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# Jane Addams Memorial Tollway (I-90) Fox River Bridge

*Traffic Needs Drive Innovative Solutions*

Scott Eshleman, P.E., S.E, CVS, *Stanley Consultants*  
Keith Sargent, P.E., *Thomas Engineering Group, LLC*

February 28, 2017

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# Project Team

**Project Owner: Illinois Tollway**



**Design Section Engineer (DSE):  
Stanley Consultants Inc.**



**Construction Manager (CM):  
Chastain-Thomas Joint Venture**



**Design Corridor Manager (DCM):  
BV3 (Benesch/V3 Joint Venture)**



**Construction Corridor Manager  
(CCM): OMEGA Associates**



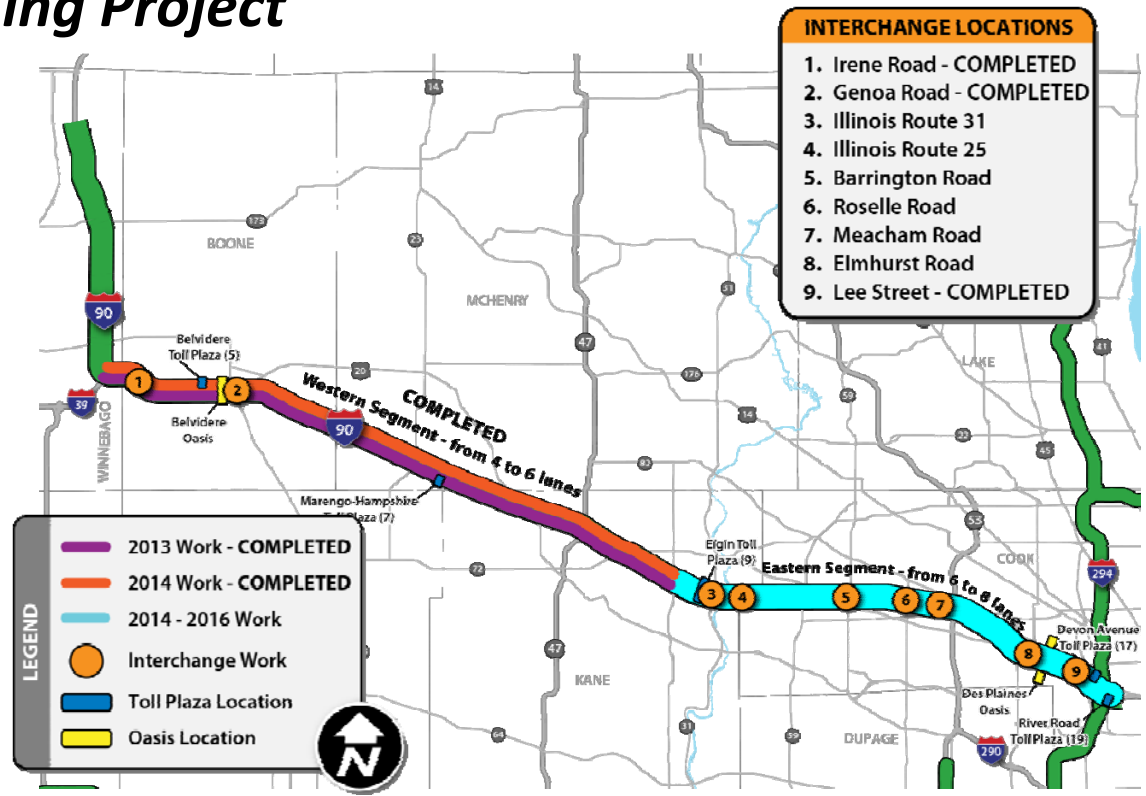
# Jane Addams Memorial Tollway (I-90) *Rebuilding and Widening Project*

Mainline completed  
Rockford to Tri-State  
Tollway (I-294)

Delivering interchange  
ramps

Implementing I-90  
SmartRoad

Includes \$95 million Fox  
River Bridge Project



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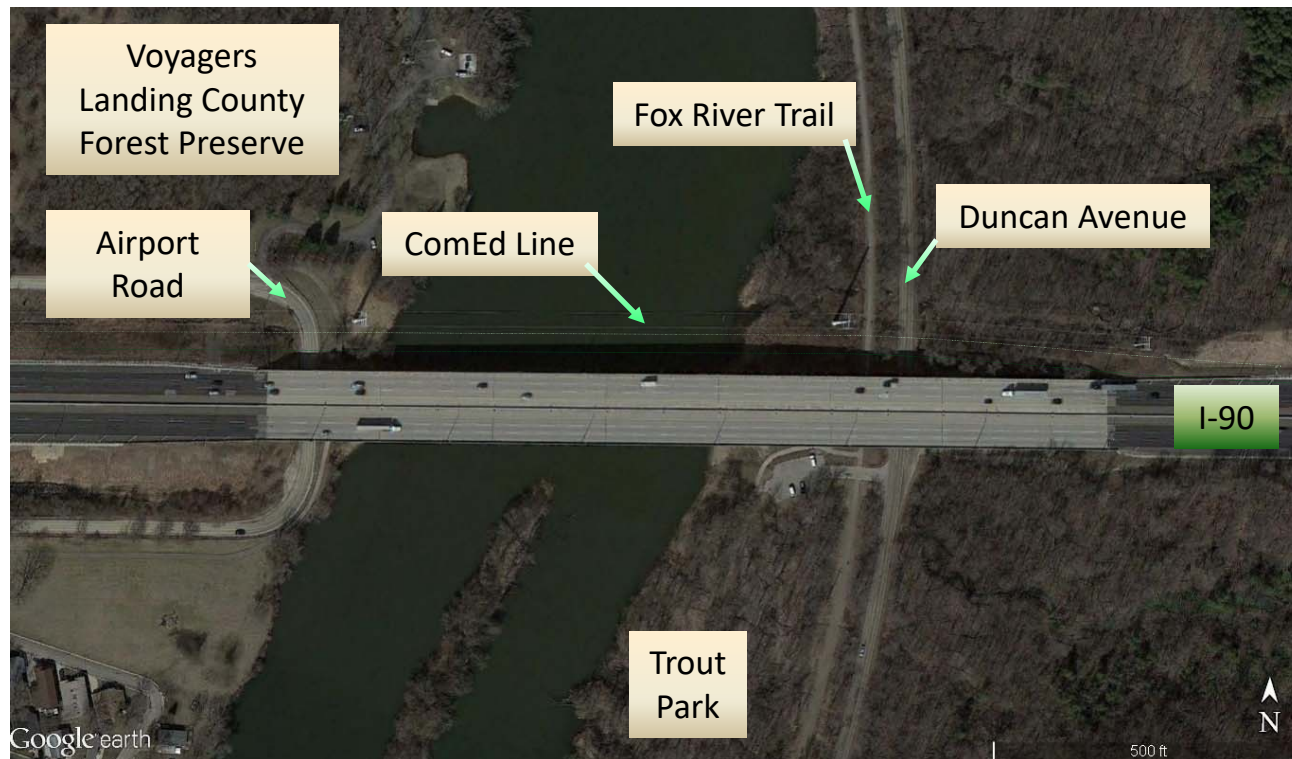
# Fox River Bridge Project Location



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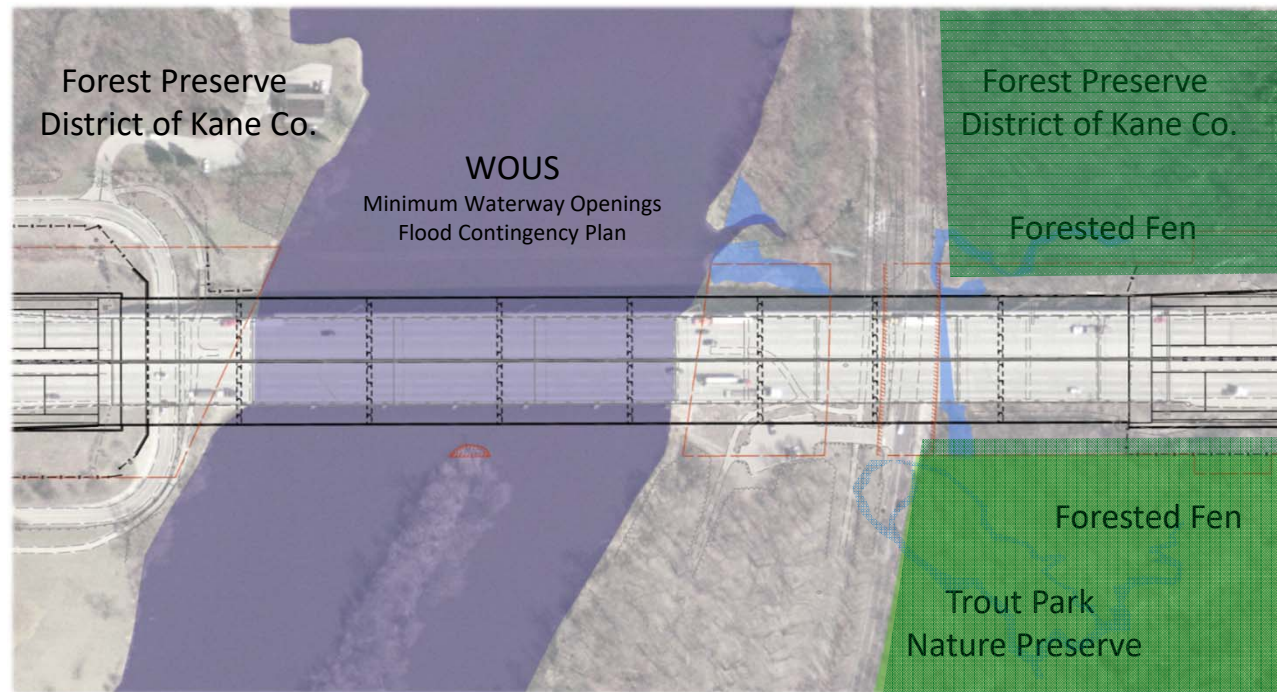
# Project Site Features



