I-74 Corridor in the Quad Cities
Concrete Applications, Delivery & Placement

2017 Iowa Better Concrete Conference
November 9, 2017

Presented By:
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OUTLINE

• Overview of I-74 Project
• Concrete Applications (Bridges)
• Concrete Delivery & Placement
I-74 PROJECT OVERVIEW

I-74 Corridor Improvement

- Joint Initiative of Iowa DOT and IL DOT
- Nearly 8 miles long
- Moline, IL to Davenport, Iowa
- Increase capacity
- Improve Travel
- Enhance connecting arterial roadways
- Improved opportunities for pedestrians/cyclists

Map showing the I-74 corridor with key locations and improvements.
Owners/Key Stakeholders

- Iowa DOT (lead agency)
- Illinois DOT
- Federal Highway Administration
- Bi-State MPO
- Cities of Moline, Bettendorf, Davenport
- Scott and Rock Island Counties
- Benesch Design Team – Final Design
- John Wood Group (AMEC) – GEC
- IL DOT - Resident Engineers/Inspectors (w/ assistance from Bruner, Cooper and Zuck Team)
I-74 PROJECT OVERVIEW

Twin Suspension Bridges

- Traffic Congestion
- Safety Concerns
- Obsolete (1935 & 1960)
## I-74 PROJECT OVERVIEW

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Mississippi River Crossing Study</td>
</tr>
<tr>
<td>2000</td>
<td>I-74 Corridor Study began</td>
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<tr>
<td>2003</td>
<td>Draft Environmental Impact Statement (EIS)</td>
</tr>
<tr>
<td>2005</td>
<td>Preferred Alternative identified</td>
</tr>
<tr>
<td>2006</td>
<td>Main Span Bridge Type chosen</td>
</tr>
<tr>
<td>2007</td>
<td>Preliminary Engineering completed</td>
</tr>
<tr>
<td>2009</td>
<td>Final EIS Approved &amp; Record of Decision Received</td>
</tr>
<tr>
<td></td>
<td>Benesch Design Team begins Final Design</td>
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<tr>
<td>2017</td>
<td>Iowa and Illinois Break Ground for New I-74 River Bridge</td>
</tr>
<tr>
<td></td>
<td>(6/28)</td>
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</tbody>
</table>
North Section – Middle Road to 67th St. (3.3 miles)

Central/South Section - Middle Road (IA) to 27th St. (IL) (4.5 miles)

Significant portion is built off existing alignment
"Bank-to-bank" is about 3,300 feet.

Plate Girder approach spans north and South of the Main Span.

Shallow water on the Illinois Side.

Clear distances between existing and proposed structure:
- 60’ at north (Iowa) end
- 600’ at south (Illinois) end
River Crossing: Iconic Focal point for this Region
I-74 CORRIDOR FEATURES

• Provides 6 through lanes with additional lanes at select locations
• Replace/reconfigure (6) service interchanges
• Construct new River crossing structures along new alignment east of existing bridge
  - provides for 4 12-ft striped lanes each bridge; with 12 ft. shoulder on each side of both bridges
  - Includes a multi-use path (14 ft. clear width) eastbound bridge with connections to paths in Bettendorf and Moline; with overlook extending 20 ft. from edge of path at midspan of EB truss
I-74 CORRIDOR FEATURES

- Corridor-wide improvements include
  - New lighting
  - Intelligent Transportation System (ITS)
  - Landscaping

- Aesthetics features throughout the corridor including aesthetic lighting of the Arch Truss and under-lighting of the River Piers

- Improves local roads (Bettendorf and Moline)
IOWA “LET” PROJECTS

Under construction

- **WB Iowa Viaduct**
  - Iowa (199) & (260)
  - Stand-alone Contract Includes Projects (199) & (260)
  - 2017-2019

- **EB Iowa Viaduct**
  - Iowa (200) & (255)
  - Stand-alone Contract Includes Projects (200) & (255)
  - 2019-2020

- **Mainline & Ramps**
  - Iowa (206) & (219)
  - Stand-alone Contract Includes Projects (206) & (219)
  - 2019-2020

**14th & Brown Streets**
- Iowa (207) & (220)
- Stand-alone Contract Includes Projects (207) & (220)
- 2020

**Median Storm Sewer & Ramp D**
- Iowa (205)
- Stand-alone Contract
- 2020

**Signage Contracts**
- I-74 and Local Roads Signs (219)
- Local Roads Signs (220)

**Iowa Viaduct & Roadway**

**Supply Contracts**
- Light Poles Supply (208)
- Luminaire Supply (209)
- Aesthetic Lighting Supply (235)
- ITS Deployment (211)
- Fiber Optics (222)

