



# Innovative Bridge Designs for Rapid Renewal

## SHRP2, Project R04

### Case Studies and Lessons Learned

INFRASTRUCTURE ADVANCEMENT INSTITUTE  
November 30, 2017, San Antonio

Finn Hubbard, Fickett Structural Solutions  
SHRP2 ABC/PBES Implementation  
Technical Lead



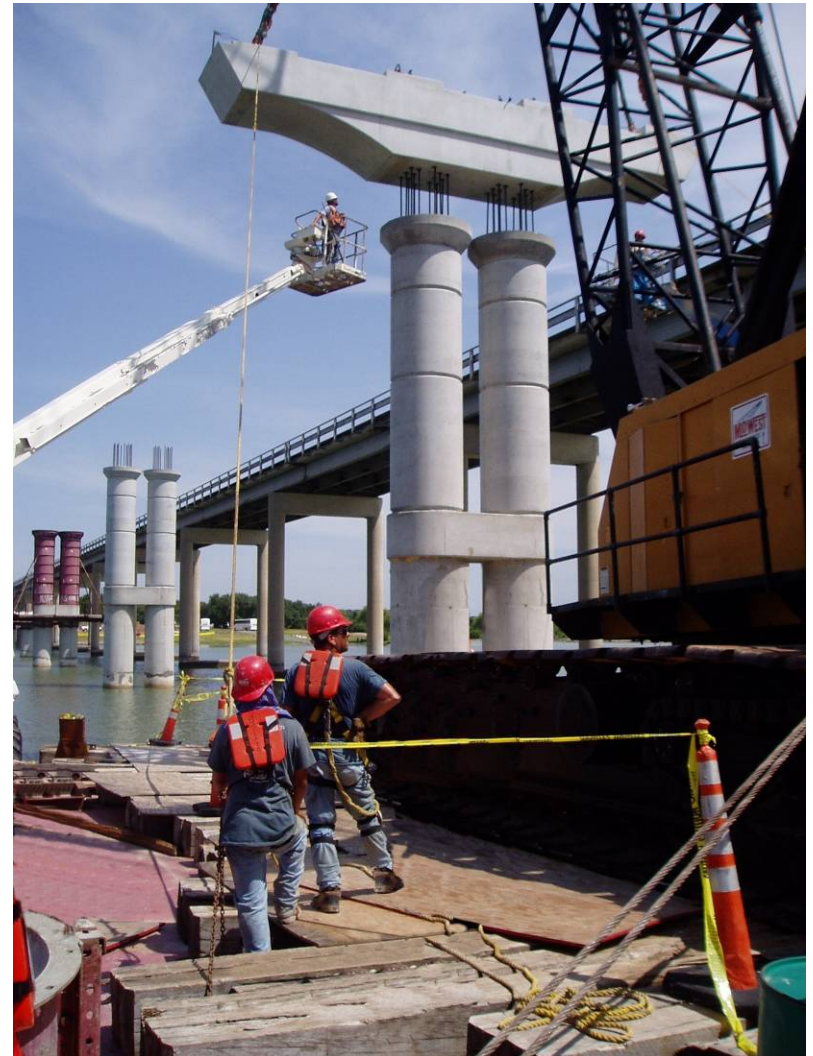
U.S. Department of Transportation  
Federal Highway Administration

AMERICAN ASSOCIATION  
OF STATE HIGHWAY AND  
TRANSPORTATION OFFICIALS

AASHTO

# Texas ABC Project

- Eliminates many tasks associated w/ CIP construction
- Grouted vertical duct connections
- Accelerated project
- Big worker **safety** gains
- Featured on front of 2009 FHWA PBES Connections Manual
- TxDOT Research
  - Project 1748
  - Project 4176