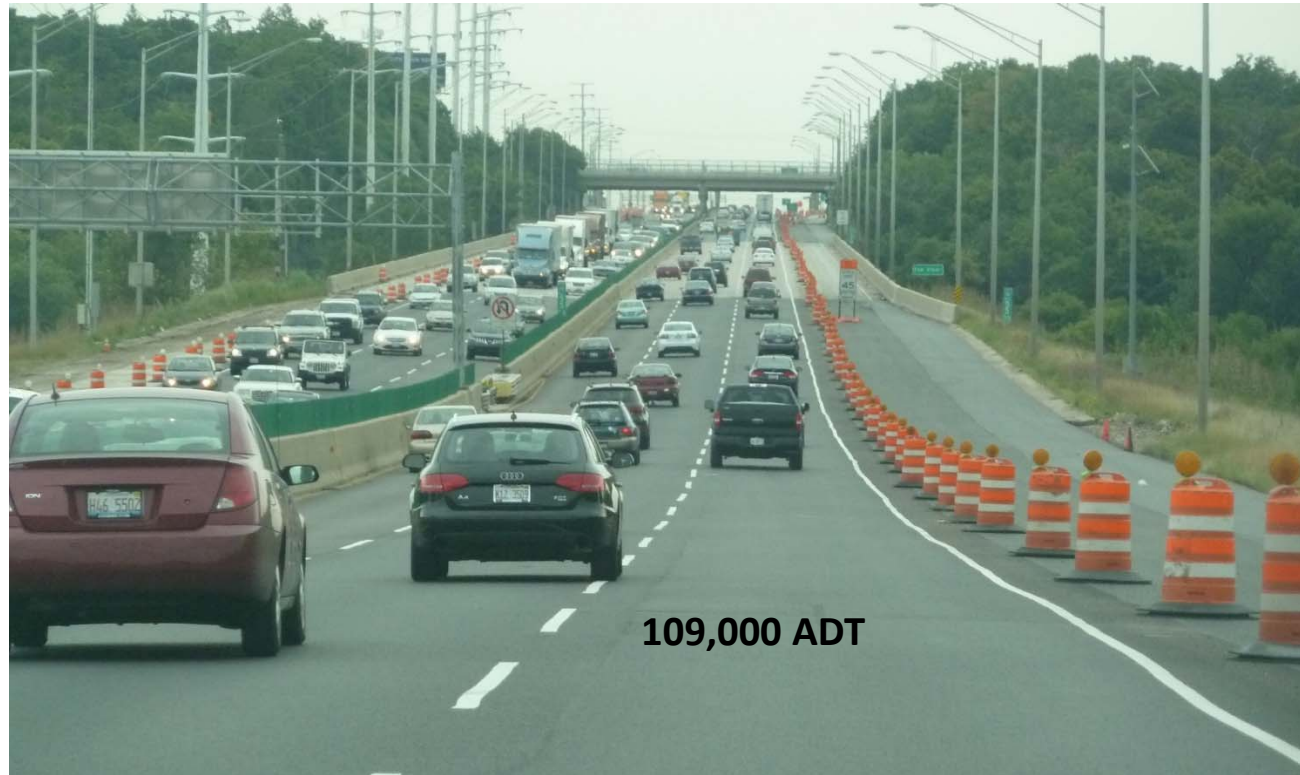
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# Environmental Awareness

Construction blackout period April 1 to June 15 (fish spawning)



## Original Six-lane Bridge



109,000 ADT



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# Six Spans Over The Fox River



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## Bridge Inspection Findings

### Extensive past beam repairs

- concrete encasement
- carbon fiber wrap

### Continued spalling indicated beams near end of useful life

### Expansion joints at every other pier (8 total)

### Failed joints affect not only beams, but piers below



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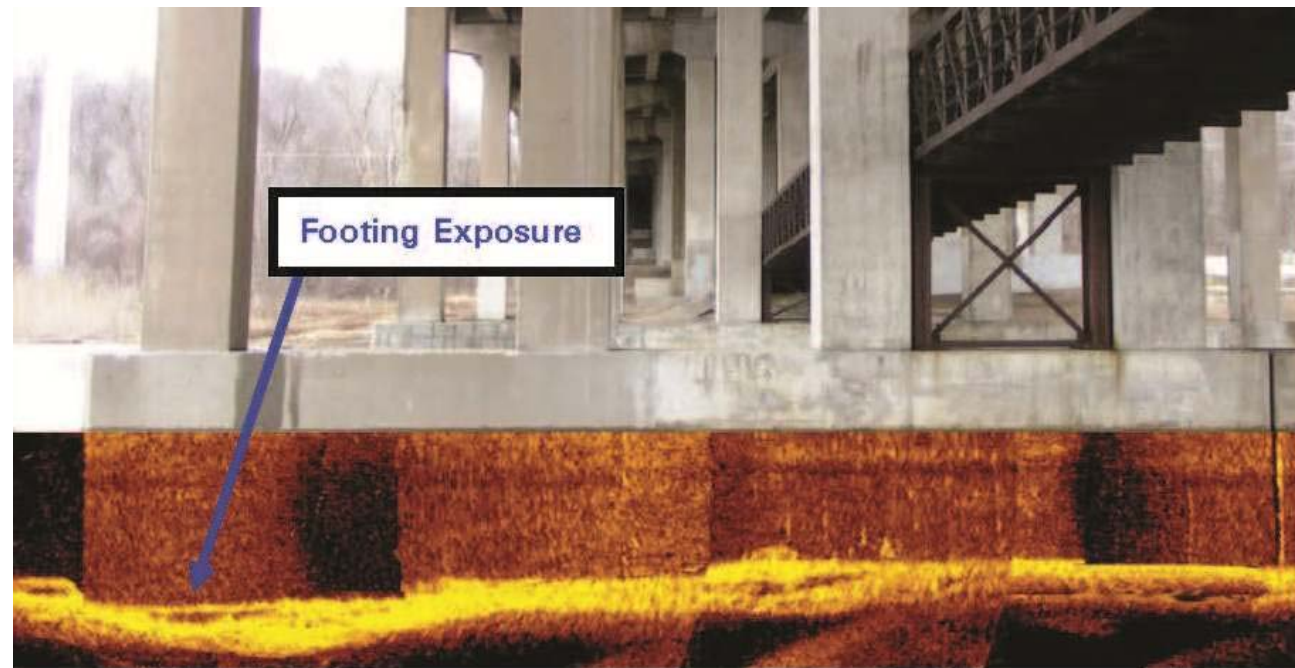
## Expansion Joint Locations Evident





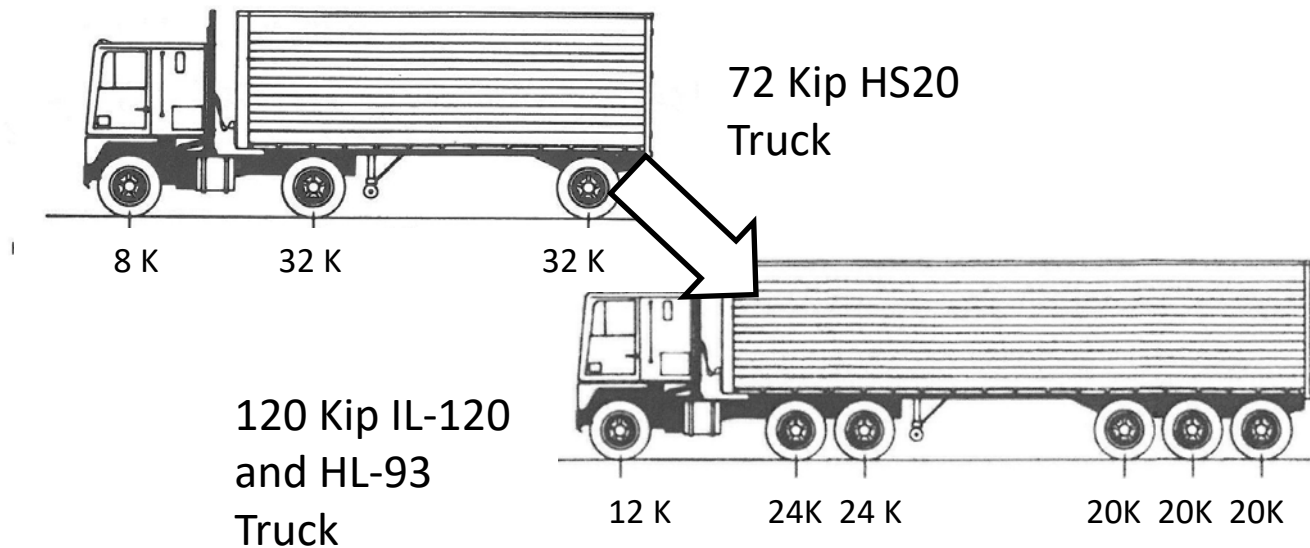
# Bridge Inspection Findings

4 of the 7 water piers were scour critical



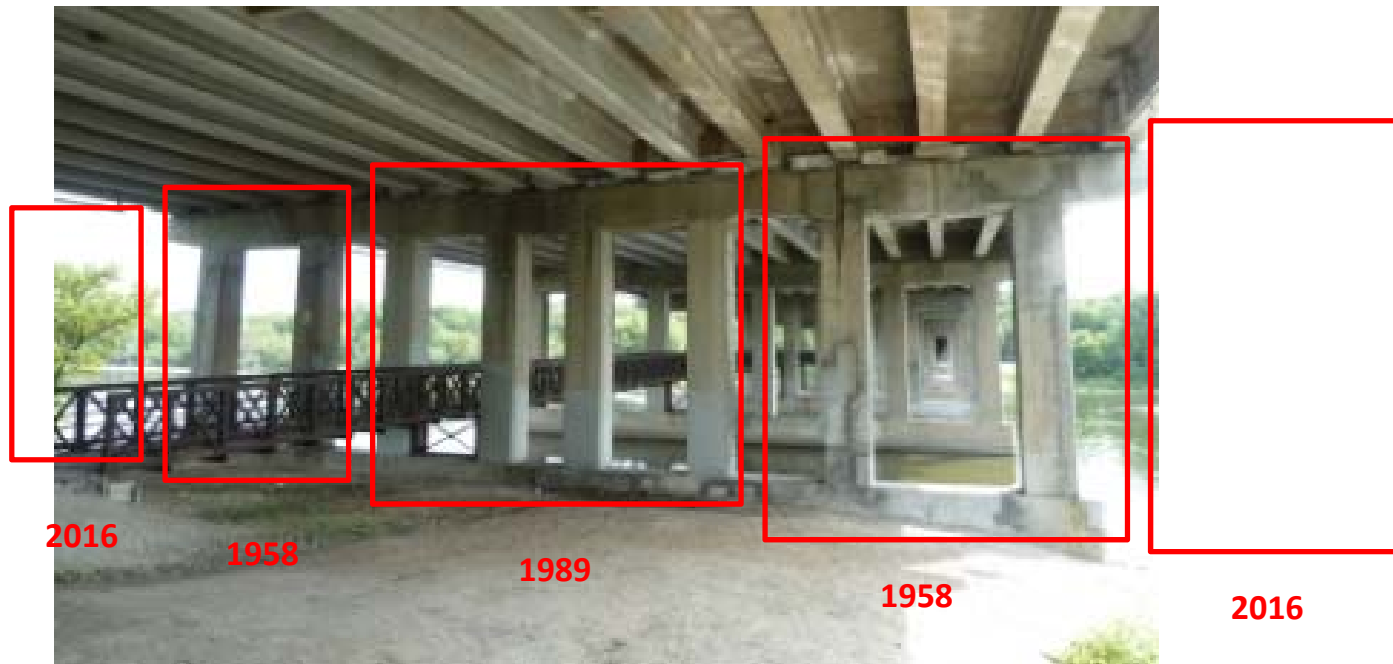
# Replacement Considerations

Replacement would allow use of more efficient bridge members and spacing to support IL-120 live loads