**Post Construction Contracts**
- Remove Suspension & Deck Truss Span Mississippi River Bridge (210)
- Remove Truss Span Mississippi River Bridge (214)
- Bettendorf Landscaping, Including Urban Park (258)
- Illinois Landscaping (64/65)

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**benczech**
IOWA “LET” PROJECTS

Let as One Contract:
Under construction

River Bridge Approach Spans
Iowa (197)
Optionally Tied** to (198) or Stand-alone Contract
2017-2020

River Bridge Arch Spans
Iowa (198)
Optionally Tied** to (197) or Stand-alone Contract
2017-2020

**Contractor may bid Projects (197), (198) as separate contracts or a combined bid of (197) and (198) together. The Iowa DOT will select the single bid or combination that provides the best value to the Iowa DOT.

Existing Bridge Demolition 2021

General Plan

Eastbound

Westbound

Proposed I-74

Existing I-74

River Bridge

I-74 Construction Projects
ILLINOIS “LET” CONTRACTS

Mainline & Ramps
Contract 64E26
2018-2020
Recently awarded

Illinois Viaduct & Ramps
Contract 64C08
2017-2020
Under construction

Note that this exhibit shows only the major construction contracts, not including supply contracts, demolition, local roads or landscaping.

I-74 Construction Contracts
ILLINOIS “LET” CONTRACTS

Mainline & Ramps
Contract 64E26
2018-2020

Recently awarded

Note that this exhibit shows only the major construction contracts, not including supply contracts, demolition, local roads or landscaping.
Focus on the Iowa Projects under Construction:

- Main River Span (Arch)
- River Approach Spans and
- Iowa Westbound Viaduct
CONCRETE APPLICATIONS – MAIN RIVER SPAN

Basket Handle True Arch Twin Bridges
CONCRETE APPLICATIONS: MAIN RIVER SPAN
Pedestrian Overlook
90” deep continuous hybrid, weathering steel plate girders
2 course, 10” thick, cast-in-place concrete deck
CONCRETE APPLICATIONS - IOWA VIADUCT
ABUTMENT MASKWALLS
Overall Design Objectives:

- Achieve higher strength capacity
- Extend life of structure / Increase durability
- Facilitate (concrete) placement
- Minimize joints
- Eliminate shrinkage cracks
- To establish quality standards
Applications of Various Concrete Specifications

- Structural Concrete (4500 psi or greater)
- High Performance Concrete
- High Performance Self Consolidating
- Arch Rib Concrete
- Mass Concrete
- Critically Integrally Colored Concrete Overlay
Developmental Specifications for Structural Concrete (4500 psi or greater): DS-15020

- Achieve Higher Strength Capacity
  - Arch Cross Beam Pedestals
  - Arch Structural Deck Slab

Sections 2403 and 2412, and Division 41 of the (Iowa DOT) Standard Specifications applies with modifications as defined in DS-15020
Developmental Specifications for High Performance Concrete (HPC) For Structures: DS-15044

- HPC Concrete
  - Early strength gains
  - Reduced permeability/Higher resistance to chlorides
  - Low creep and shrinkage
Developmental Specifications High Performance Concrete (HPC) For Structures: DS-15044

- Extending Life of Structure
  - Approach Spans Deck (in conjunction with Stainless Steel)

- Increase Durability
  - Maskwalls
  - Abutments
  - Pier Caps under Expansion Joints
Developmental Specifications for High Performance Self Consolidating Concrete (HP-SCC): DS-150170

- **Specified for:**
  - Approach Spans Columns
  - Viaduct Pier Columns

- **Meet Design Objectives:**
  - Increase durability
  - Facilitate concrete installation
  - Minimize joints
APPROACH SPAN PIERS
Oversize Tank Barge (Empty) Tow

