Superstructure continuity
  - Eliminate steel alternatives
  - Span ranges that capture the best solution for our bridge height (constructability)
  - Alternatives with span Lengths that have Historically been competitive
  - Alternatives that Accommodate Bridge Curvature (1,500’ radius on the east)
  - Eliminate spliced I-Girders

High Level Approach Spans Alternatives – Span Range

- Application of Bridge Type by Span Range
- Graph shows comparison of different bridge types based on span length.
High Level Approach Span Concepts Evaluation

- Qualitative and quantitative methods were used to evaluate the various structure alternatives.
- With the exception of cost, each criterion was assigned a "bubble" based on quantifiable numbers and engineering judgment to establish a relationship between the alternatives.

<table>
<thead>
<tr>
<th>Criteria</th>
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<td>Constructability</td>
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<td>Maintenance and Durability</td>
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High Level Approach Spans – Recommendations

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Main Span Unit Alternatives Study

Option 3 – Span By Span Segmental

Option 6 – PCI Simple Span and Spliced U-Beam (U72)

Option 8 – Florida U-Beam (FUB-72)
Design Guidelines/Constraints

• Bridge Structural Configuration
  - Each roadway is composed of three 12-foot-wide lanes and two 12-foot-wide shoulders
  - A minimum vertical clearance of 215 feet
  - A minimum horizontal clearance of 600 feet.
  - Have no permanent effect on river navigation and minimize impacts during construction.
• Vessel Collision Impact Resistance
• Pier Placement Locations – Span Length Driver
• Tower Heights – FAA Restrictions
• DEIS Environmental Commitments

Superstructure Types Considered

• Cable-Stayed Bridges - Most Economical Structure Type for this Span Range

Main Span Bridge Alternatives

1. Precast Concrete Segmental
2. Steel Edge Girder – Split Deck
3. Cast-in-Place Concrete Edge Girder – Split Deck
4. Steel Edge Girder
5. Steel Double Deck
6. Precast Concrete Segmental – Split Deck
7. Cast-in-Place Segmental – Split Deck

Back Span Location Study

• Back span length influences the behavior of the main span unit:
  - Uplift force to be resisted at anchor piers
  - Live load stress range on stay cables (important for fatigue considerations)
  - Structure bending moments
  - Aerodynamic behavior
• Minimizing anchor pier uplift while considering impacts to:
  - Longer main span unit = Higher construction cost
  - Increase of live load force range (stays)
  - Increase in bending moments (backspan)

East Tower Location
Optimized Main Span Length

- Received approval to place Pier on Madison Street:
  - Allows shortening of Back Span and Main Span
  - Places West Tower closer to the Bulkhead
  - East Tower Location unchanged

Vessel Collision Review

- West Tower:
  - Evaluated Design Vessel's Ballasted Draft and Design Draft

- East Tower:
  - Evaluated Design Vessel's Ballasted Draft and Design Draft
Vessel Collision Review

- Findings using the Design vessel geometry (92,000 DWT, LOA= 870 ft, Design Draft = 34.4’, a_s= 25 ft) indicate the following:
  - **East Pier:**
    - Likely only subject to Ballasted direct hit to the Pile Cap (i.e. no pile damage)
    - Grounding of the design vessel
  - **West Pier:**
    - Subject to design vessel impacts below the cap
    - Subject to direct cap impacts for ballasted Condition
  - Magnitude of Vessel Collision Load - 17,000 Kips

### Main Span Concepts Evaluation – Recommendations

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### Main Span Bridge Alternatives

- **Alternative 1 – Precast Concrete Segmental**
  - Total Construction Cost: 152' 560' 1,350'
  - 2,774'

- **Alternative 3 – CIP Concrete Edge Girder, Split Decks**
  - Total Construction Cost: 585' 1,380'
  - 2,550'

- **Alternative 7 – CIP Concrete Segmental, Split Decks**
  - Total Construction Cost: 585' 1,380'
  - 2,550'