# Replacement Considerations

Replacement would eliminate requirement for continual substructure maintenance



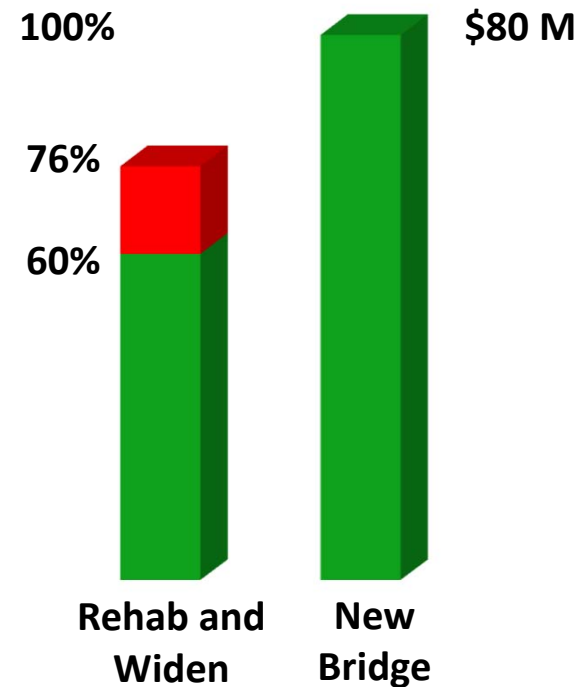
# Bridge Condition Report Recommendation

## Cost Consideration:

Rehab & Widen = 76 % of New Bridge

## Conclusion:

Costs and overwhelming logistical reasons warrant Complete Replacement

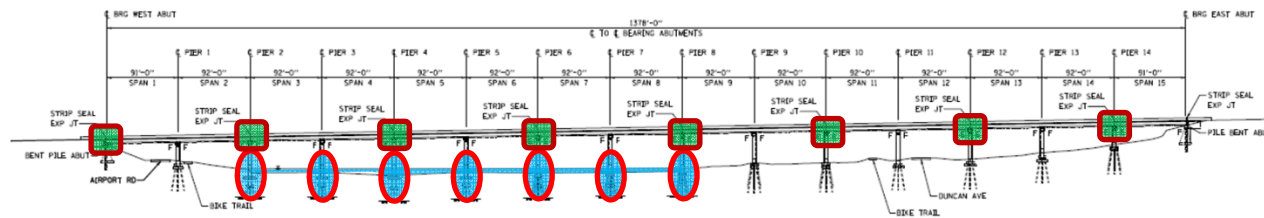


## Bridge Type Study Alternatives

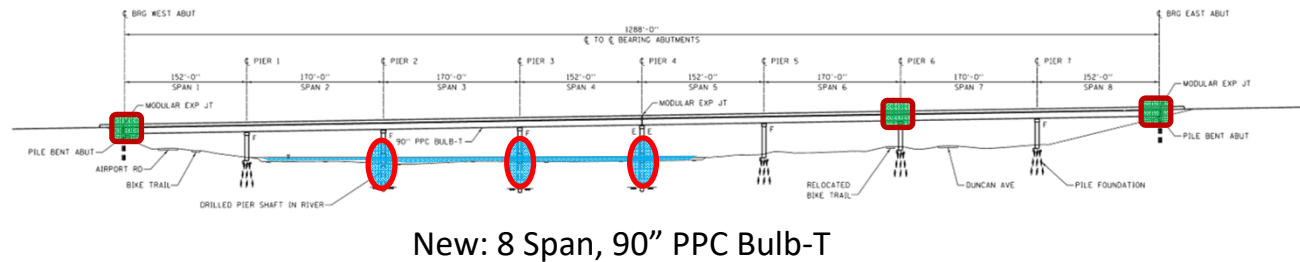
Option	Size
In-Kind Replacement (From BCR)	92' spans
Alt 1: 72" PPC Bulb-T, (med spacing)	135' spans
Alt 2: 90" PPC Bulb-T, (extra wide spacing)	135' spans
<b>Alt 3: 90" PPC Bulb-T, Long Span</b>	<b>up to 170' spans</b>
Alt 4: Spliced PPC Bulb-T	up to 230' spans
Alt 5: Steel Plate Girder	up to 230' spans
Alt 6: Haunched Steel Plate Girder	up to 350' spans
Alt 7: Precast Concrete Arch	200' spans



# Chose 90" PPC Bulb-T Long Span



Existing: 15 Span, 54" & 60" PPC Beams



New: 8 Span, 90" PPC Bulb-T

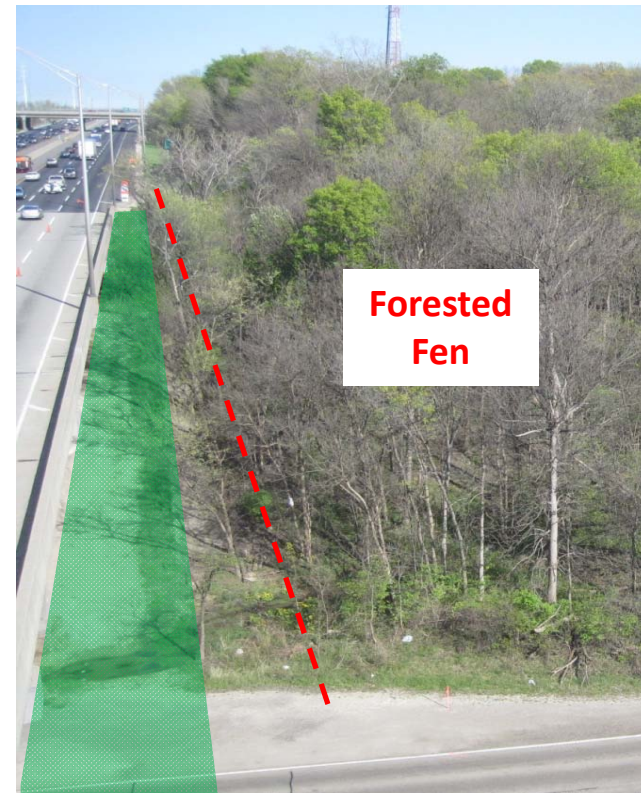
**8 Expansion Joints Down to 3**

**7 Piers in Water Down to 3**





# Constraints To Beam Erection From Below

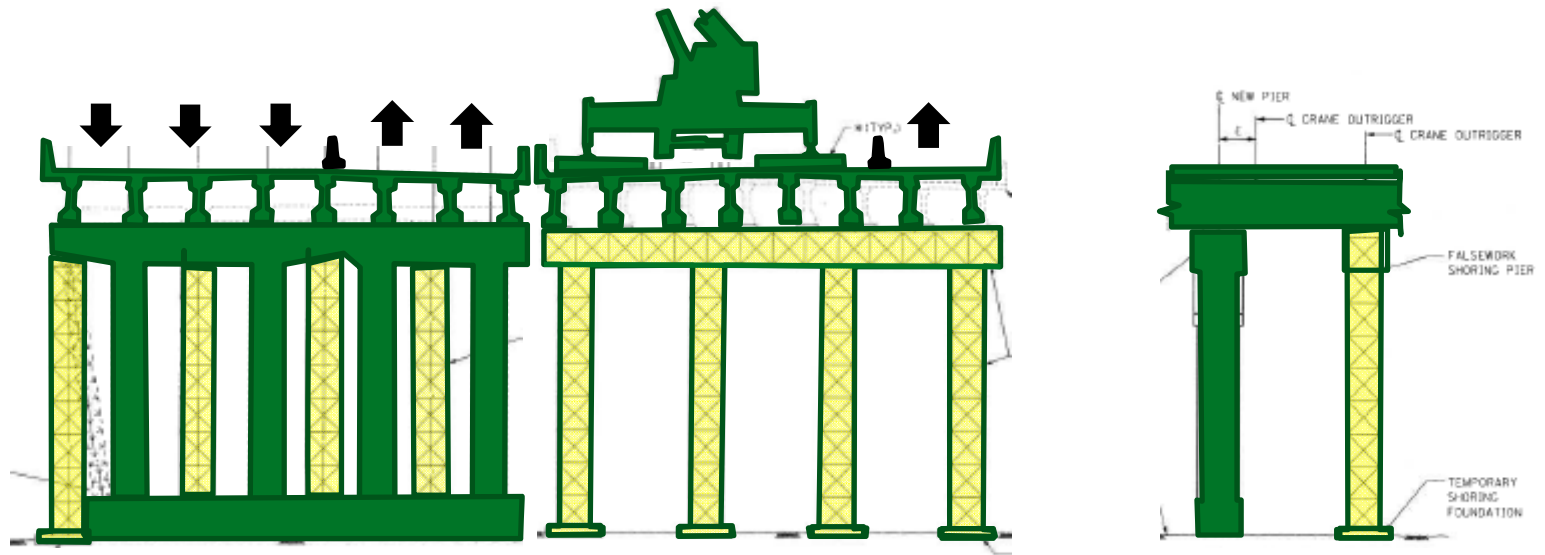


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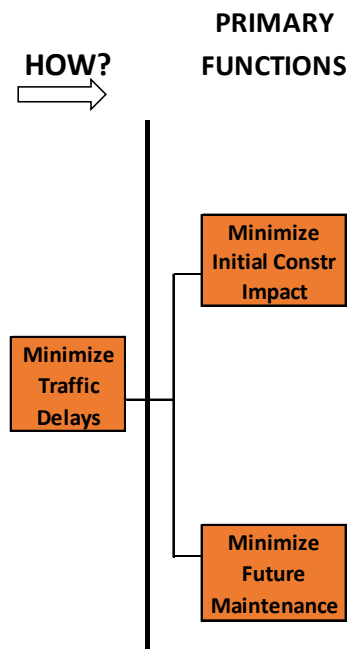
## Crane on Bridge ➡ Big Challenges

Poor condition of existing bridge requires extensive crane mats and temporary supports/cribbing of pier caps and beams