2869 KIP (LONG.)
1435 KIP (TRANS.)

OVERSIZE TANK BARGE
(EMPTY) TOW

OVERSIZE TANK BARGE
(FULLY LOADED) TOW

5252 KIP (LONG.)
2626 KIP (TRANS.)

CESSION EL. 562.0
NORMAL POOL EL. 561.0

EL. 557.0
OVERSIZE TANK BARGE (LOADED) RUNAWAY

2630 KIP (TANKER) (LONG.)
1315 KIP (TANKER) (TRANS.)

500 YR. H.W. EL. 573.04
NORMAL POOL EL. 561.0
EL. 557.0
CONCRETE APPLICATIONS

- Challenges for Approach Piers
  - Rebar congestion due to design for vessel collision loads and Seismic Zone 3 detailing
  - Tall Columns
  - Westbound Viaduct Piers similar
Developmental Specifications for High Performance Self Consolidating Concrete (HP-SCC): DS-150170

- Limitations:
  - Control the heat of hydration
  - Added pressures due to the use of self-consolidating concrete and tall pours
  - Requires additional quality control measures
HP-SCC limitations addressed as follows:

- Meet Developmental Specification for Mass Concrete-Control of Heat of Hydration
- Submit QC Plan developed by a PE licensed in State of Iowa
- Perform Trial Batch Concrete – approval will be based on trial batch mix properties and trial batch report
- Perform a Field Demonstration by casting mockup of a Pier
- Design falsework and forms for full hydrostatic head pressure of concrete
- Match color of conventional concrete when poured against conventional concrete; mockup is required
CONCRETE APPLICATIONS

Special Provisions for Arch Rib Concrete: SP-150200

- Defines the requirements for furnishing and installing concrete for the Arch Rib and Cross Beam for Piers 12 and 13
CONCRETE APPLICATIONS: ARCH RIB CONCRETE
CONCRETE APPLICATIONS: ARCH RIB CONCRETE

Arch Rib Concrete (typ)

Cross Beam

Construction Jt.

Arch Span- Hybrid Foundation
Challenges for Arch Rib/Cross Beam

- Rebar congestion due to design for vessel collision loads and Seismic Zone 3 detailing
- Manage the location of Construction joints

Design Objectives for Arch Rib/Cross Beam

- 100 year design life
- Transfer of forces from the Steel Ribs to the foundation
CONCRETE APPLICATIONS: ARCH RIB CONCRETE

• Arch Rib Concrete Special Provision Allows Options:
  - High Performance Self Consolidating Concrete
  - High Performance Concrete

• Requires submittal of Quality Control Plan developed by PE licensed in State of Iowa

• Requires Contractor to perform:
  - Trial Batch Concrete – approval based on trial batch mix properties and trial batch report
  - Field Demonstration by casting mockup of the Arch Rib at most congested reinforcement section
Developmental Specifications for Mass Concrete - Control of Hydration: DS-15032

- Produce a structure free of shrinkage cracks that would be a result of heat of hydration during the curing
  - Appropriate concrete mix design
  - Management of concrete temperature
  - Management of temperature differential
Developmental Specifications for Mass Concrete - Control of Hydration: DS-15032

- Applies to
  - Concrete footing with a least dimension greater than 5 feet
  - Other concrete placements with a least dimension greater than 4 feet

- Additional requirements for when the least dimension greater than 6.5 feet

- Does not apply to concrete drilled shafts.
Developmental Specifications for Mass Concrete - Control of Hydration: DS-15032

• Requires Thermal General Control Plan
  - standard of care for mass concrete members,
  - ambient temperature assumptions,
  - incoming concrete temperature assumptions,
  - critical dimension assumptions
  - material properties

• This document accompanies each thermal control plan for the structural elements defined in Contract Docs
TCP Plans are submitted for the following:

- All pier stems with a critical dimension of 4 ft. 2 in.
- All pier stems with a critical dimension of 6 ft. 2 in.
- All pier caps with Mass Structural concrete
- All pier caps with HPC Structural concrete
- All footings with Mass Structural concrete
- All footings with HPC Structural concrete
- Pier 12 and 13 Pedestals, Ribs and Crossbeams
TCP plans with a least dimension of greater than 6.5 feet have additional requirements:

- Developed by PE licensed in State of Iowa
- Proposed methods to achieve required concrete temperature & control concrete temperature differential to prevent thermal cracking during both warm and cold weather
- Information on the temperature sensing and recording equipment to be used
TCP plans with a least dimension of greater than 6.5 feet have additional requirements:

- Mass concrete placement plan to ensure prevention of concrete cold joints
- Provide specific options for controlling the temperature gradient for both warm and cold weather placements
- Applies to all footing elements, all pedestal and extended pedestal elements, all rib elements and all cross beam elements (excluding the cross beam pedestals)
CONCRETE APPLICATIONS: MASS CONCRETE