# Next Generation *Innovative Bridge Design* Projects



- Eight projects scattered around the county
  - Gila River Indian Reservation (Arizona)
  - California, Fort Goff Creek
  - Kentucky, Stewarts Creek
  - Maine, Kittery Overpass
  - Missouri, Boone County
  - Rhode Island, Warren Avenue
  - Wisconsin, I-39/90
  - Michigan, Seney Wildlife Refuge

# Gila River - Arizona

- Project Delivery – CMGC
- Construction Manager/General Contractor
  - Team the GRIC DOT with the designer and contractor
  - Allows maximum use of contractors means and methods
  - Owner intimately involved in process
  - Bridge slide project (SIBC)
  - Wide open site, good for slide in ABC

# Gila River - Arizona



# Gila River - Arizona



# Gila River - Arizona



# Fort Goff Creek, California



- Built in a remote location in Northern California
  - 90 minutes to nearest ready mix plant
  - Precast answers this quality issue well
- Lessons Learned
  - Allow time for all needed pre-approvals
  - Entire team must be on board with ABC approach and available
  - ABC allowed construction in one short season



# Fort Goff Creek, California



2014/11/19

# KY-6, Kentucky

- Replaced 2 bridges using R04 ABC techniques.
- A + B bidding, (Cost plus time)
  - Shorten closure time
  - Total project only 38 days
- Galvanized and painted steel superstructure
- Galvanized deck rebar
- Super in 2 longitudinal pieces
- Preassembly worked great



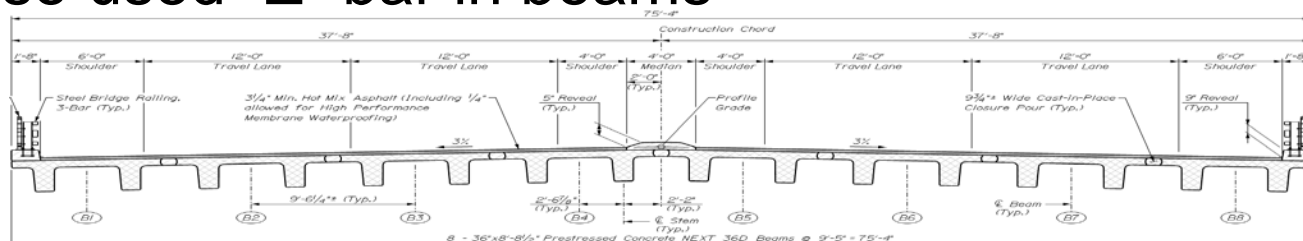
# KY-6, Kentucky



12.12.2014 13:23

# Kittery, Maine

- Replaced aging concrete ridged frame bridge.
- Maximum closure time was 35 days, **used 29**
- Heavy tourist area
- Contractor redesigned precast abutment wall to footing connection, accepted by Maine DOT
- Northeast Extreme Tee Deck Beams (NEXT)
- Carbon fiber prestressing strands to be used
  - No corrosion issues with stand
  - Also used “Z” bar in beams



# Kittery, Maine



# Kittery, Maine



# Lessons Learned, Kittery

- ABC works!
- Traffic interruptions was minimized
- The tourist season saw minimal effects
- Locals really got involved in the whole ABC process
- Local police suggested useful modifications to the traffic management plan
- Excellent local and state wide press
- A + B bidding was successfully used

# Route B Bridge, Missouri



- Replaced bridge on Route B over Loop 70 in Columbia, MO
- ABC and Geosynthetic Reinforced Soil Abutments (GRS)
- Lessons Learned:
  - Make sure modular block are available that meet the spec.
  - Anyone can build a GRS Abutment
  - Present new technology early to contractors



# Route B Bridge, Missouri



# Warren Ave. Rhode Island

- Replaced highly deteriorated Warren Ave Bridge in Providence, R.I.
- Lessons learned:
  - Semi twin bridge took 400 days to build
  - New bridge closed road to traffic for 21 days
  - Very happy locals!