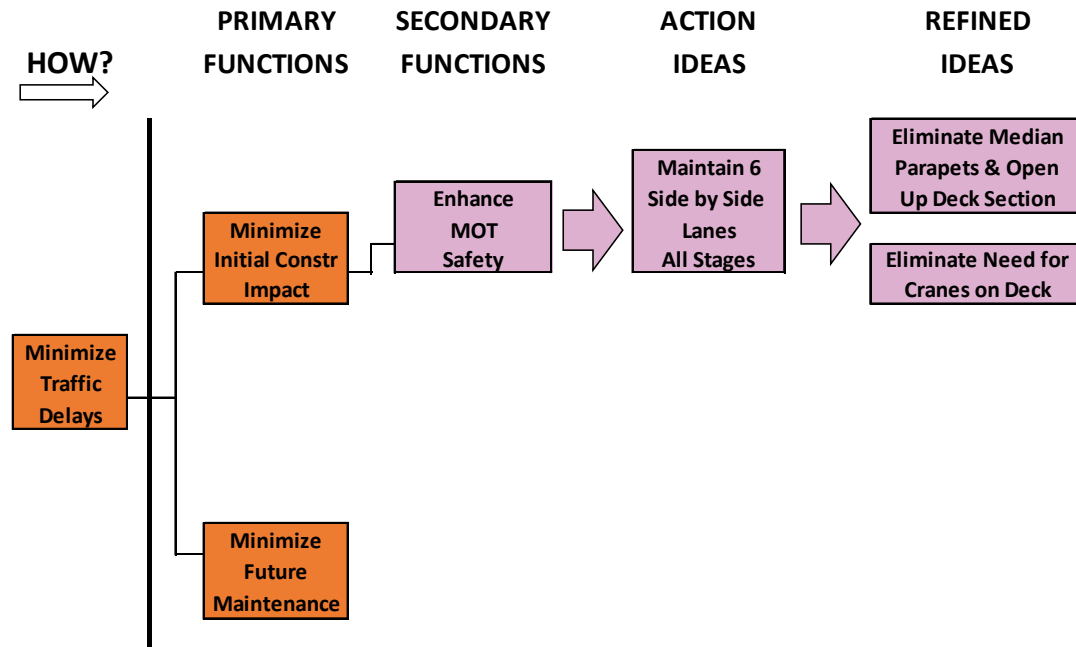
Limited work area for crane on deck and six lanes of traffic



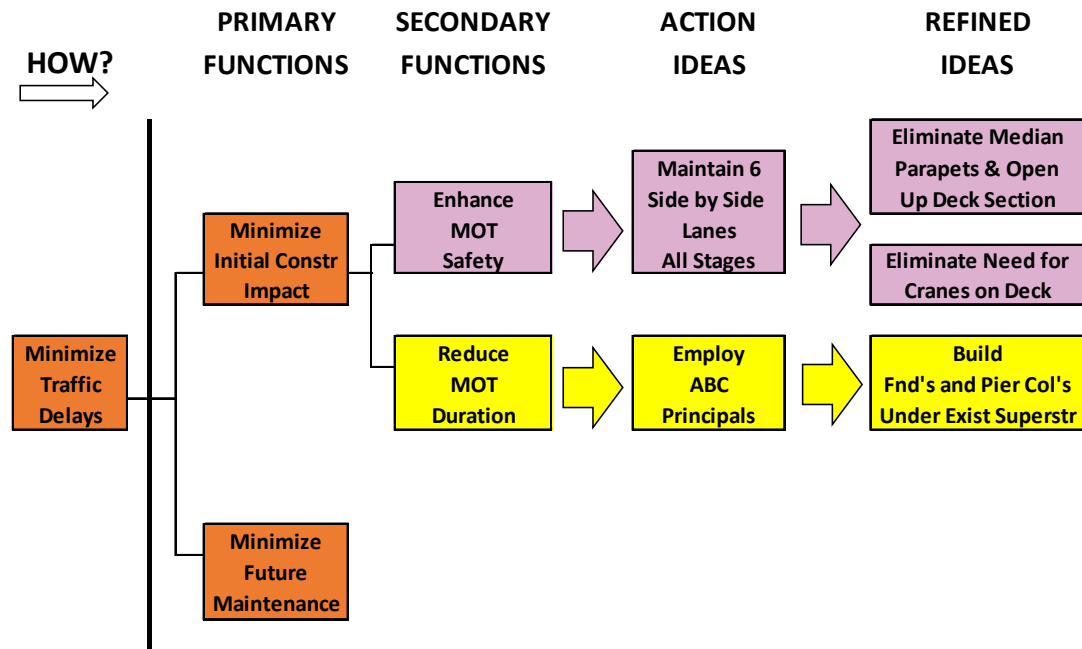
# Function Logic Drives Innovative Ideas



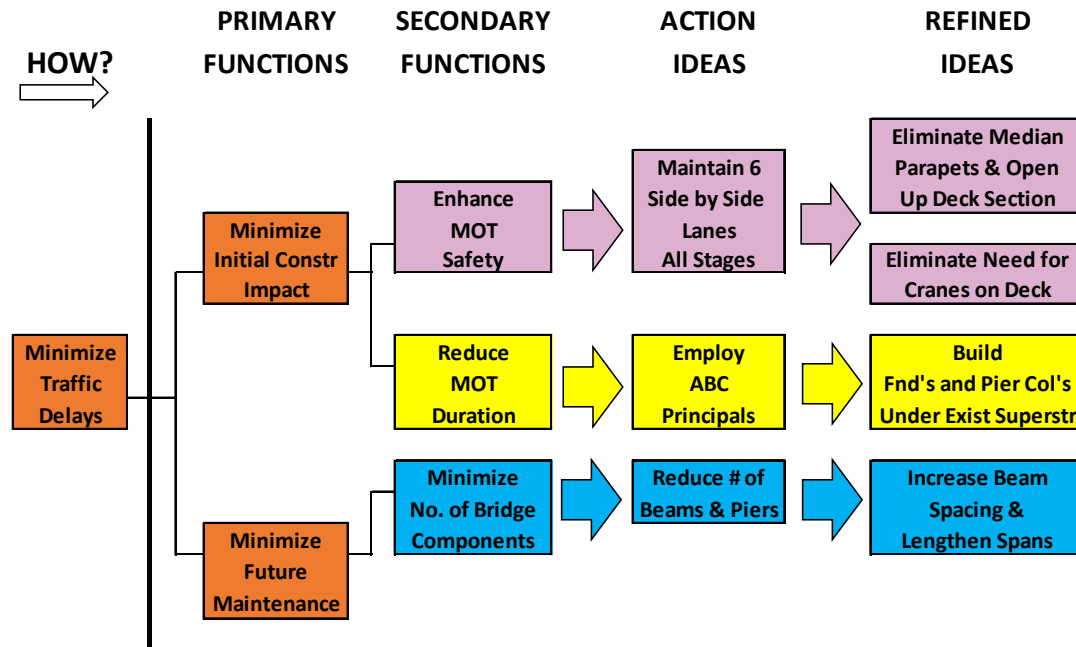
# Function Logic Drives Innovative Ideas



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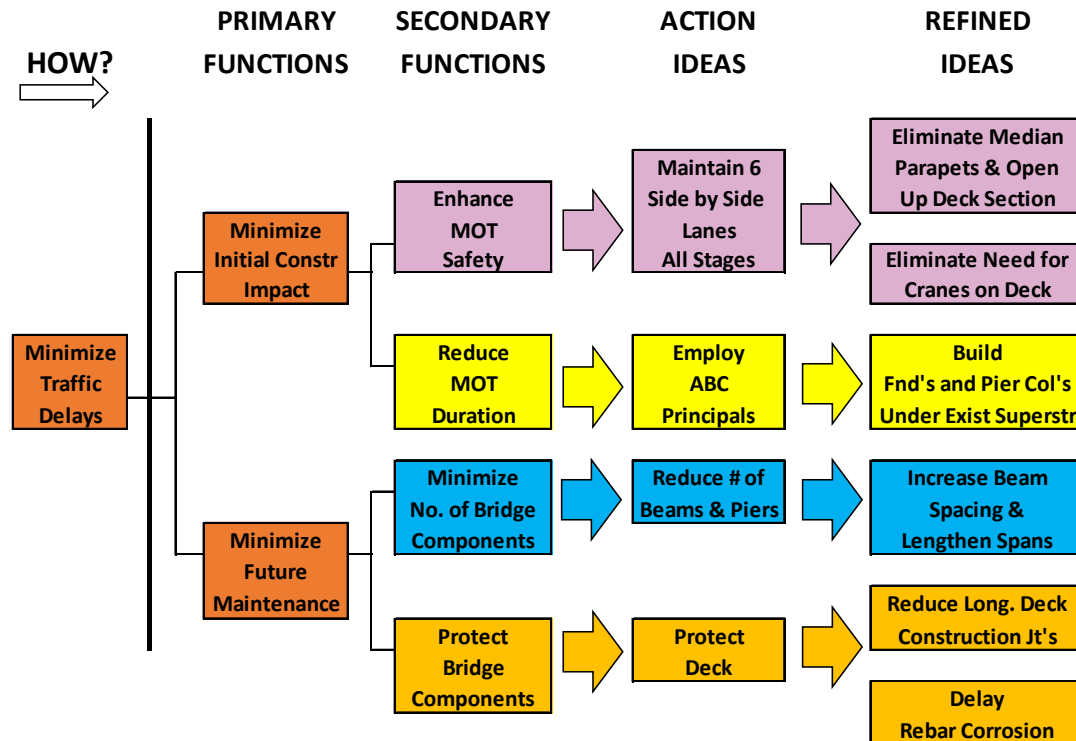