Figure 1: EBP4 Footing Elevation

Figure 2: EBP4 Footing Section View
CONCRETE APPLICATIONS: MASS CONCRETE

Figure 1: Example of sensor locations for pier stem and upper pier stem on elevation view.
Special Provisions for Critically Integrally Colored Concrete Overlay: DS-150204

Design Objectives:

- Achieve Aesthetic Objectives
- Increase durability
- To establish quality standards
CONCRETE APPLICATIONS - COLORED CONCRETE OVERLAY
Concrete Colored Mockup Submittal
- At least 60 days prior to production work
- Location selected by Engineer
- Finish one 10ft x 10 ft area simulating location defined in plans
- Acceptance is per visual and slip-resistance project defined standards
- Remains at site throughout completion of work for use as quality standard for finished work
CONCRETE DELIVERY - ARCH & APPROACH

- Concrete Mix Supplier: Hahn Ready Mix
- Plant Locations:
  - Davenport (existing facility)
  - Riverstone (new facility expect early 2018)
- Arch & Approach Piers (currently):
  - Davenport over I-74 to IL DOT side then onto barges
  - 3 to 5 trucks per barge
- Arch Pier 13 & Approach Piers 14 and 15:
  - Use slick-line with Barges (Iowa side)
CONCRETE DELIVERY: CHALLENGES

Environmental Sensitive Areas

Moline

Bettendorf
CONCRETE DELIVERY: CHALLENGES

Protection of Bettendorf Levee System
CONCRETE DELIVERY - ARCH & APPROACH

**OUTLINE**

- CONCRETE DELIVERY - ARCH & APPROACH

**Slick-Line**

**Pier 13**

**FULL-SIZE BARGE LIGHTING**

**PORTABLE BARGE LIGHTING**

**MOORING PILE MARKING**

**ELEVATION**

CATWALK, BARGE, AND MOORING PILE WILL BE IN PLACE FROM AUGUST 1, 2017 UNTIL DECEMBER 31, 2020. ALL MOORING PILE WILL BE REMOVED FLUSH TO EXISTING RIVER BOTTOM UPON PROJECT COMPLETION.
CONCRETE DELIVERY - ARCH & APPROACH
CONCRETE PLACEMENT - ARCH & APPROACH
Concrete Mix Supplier: Hahn Ready Mix

Plant Locations:
- Davenport
- Moline as backup

Viaduct Piers:
- All piers on land
- Easily accessible by trucks
OUTLINE

CONCRETE PLACEMENT - WB VIADUCT

- Crane and bucket will be used to pour concrete into the hoppers
- Section 1 will be placed with hopper/tremie system flowing through pour window 1
- Section 2 will be placed with hopper/tremie system flowing through pour window 2
- Section 3 will be placed with hopper/tremie system
- Section 4 will be placed with hopper/tremie system
- Section 5 will be placed directly from the bucket
- Concrete will have a free fall distance of less than 6" at all times

Approximately 9 FT to start and cut incrementally until within 6 FT of top
CONCRETE DELIVERY - VIADUCT
## CONCRETE BY THE NUMBERS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CY</th>
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<tbody>
<tr>
<td>HP SELF-CONSOLIDATING CONCRETE (HP-SCC)</td>
<td>5,347</td>
</tr>
<tr>
<td>STRUCTURAL CONCRETE (BRIDGE)</td>
<td>49,365</td>
</tr>
<tr>
<td>HIGH PERFORMANCE STRUCTURAL CONCRETE</td>
<td>19,708</td>
</tr>
<tr>
<td>STRUCTURAL CONCRETE 4500 PSI (31 MPA) OR GREATER</td>
<td>3,714</td>
</tr>
<tr>
<td>ARCH RIB CONCRETE</td>
<td>8,312</td>
</tr>
<tr>
<td>CRITICAL INTEGRALLY COLORED CONCRETE OVERLAY</td>
<td>75</td>
</tr>
<tr>
<td>CONCRETE DRILLED SHAFT, 84 IN. DIAMETER</td>
<td>8,071</td>
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<tr>
<td>CONCRETE DRILLED SHAFT, 114 IN. DIAMETER</td>
<td>761</td>
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<tr>
<td>CONCRETE DRILLED SHAFT, 120 IN. DIAMETER</td>
<td>2,947</td>
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<td>Total Iowa Bridge Concrete</td>
<td>98,300</td>
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Total Bridge (Iowa + IL) Concrete 118,564
THANK YOU!

QUESTIONS?