Bayonne Bridge Navigational Clearance Program
“Raising the Roadway”

Ohio Transportation Engineering Conference (OTEC)
October 2, 2018

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HDR/WSP, a Joint Venture
Bayonne Bridge: Design

1. Bayonne Bridge History
2. Main Span Arch
3. Approach Substructure
4. Approach Superstructure
5. Construction Update
Bayonne Bridge History

- Owned by the Port Authority of New York & New Jersey (PANYNJ)
- Opening Date: November 15, 1931
- Longest arch bridge in the world when opened (currently 5th longest)
- Othmar Amman design
- National Historic Civil Engineering Landmark
Bayonne Bridge History
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Navigation Clearance

Former Navigational Clearance

Former Approach
Navigation Clearance

New Navigational Clearance

New Approach
Arch Strengthening & New Roadway

New Floor Beam
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The Approaches

NY Approach:
- 2,378 ft. long
- 5% grade
- 12 spans

NJ Approach:
- 2,929 ft. long
- 4.85% grade
- 14 spans
New York Approach
New Jersey Approach
The Bridge Approaches
The Approaches – Staged Construction
The Approaches – Staged Construction
The Approaches – Staged Construction
The Approaches – Precast Pier Columns

Single Pier (Type 2)  Combined Short Pier (Type 1)  Combined Tall Pier (Type 1)
The Approaches – Precast Pier Columns
• **Eccentric Pier Column Loading**
The Approaches – Precast Pier Columns

Type 2 Pier

Type 1 Pier
The Approaches – Drilled Shafts

Drilled Shaft

Section at Casing

Section at Rock Socket
The Approaches – Footings
The Approaches – Footings

- 4 – 6’ dia. shafts
- Column looped tendons
- 4 – 6’ dia. shafts
### The Approaches – Substructure Quantities

<table>
<thead>
<tr>
<th></th>
<th>5,000 PSI CONCRETE</th>
<th>6,000 PSI CONCRETE</th>
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<tbody>
<tr>
<td></td>
<td>CONCRETE (CY)</td>
<td>CONCRETE (CY)</td>
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<tr>
<td>REINFORCING STEEL (LB)</td>
<td></td>
<td></td>
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<tr>
<td>LB STEEL/ CY CONCRETE</td>
<td></td>
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<tr>
<td><strong>DRILLED SHAFTS</strong></td>
<td>18,141</td>
<td>13,245</td>
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<td></td>
<td>1,291,840</td>
<td>2,608,260</td>
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<td>71</td>
<td>196</td>
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<td><strong>SUBTOTAL</strong></td>
<td>13,845</td>
<td>2,820,504</td>
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<td>204</td>
<td>196</td>
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<tr>
<td>8,500 PSI CONCRETE</td>
<td>CONCRETE (CY)</td>
<td>REINFORCEMENT STEEL (LB)</td>
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<td>----------------------</td>
<td>---------------</td>
<td>--------------------------</td>
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<tr>
<td>TYPE 1 PIER CAPS</td>
<td>3,981</td>
<td>894,562</td>
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<tr>
<td>TYPE 2 PIER CAPS</td>
<td>1,200</td>
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<tr>
<td>COLUMNS</td>
<td>18,765</td>
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<td>P/T BARS</td>
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<td>P/T STRANDS</td>
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<td>890,327</td>
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</tbody>
</table>
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Precast Segmental Box Girders
Superstructure Articulation

New York

New Jersey
- **BASE AASHTO LOADING**
- LIGHT RAIL TRANSIT

Typical Roadway

with Acceleration Lanes
Precast Segmental Box Girders

Typical 36’ Roadway

Wide 48’ Roadway

TYPICAL CROSS SECTION
INCLUDES ACCELERATION AND DECELERATION LANE
Typical SB 36’ Roadway

Wide NB 48’ Roadway
Typical Cross Section

Transverse PT

Vertical PT Bar

TYPICAL CROSS SECTION
Typical Cross Section
Expansion Pier Construction

Half Cross Section

Exp. Pier Cantilever
Expansion Pier Construction
SUPERSTRUCTURE DATA

- Total number of segments = 1,178
- Total length of superstructure = 10,614 ft
- Total out-to-out deck area = 520,000 ft²
- Total concrete (10 ksi) = 44,900 cy
- Total post-tensioning = 3,500,000 lbs
  - Longitudinal PT = 5.14 psf
  - Transverse PT = 0.96 psf
- Total Reinforcement = 8,600,000 lbs
  - Total stainless steel (75 ksi) = 6,000,000 lbs
  - Total epoxy coated (60 ksi) = 2,600,000 lbs
- Superstructure Rebar Density = 192 lbs/cy
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First Post-Panamax Vessel – September 2017
Questions?