# Function Logic Drives Innovative Ideas

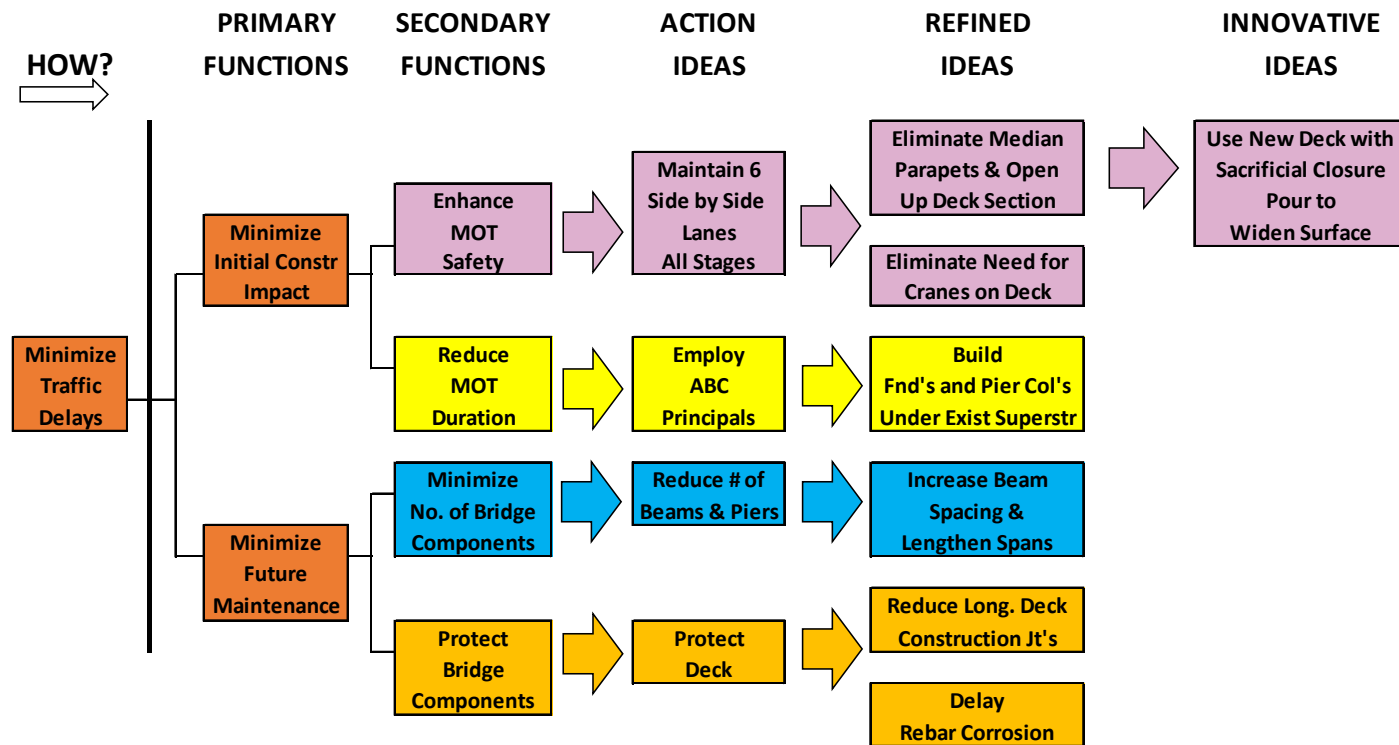




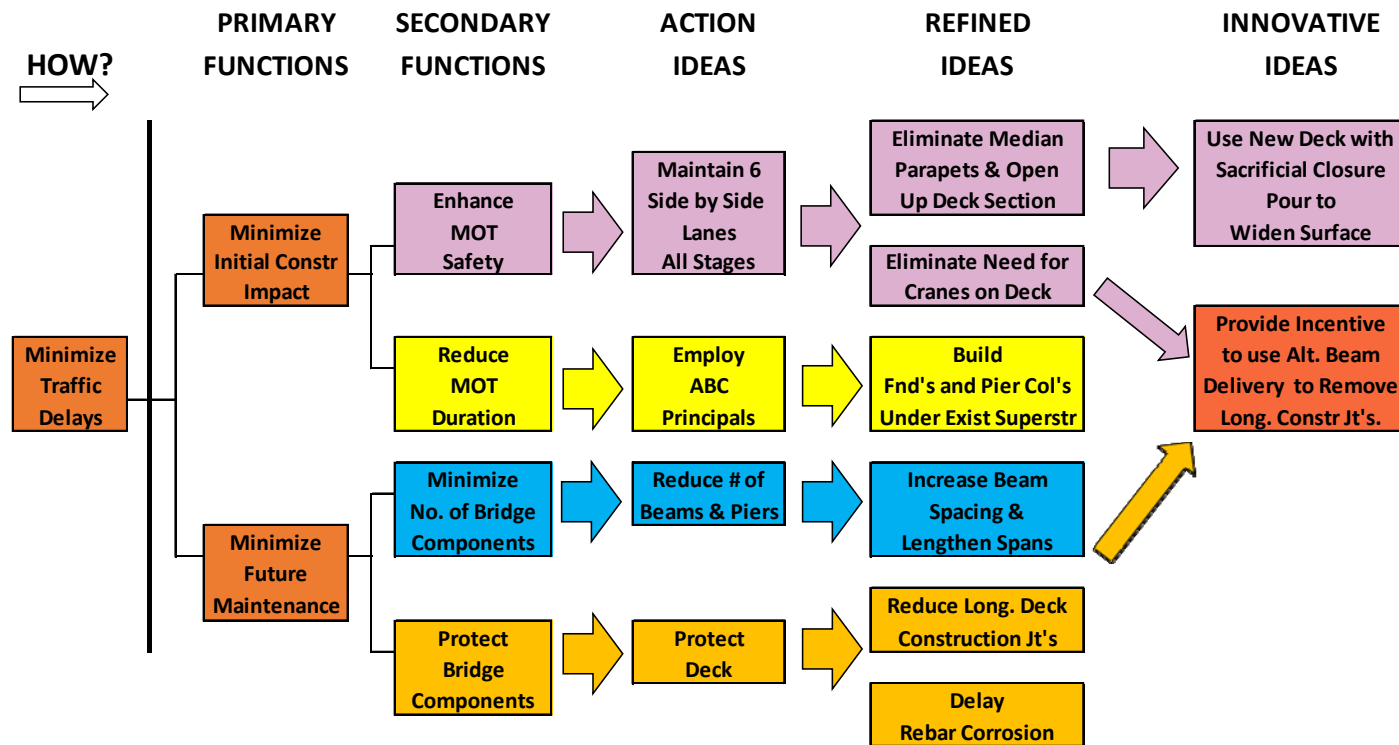
# Function Logic Drives Innovative Ideas



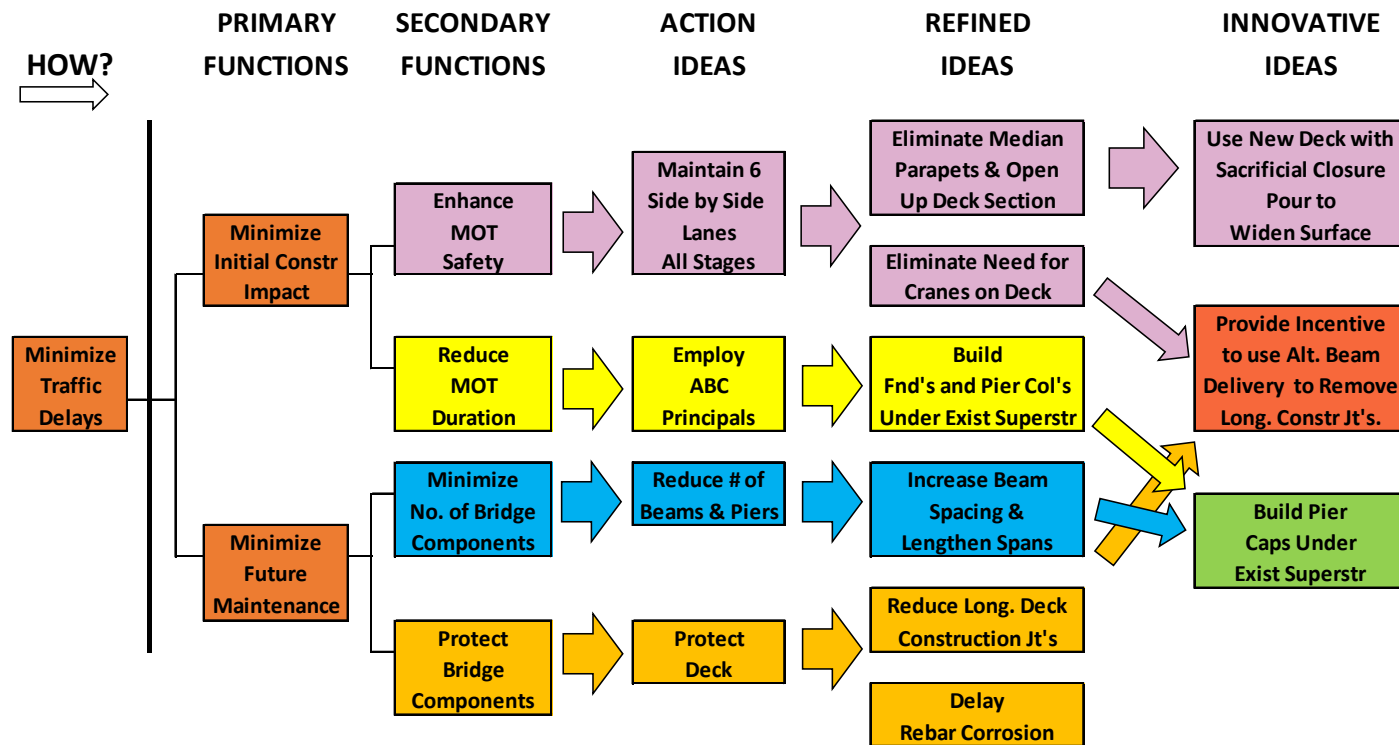
# Function Logic Drives Innovative Ideas



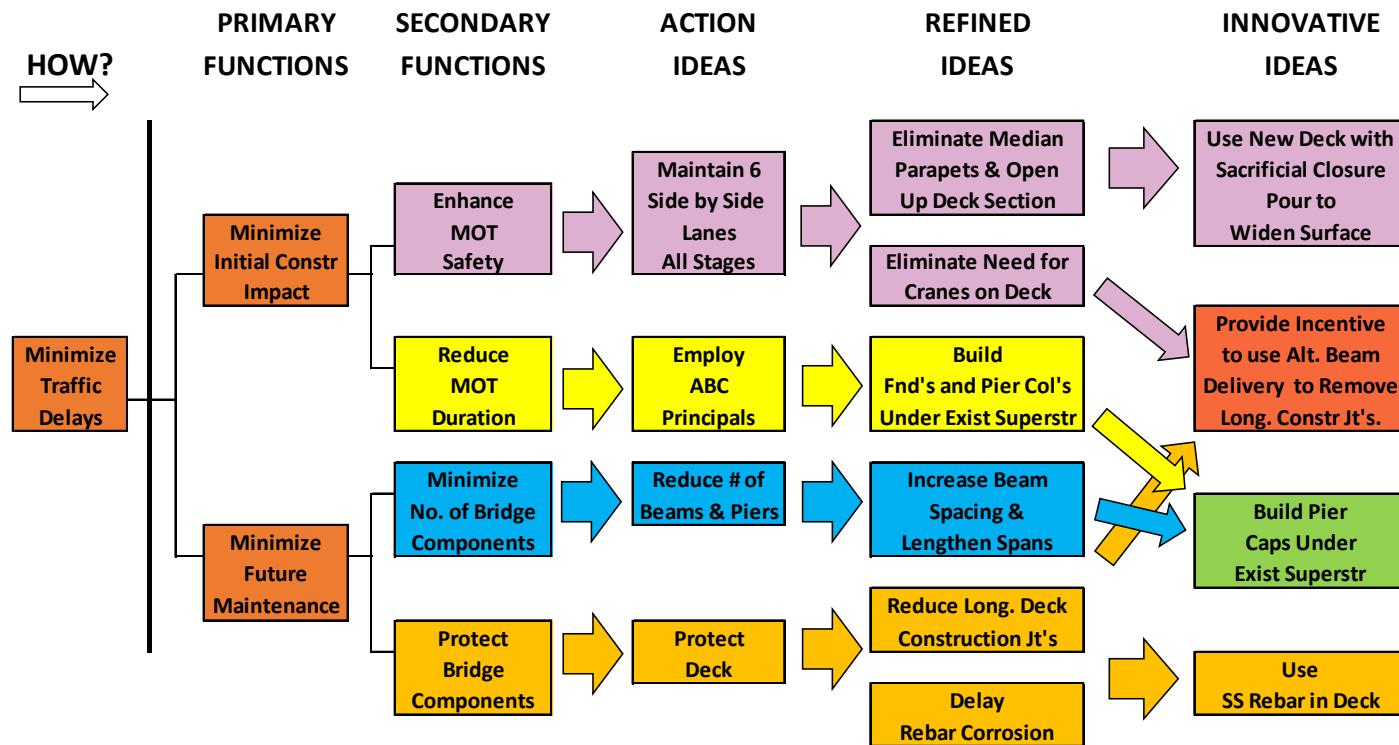
# Function Logic Drives Innovative Ideas