# Warren Ave. Rhode Island



# Warren Ave. Rhode Island



# I-39/90, Wisconsin

- Replaced 5 bridges using accelerated precast pier technique.
- ABC applied to pier construction
  - Precast columns and caps on cast-in-place footings
- Five median piers between I-39 lanes
- Saved 3 weeks time per bridge
- Main ABC driver was safety
  - Less exposure of traffic to contractor
  - Less exposure of contractor to traffic

# I-39/90, Wisconsin



# I-39/90, Wisconsin



# Lessons Learned, Wisconsin

- The first precast ABC project was pricey
- Better price with second contract
- Price was the same as cast-in-place on third contract





# Seney National Wildlife Refuge, Michigan



- Federal Lands Highway applied R04 Toolkit to Seney National Wildlife Refuge PBES project
- Single lane, three-span continuous concrete box beam bridge
- Piers/abutments built with precast pile caps
- Placed a concrete overlay on top of boxes
- Concrete rails cast on to boxes before beam erection
- Prefabrication will limit impacts in an environmentally sensitive area

# Seney National Wildlife Refuge, Michigan



# Michigan



# Seney National Wildlife Refuge, Michigan



# Three R04 Showcases

## Three Peer to Peer Exchanges

- Implementation projects, Showcases and Peer to Peer exchanges provided various lessons learned



# Many Forms of ABC

- Multiple pieces assembled on site or off-site
- Slide in Bridge Construction (SIBC)
- Self Propelled Modular Transporters (SPMT's)
- Keep your toolkit open to all ideas when considering ABC



# Contract Methods Vary

- Contracting methods can vary depending on needs
  - Design, bid, build (Traditional)
  - Design, build (Less control)
  - Construction Manager/General Contractor (CMGC)
  - A + B, Cost plus time



# Identify Goals Upfront

- Identify the main goal of the project
  - Least disruption of traffic?
  - Least cost?
  - Environmental protection?
  - Length of construction season?
  - Length and ability of detour?





# Time Savings Considerations

- Determine need for speed. (Maximum closure time)
- SPMT's are very fast, but pricey.
- SIBC is a nice combination of speed and cost.
- If 14 to 21 days will work, assembling pre built pieces is cost effective.
- Weigh cost for speed.
  - Choose the time line carefully!



# Technical Lessons Learned

- Foundations selection can be a significant issue.
  - Spread footing are fast
- Post tensioning works, but takes time.
- UHPC is a good tool, but expensive.
  - Make sure forms are watertight
- Weight of precast elements can pose issues.
- Shop reviews require detailed attention.
  - Best to have issues on paper

# Technical Lessons Learned

- Geosynthetic Reinforced Soil (GRS) abutments are fast and inexpensive
  - Scour needs to be considered in their use
- ABC can help with some weather issues
- Grouted bar splice couplers work well for ABC
- Deck overlays solve deck alignment issues



# Owner Lessons Learned



- “DOT’s need to be innovative to stay relevant.”
- Durable joints are a must to gain acceptance.
- A top down team approach with real resources committed is critical.
- Cultural change from “we have always done it this way” is not easy.
- **DOT’s gain real political capital from ABC**

# Contractor Lessons Learned

- Contractors like to retain as much work as possible.
- Contractors bid labor, material and **risk**.
- Contractors like CM/GC contracts.
  - Geared to their means and methods
- Contractors have good suggestions -work with them.



# Lessons Learned, (The Hard Way)

- Survey twice, make sure its right
- Need good concrete bond to UHPC
- Must use high quality joint grout material
  - Avoid maintenance issues down the road
  - UHPC has been a great step forward
- Double check all rebar clearances during shop drawing reviews
- If using rebar couplers in precast elements, templets, templets, templets!

# Concluding Thoughts

- Be open minded.
- Do not be afraid to experiment with the method and materials.
- Seek designer and contractor input before AND after every job for improvements.
- Expect great publicity from ABC projects.
  - Let the public know what your doing and why it is special!



# Questions?

