FHWA OFFICE OF OPERATIONS PEER EXCHANGE WORKSHOP

ACCELERATED ROAD WORKS FOR WORK ZONE SAFETY AND MOBILITY

Accelerated Construction Techniques

Jagannath Mallela
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Denver, CO
Accelerated Bridge Construction

Objectives

- The reasons for using ABC/PBES
- Definitions of ABC/PBES
- Benefits of ABC/PBES
- Focus Areas
- The status of EDC deployment goals for ABC/PBES
Reasons for Using ABC
Present & Future Challenges

- Aging Infrastructure
- Increased traffic volumes
  - Freight tonnage
  - Urban capacity
- Rising construction costs
  - $176B to maintain bridges (2005-2024)
  - $8.8B annually
Work Zone & Congestion Impacts

Work zone:
- 6,400 work zones (2003)
- 6,157 lane miles closed
- 20% capacity reduction

Congestion:
- Congestion robs our nation of productivity and quality of life
- 4 billion hours/year time delay
- 2.9 billion gallons of wasted gas/year
- $78.2 billion in 437 urban areas
More Challenges Ahead

- Globalization of manufacturing increases demands on our transportation Intermodal networks
- 1 M more truck traffic by 2016 (ATA)
- More drivers on highways
- Urban Sprawl Continues
Definitions of ABC/PBES
Accelerate Bridge Construction (ABC)

**ABC (v):** The use of *innovative* planning, design, materials, and construction methods to reduce onsite construction and mobility impact times

**PBES** are structural components of a bridge that are built offsite, or adjacent to the alignment, and includes features that reduce the *onsite construction time* and *mobility impact time* that occurs from *conventional construction* methods.
Benefits of ABC/PBES
Benefits of ABC with PBES

**ABC / PBES improves:**

- Work-zone safety for the traveling public and contractor personnel
- Material quality and product durability
- Total project delivery time
- Site constructability issues

**ABC / PBES reduces:**

- Mobility Impacts
- Onsite construction times
- Weather-related time delays

**ABC / PBES can minimize:**

- Environmental impacts
- Impacts to existing roadway alignment
- Utility relocations and right-of-way take
FHWA Ever Day Counts ABC Focus Areas
Focus Areas

<table>
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<tr>
<th>Foundation &amp; Wall Elements</th>
<th>Rapid Embankment Construction</th>
<th>Prefabricated Bridge Elements &amp; Systems</th>
<th>Structural Placement Methods</th>
<th>Fast Track Contracting</th>
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<td>Continuous Flight Auger Piles</td>
<td>EPS Geofoam</td>
<td>Prefabricated Elements</td>
<td>Self-Propelled</td>
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<td>Geosynthetic Reinforced Soil (GRS)</td>
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<td>- Superstructure</td>
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<td>Prefabricated pier coferdams</td>
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<td>- Superstructure</td>
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<td></td>
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<td>- Substructure</td>
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<td></td>
<td>- Total Bridge</td>
<td>Horizontal Sliding or Skidding</td>
<td>- Warranties</td>
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</tbody>
</table>

Other conventional or heavy lifting equipment or methods

Source: FHWA EDC PBES Initiative
Prefabricated Cantilever Abutment (Source: FHWA ABC Manual)

Partial Depth Precast Deck (Source: FHWA Highways for Life)

Precast Open Frame Pier Bent (Source: FHWA ABC Manual)

Bridge Move with SPMT (Source: FHWA Highways for Life)

Bridge Move with SPMT (Mammoet)

Sliding (FHWA HfL)

Strand Jack Lifting (Mammoet)
ABC Decision Framework
Flowchart

Decision Making
The Status of EDC Deployment Goals for ABC/PBES
Pursuing PBES for EDC

Map showing the status of PBES for EDC Initiative across the United States, with states marked in green indicating "Yes" and blue indicating "N/A".
Current Status

PBES Design or Built

Fully Implemented

143 Non-Federally Funded
132 Federal Funded (10%)
Conclusions

Advantages:

• Faster (offsite & off critical path)
• Safer (public and construction)
• Better Quality (controlled environment)
• Lower Cost (total project/life cycle costs)
• Easily adaptable to many site constraints
Questions?