# Function Logic Drives Innovative Ideas



# Function Logic Drives Innovative Ideas



# New Bridge Facts

8-span structure (spans are 150' to 170')

PPC Bulb-T's weigh up to 200,000 pounds and are 90" tall

Length = 1,315', width = 167', 1.7 % longitudinal grade

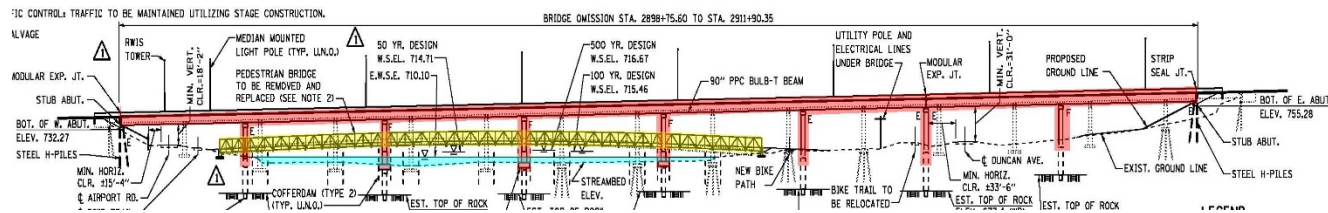
Deck line 40' to 50' above water surface

3 expansion joints

Tollway's expected deck lifespan is 75 to 100 years



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## Moving Into Construction...

Project advertised on March 13, 2014

Bids opened on April 10, 2014

Low bidder: Kenny-Kraemer Joint Venture

Contract award: \$75,412,944.69

Notice to Proceed granted May 30, 2014

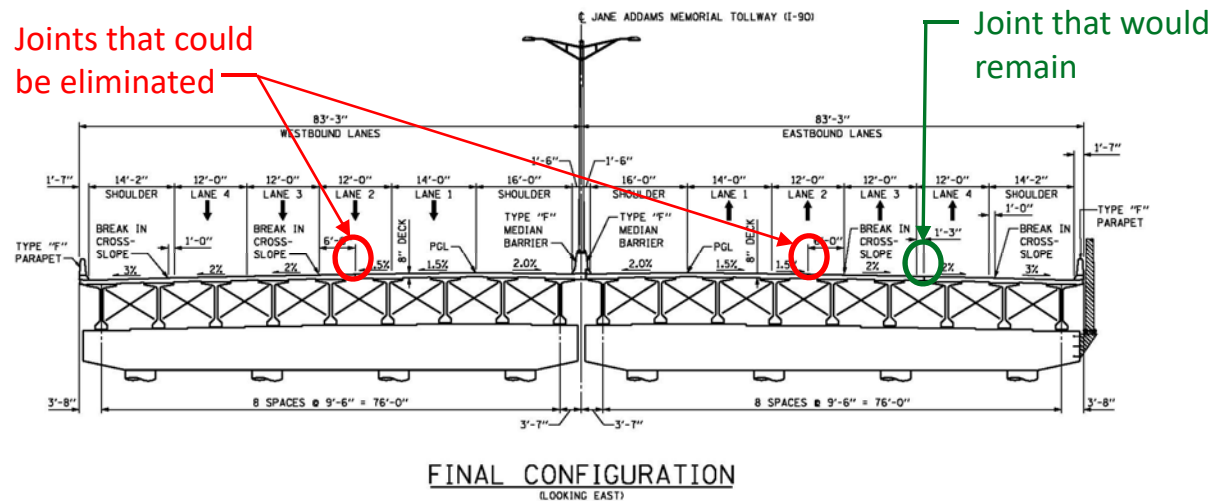
Mobilization began June 23, 2014



# Specialized Beam Erection Alternative

Project designed for conventional beam erection

Alternate bid beam erection would allow the elimination of sub-stages and long-term longitudinal deck joints



# Project Bid Tabulations

Alternate Bid – Specialized Beam Erection			
	<i>Kenny-Kraemer JV</i>	<i>Bidder 2</i>	<i>Bidder 3</i>
Base bid	<b>\$73.2M</b>	\$75.6M	\$76.3M
Incentive	\$2.2M	\$2.2M	\$2.2M
Total value	\$75.4	\$77.8M	\$78.5M

**Awarded low bid was 5 percent below engineer's estimate**

**Bids were tight with only a \$3.1 million variance between high and low bid**

Standard Bid		
	<i>Bidder 4</i>	<i>Bidder 5</i>
Bid	\$74.4M	\$79.2M



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## Special Materials

### **Bridge deck constructed of “high-performance concrete”**

- Reduced shrinkage potential, which will help lengthen the bridge lifespan

### **Bridge deck constructed with stainless steel reinforcement bar**

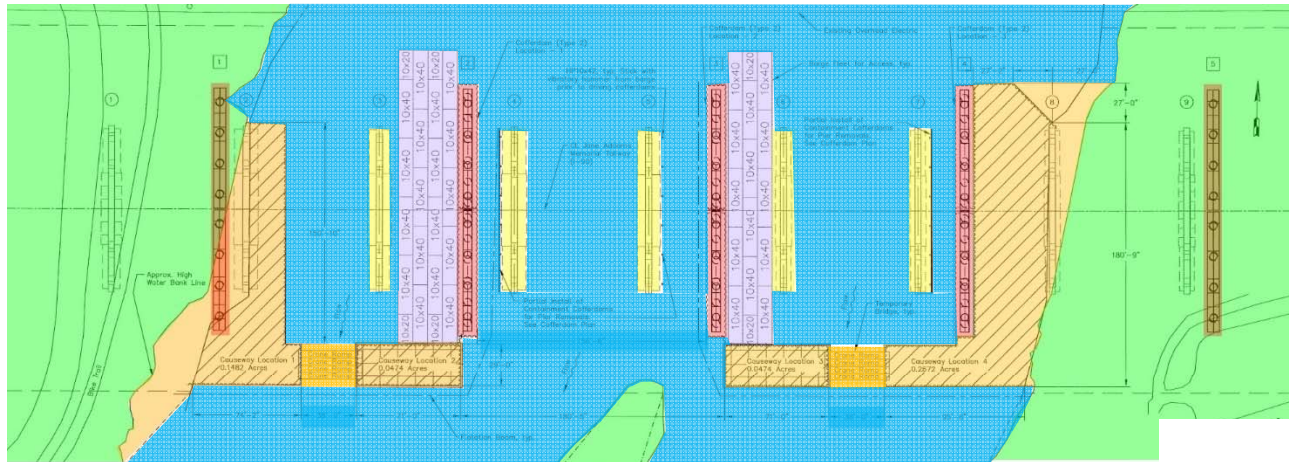
- Special handling required – cannot touch other metal

### **Mass concrete structures (minimum 5-foot dimension)**

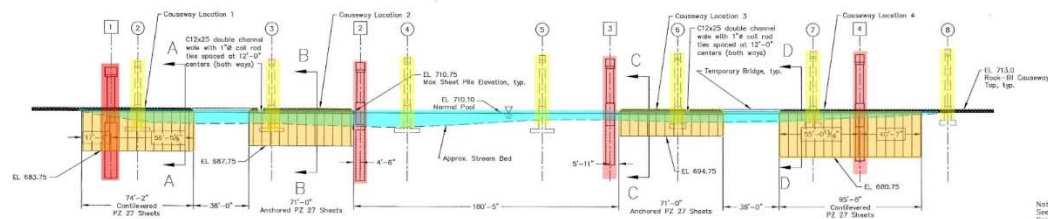
- Temperatures monitored to make certain differentials do not exceed 35° F



# Fox River Temporary Causeway



Causeway Plan



Causeway Elevation



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# Fox River Temporary Causeway



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## Fox River Temporary Barge



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## Substructure Construction

- **Four land-based piers founded on four 6' dia. drilled shafts with 11'-0" rock sockets**
- **Three water-based piers founded on six 5' dia. drilled shafts with 11'-0" rock sockets (included fender wall)**
- **All piers had four 5' dia. columns with wider pier caps**
- **Piers constructed underneath existing bridge prior to stage construction!**
- **Abutments founded on two rows of piles and built in stages (unlike piers)**





# Substructure Construction



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# Substructure Construction



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# Substructure Construction



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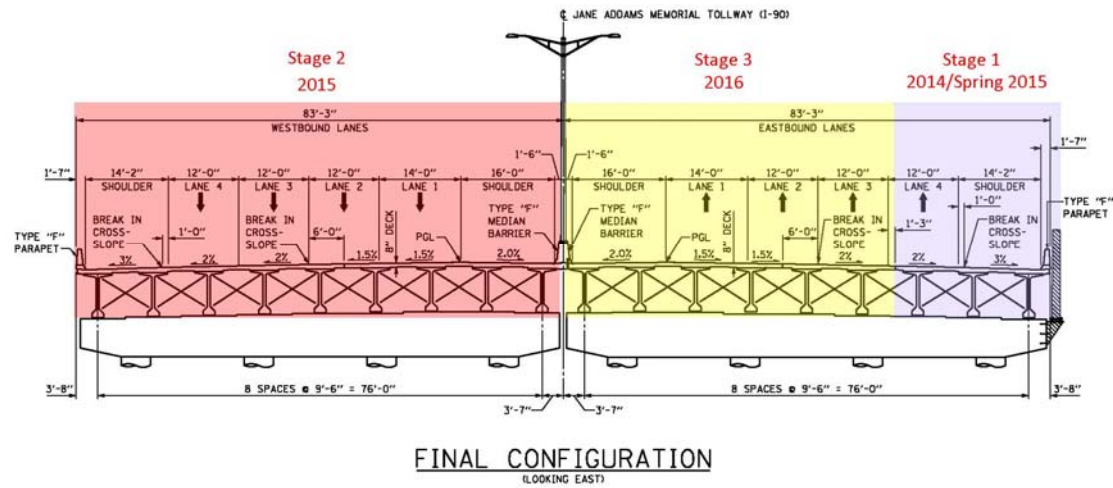
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# Proposed Construction Staging

