Woodrow Wilson Bridge Project
Virginia Approach Spans

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Formerly of URS Corp for Potomac Crossing Consultants
Woodrow Wilson Bridge Project
Second Severn Crossing
Medway Crossing (Channel Tunnel Rail Link)

Flared segments

Tapered pier legs
Woodrow Wilson Bridge Project

Virginia approach Spans
Contractor: Granite/Corman joint venture
Construction Budget: $135M
Completed: August 2008
Construction stages

February 2003
Demolition of Hunting Towers

March 2003

October 2004
Virginia Approach Spans
Challenges

Segment shape - multi directional curvature

Schedule - Finite bridge opening dates. Fixed Construction cycle

Confinement - restricted site space and access, water bound two sides, two public trails across site

Access - difficult access to arches for grouting, stressing repair and finishing operations

Inspection - effective client/contractor team integration, common goals. Apply principles of trust and money, partnering

Mass concrete operations - Pier knuckle and pile caps

Coordination - with adjacent contractors for approach highway and bascule bridge

Continuous improvement – Flexible working methods, concrete
Foundation and pedestal construction
Detailed view of pedestal
Construction
V-pier structure

- Tie Beam
- Arch Rib
- Knuckle
- Pedestal and Foundation
- Bearing Pad
Pier knuckle
Pier knuckle/tie beam assembly
Epoxy resin adhesive

Normal and slow-set epoxies
Multiple temperature range formulations required
Specific requirements for
  • Consistency
  • Gel Time
  • Contact Time
  • Compressive Yield Strength
  • Bond Strength
  • Heat Deflection
Special requirements for low temperature (20-40°F) applications
Placing upper knuckle and tie beams
Upper knuckle construction
Segmental Precast Pier Overview

4 V-Piers at 6 Pier Locations >> 24 V-Piers >> 48 Arches

Two Separate but Similar Pier Geometries

- One casting bed for 14’ Arches converted to cast 18’ Arches
  - 20 Arches 14’ Typical Width V7 OL, V6, V5
  - 4 Arches 18’ Typical Width V7 IL
- One casting bed for 16’ Arches
  - 24 Arches 16’ Typical Width V4, V3, V2

- Five Segment Types
  - Starter (length varies) – highest #
  - Typical (10’ long at top) - #5 to #9
  - Flared (inconsistent width) - #4 to #1
  - Knuckle (bearings) - #0
  - Tie Beams (span arch to arch)
Segment placing

Temperature curing closure pour

Placement segment

Knuckle core

Knuckle wing placed
Temporary stay system
Post-tensioning
Grouting operations
Pre-casting operations
Concrete placing sequence
Outline – Two Improvements

Overview of Precast Segmental Piers
- Long Line vs. Short Line Casting

Project Innovations & Best Practices
- Segment Casting Sequence (time & cost savings)
- Precast Segment PT Bar Joint Interface (quality)
Linear Casting Sequence
Skip Casting Sequence

Casting Order

Plan

Segment ID

Elevation
Post-Tensioning Bar Interface at Segment Joints
Post-Tensioning Bar Interface at Segment Joints

Hole in PT Plate Washer is 1-7/8” for 1-3/8” PT Bar
Duct is I.D. is 3-5/8”
A blockout almost doubles the size of the mandrel allowed to keep ducts straight
Blockout is 2-1/4” deep
Rebar cover is only 1-1/2”
Original plate washer blockout

Direction of Segment Erection

SEGMENT JOINT

PT PLATE WASHER BLOCKOUT

5\"x9\"x1-3/4\" PLATE WASHER

CL 1-\(\frac{3}{8}\) PT Bar

3\" PE Duct

4\" PE Duct

3\" PE Duct

WETCAST SEGMENT

MATCHCAST SEGMENT
Problems with original P/T plate washer blockout
Modified Plate Washer Blockout

- **5"x9"x1-3/4" PLATE WASHER**
- **SEGMENT JOINT**
- **PT PLATE WASHER BLOCKOUT**
- **CL 1-3/8" PT Bar**
- **WETCAST SEGMENT**
- **MATCHCAST SEGMENT**

- **Direction of Segment Erection**

- **3" PE Duct**
- **4" PE Duct**
- **3" PE Duct**
Results of Modified Blockout
Continual improvements
Demolition of old bridge
Transparent noise wall

Transparent Soundwall
April 2008
Steel superstructure

Lead core elastomeric bearing
Deck construction
Median and fascia barrier walls
Value engineering

Sequence of pre-casting segments from linear to skip casting. This change resulted in significantly improving productivity.

Decision to locate the precast yard on the job site.

Separating the precast knuckle segment into three pieces to accommodate handling and placing.

P/T duct connectors at segment bulkheads for improved alignment across joints. This cut a four-hour procedure down to 30 minutes.

Mandrill use in pre-cast ducts reduced coring or open concrete repairs.

Casting knuckle nose at ground level as opposed to in the air.

Combining an inflatable bladder with the mandrill use in pre-cast ducts reduced coring or open concrete repairs.

Needle beam formwork system for the large bridge deck overhangs to mitigate girder torsion issues.

A slip-exit off the Capital Beltway was created to ease material deliveries and relieve in-town congestion.

Daily improvements via RFC’s and RFI’s.
Thank you!

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