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FHWA OFFICE OF OPERATIONS PEER EXCHANGE WORKSHOP

INNOVATIVE CONTRACTING AND ACCELERATED CONSTRUCTION TECHNIQUES FOR WORK ZONE SAFETY AND MOBILITY

Precast Concrete Pavement Systems for Rapid Repair, Rehabilitation, and Construction

Jagannath Mallela
September 19, 2011
Baltimore, MD
Accelerated Construction of Concrete Pavements

- Precast Concrete Pavement Systems (PCPS) for concrete pavement construction
  - Momentum is growing
  - Demonstration projects and pilot projects
  - Innovations and modifications
  - Specifications
PCPS Attributes

- Improved quality and performance
- Accelerate construction
- Reduce work zone size and times
- Reduce safety risks
- Reduce risk to contractor and owner agency (use specific terms)
- Extended construction season
- Reduced costs
PCPS Basics

- Fabricated off-site
- Transported to the project site
- Installed on a prepared foundation
- No field curing or time to achieve strength
- Two main categories
  - Jointed Systems – Include system specific joint design
    - Example – Super-Slab and several other generic systems
  - Prestressed Systems – Use a combination of pretensioning (plant during fabrication) and post-tensioning (installation)
    - Example – Precast Prestressed Pavement System (PPCP)
Recent Project Example – I-66 WB, Fairfax, VA
Jointed PCPS - Super-Slab® Pictures
(From I-66 VA and Tappan Zee Toll plaza)
PPCP Pictures (From I-66 VA)
Applications

- Slab replacement
- Full-depth repair
- Conventional paving

Conventional

PCPS

Rehabilitation

Post-tensioning (optional)
New Construction

2007 © ARA, Inc.
PCPS General Terminology

- Structural capacity for handling
- Friction reducing interlayer or filler material (N.T.S.)
- Slab length
- Post-tensioning option (PPCP)
- Load transfer mechanism with new or existing pavement
- Pretension in transverse direction option (PPCP)
- PCC thickness, material properties
- Existing structure
- Grouting materials

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States with PCPS Experience

- **HfL projects**
- **Other projects**
Project Level Decision Logic

- Project Scope
- Pavement Treatment Alternatives
- Cost Consideration
- Construction Considerations
- Project Specific Considerations

PCPS Project Selection

Maintenance and protection of traffic
Project Level Decision Logic

- Project Scope
- Pavement Treatment Alternatives
- Project Specific Considerations
- Construction Considerations
- Maintenance and protection of traffic

PCPS Project Selection

Cost Consideration

Project Scope

Pavement Treatment Alternatives

Project Specific Considerations

Construction Considerations

Maintenance and protection of traffic
Project Scope

- Pavement service life and objectives
- Current & projected traffic density
- Slab replacement criteria
- Estimated project duration
- Work window options
Project Level Decision Logic

- Project Scope
- Pavement Treatment Alternatives
- Cost Consideration
- Project Specific Considerations
- Construction Considerations
- Maintenance and protection of traffic

PCPS Project Selection
Pavement Treatment Alternatives

General rules of thumb, based on lane occupancy times
Project Level Decision Logic

- Project Scope
- Pavement Treatment Alternatives
- Cost Consideration
- Construction Considerations
- PCPS Project Selection
- Project Specific Considerations
- Maintenance and protection of traffic

ARA Proprietary
Project Specific Considerations

- Need for accelerated construction
  - M&PT considerations, seasonal restrictions, stakeholder impact
- Funding guidelines
- Design and engineering data requirements
- Construction risk
- Specifications

Maintenance and protection of traffic
Specification Options

- **Sole Source Specification**
  - Preselect PCPS system and work directly with provider

- **Multiple Source Specification**
  - Use PCPS with general performance guidelines

- **Generic Specification-Prequalification:**
  - Use generic performance specifications = Prequalification of Precast Concrete Paving Systems (www.aashtotig.org)
Prequalification of PCPS
Gaining State DOT Approval

- Type of system employed
- Slab thickness
- Slab geometry
- Joint matching needs
- Load transfer
- Reinforcing steel
- Material handling
- Embedment material

- Subgrade requirements
- Bedding requirements
- Pre & post-tension requirements
- Surface texture
- Ride quality
- Load transfer efficiency
- Slab installation procedures

Trial installations - prove the PCPS off-site - before the project begins
Project Level Decision Logic

- Project Scope
- Pavement Treatment Alternatives
- Cost Consideration
- Project Specific Considerations
- Construction Considerations

Maintenance and protection of traffic
Construction Considerations

- Qualified precaster presence in area
- Contractor’s familiarity with PCPS construction process
- Planning and scheduling
- Quality assurance
- Contract plans
Project Level Decision Logic

- Project Scope
- Pavement Treatment Alternatives
- Project Specific Considerations
- Construction Considerations
- Maintenance and protection of traffic
- Cost Consideration

PCPS Project Selection
Cost Considerations

• Should expand beyond initial costs
• LCCA - reduced maintenance costs and user-delay cost
• MTO reports only 10% higher cost than high early strength
• Economies of scale and industry familiarity
• Considerations of Road User Costs appropriate
PCPS Summary

- Successful installations nationwide
- Proven long term performance
- Ideal for accelerated construction for projects with lane closure restrictions
- Specification and guidelines available for your use
- PCPS can be added to your PCC treatment toolbox
Thank you!!

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