Stage 1: Fall 2014/spring 2015 – widen eastbound structure

Stage 2: 2015 – complete removal/rebuild westbound structure

Stage 3: 2016 – complete eastbound structure

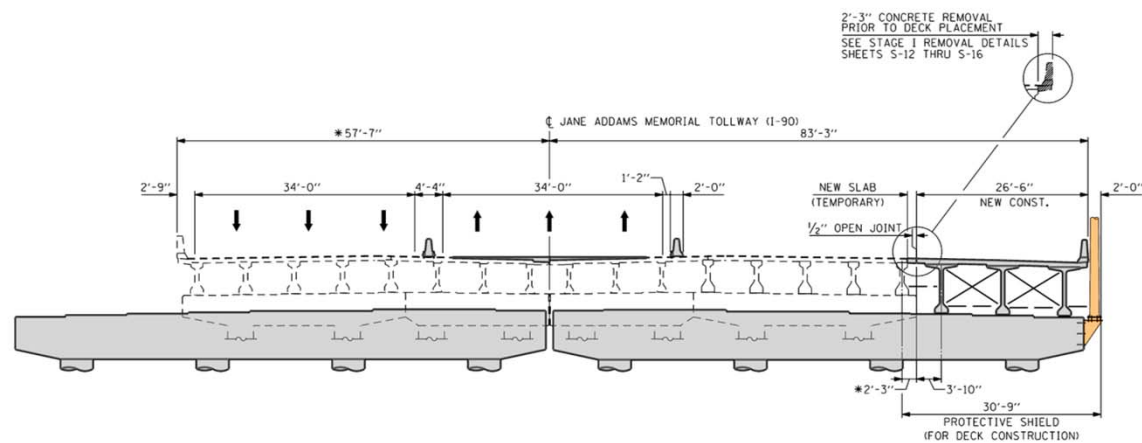


# Stage 1 MOT

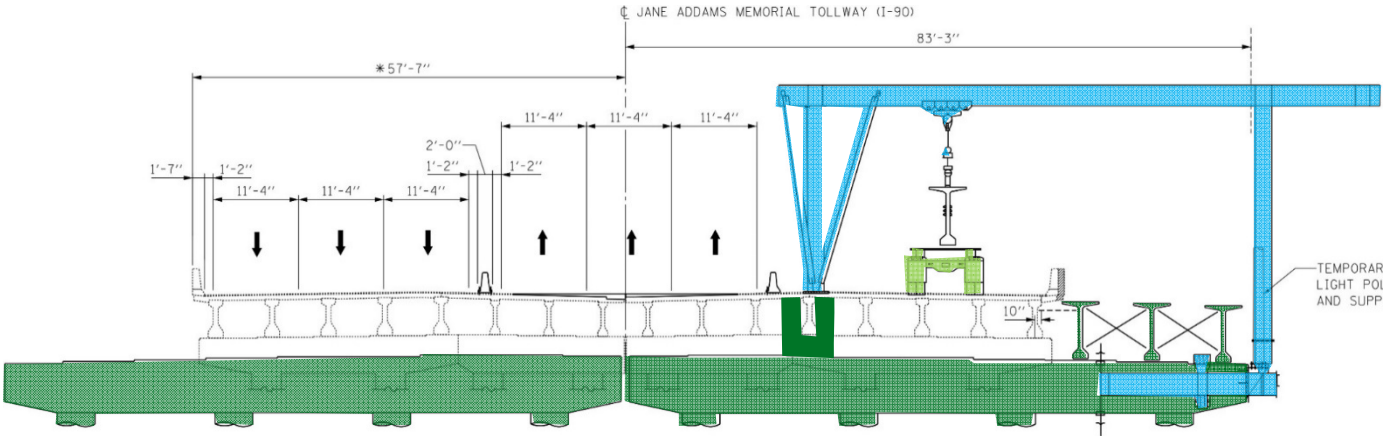
Traffic shifted north to accommodate south work zone

In place fall 2014 to spring 2015

Westbound substructure work continued below



# Stage 1 Beam Erection





## Gantry Secured To New Pier



## New Piers Prepared For Gantry Support



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## Gantry Secured To Existing Deck





## Gantry System Ready For Beam Delivery



## Haul Trucks Queue For Beam Erection



## Lifting Yoke Attached To Beam





## Beam Hoisted Off Truck



## Gantry Controlled By Pull Wires





## Beam Maneuvered Into Position



## First Beam Placed: Gantry A Success!



# Stage 1 Beams In Place



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# Stage 1 Bridge Deck



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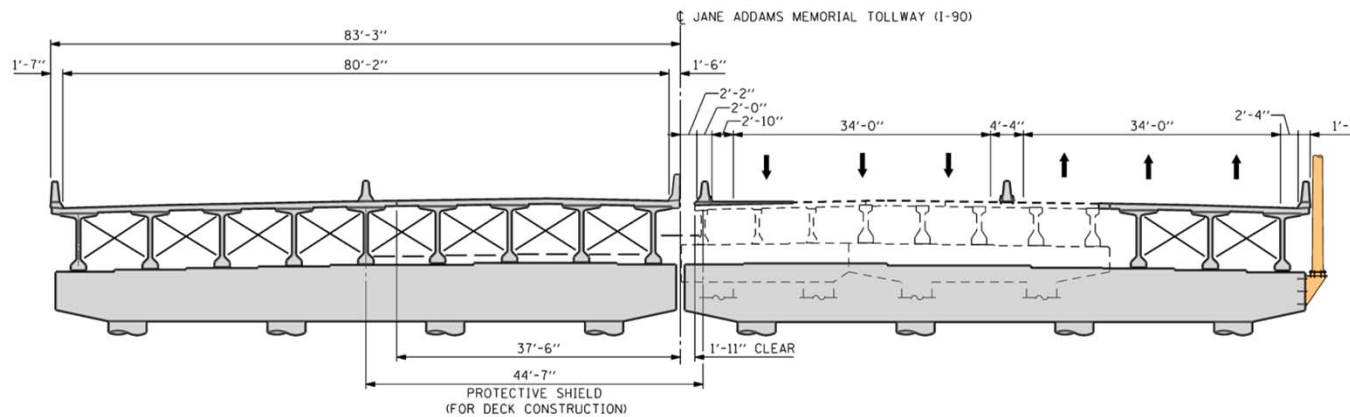
# Stage 1 Bridge Deck



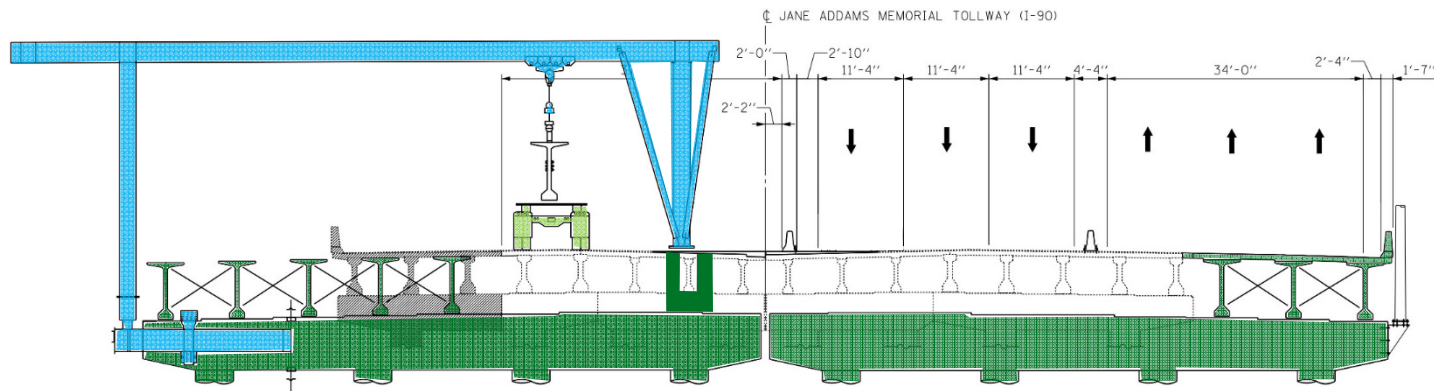
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## Stage 2 MOT

- Stage 2 MOT placed all traffic on the widened eastbound bridge
- Work zone became the entire westbound structure
- Shift occurred in early June 2015

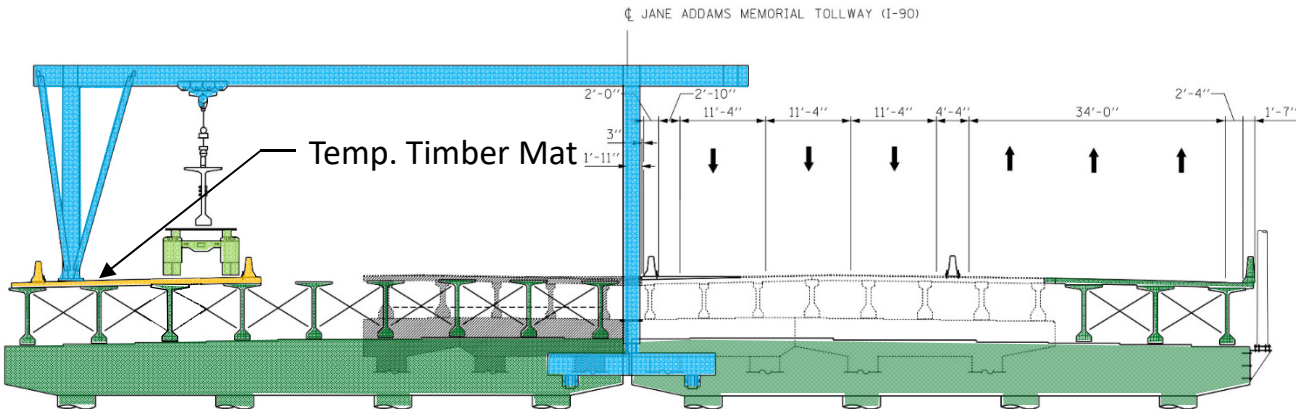


## Stage 2A Rem / Beam Erection





# Stage 2B Rem / Beam Erection



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# Stage 2 Phase 1 Demolition



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# Stage 2 Phase 1 Beam Erection



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# Stage 2 Phase 1 Timber Matting



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# Stage 2 Phase 2 Demo



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# Stage 2 Phase 2 Beam Erection



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# Stage 2 Bridge Deck



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# Stage 2 Bridge Deck



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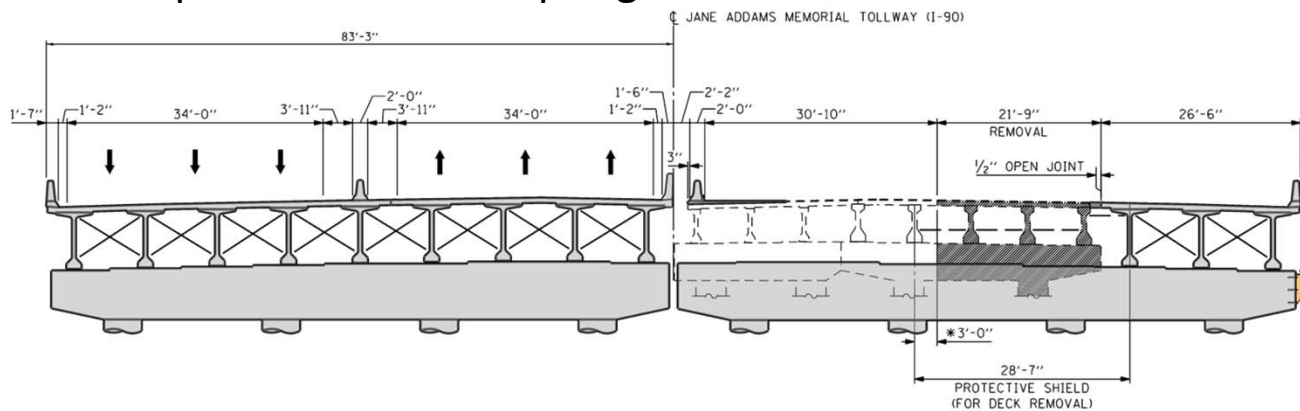
# Stage 2 Bridge Deck



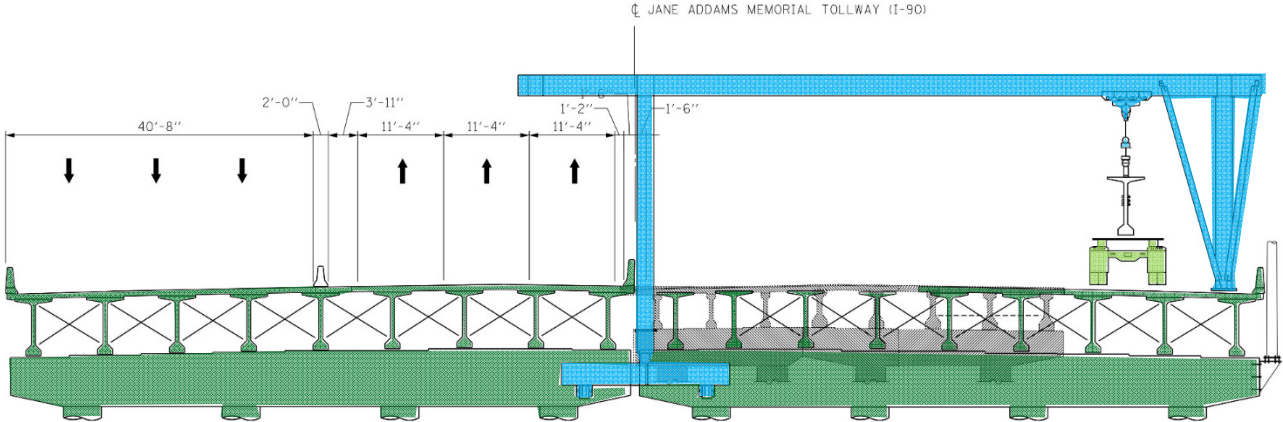
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## Stage 3 MOT

- Traffic shifted north to accommodate south work zone
- In place fall 2014 to spring 2015



# Stage 3 Rem and Construction



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# Stage 3 Removal



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# Stage 3 Prepare For Gantry



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# Stage 3 Beam Erection



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# Stage 3 Bridge Deck



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# Stage 3 Bridge Deck



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# Stage 3 Bridge Deck



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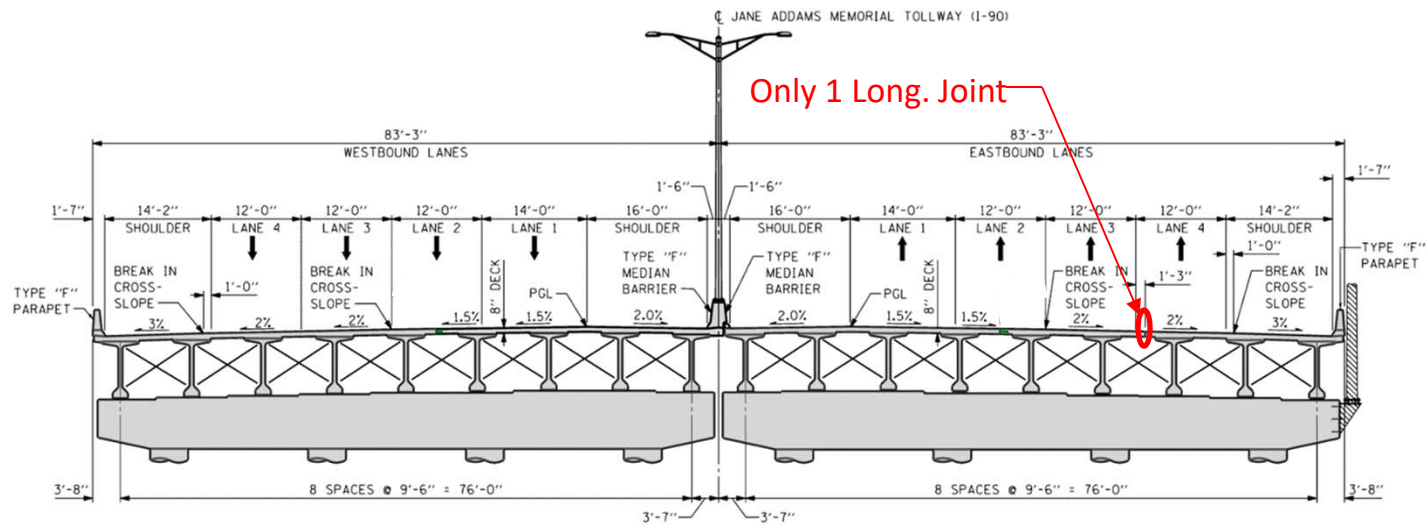


# Stage 3 Bridge Deck



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# Final Configuration



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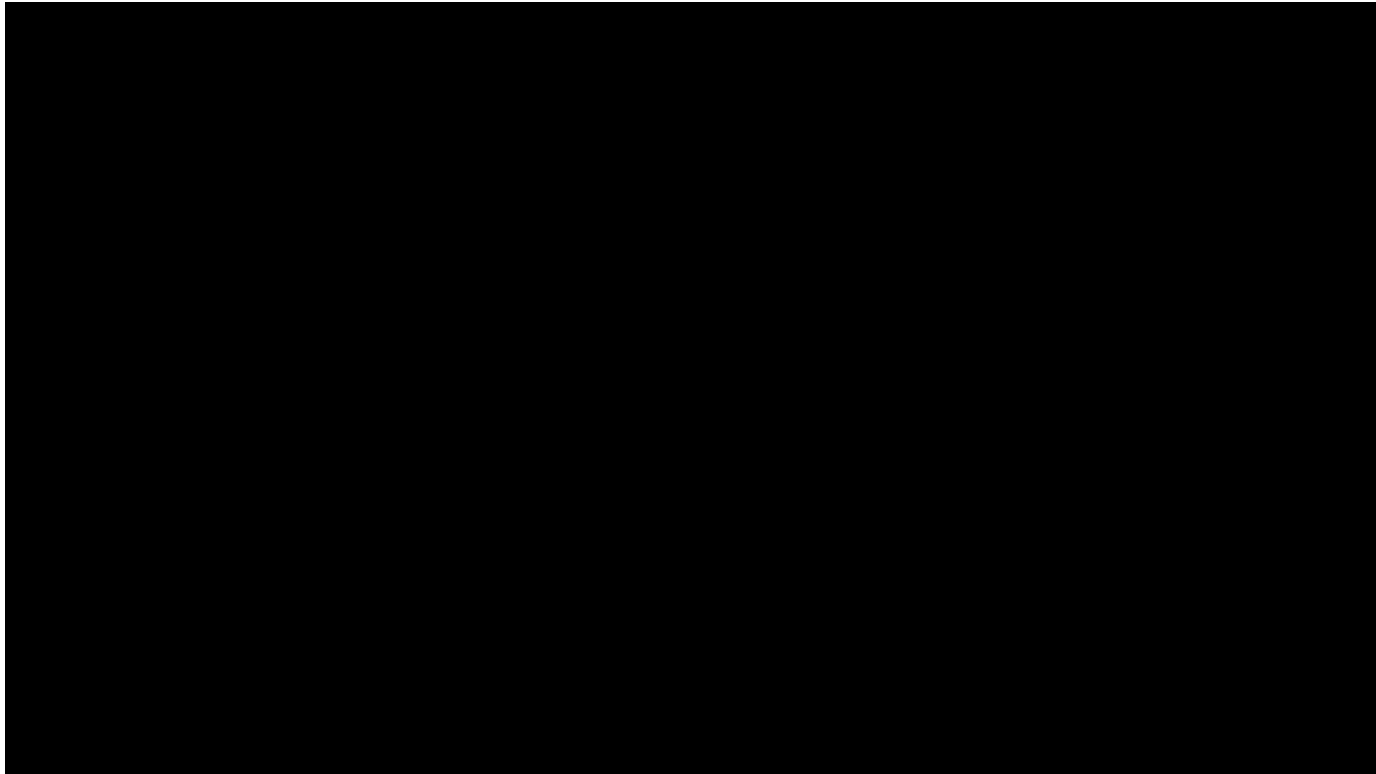
# New Bridge



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# Time Lapsed Video



# ACEC Engineering Excellence – Eminent Conceptor!



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## Closing Thoughts On Traffic-Driven Innovation

- Building new piers in their entirety under the existing bridge had zero impact on Tollway customers.
- Incentive to use alternate beam delivery system limited lane closures and required no unfavorable MOT configurations such as weaves, split lanes, counter-flow lanes, etc.
- Alternate beam delivery system also saved significant time, therefore reducing customer impacts.
- Use of special materials will prolong life of structure, therefore reducing long-term impacts.



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# THANK YOU

