Precast Concrete Pavement System

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Executive Director

FL Prestressed Concrete Association
FL Prestressed Concrete Assn.

• Established 1957 – First in the Country!
• 16 PCI Certified Producer Members (19 Plants)
• 58 Associate/Professional Members
• Market/Promotion of Industry Products/Systems
• Education – Colleges/Universities
• Training – PCI Level 1, 2 & 3
Marketing/Promotion

• **HOW PRECAST BUILDS**: (Lunch-n-Learn Topics)
  – Precast/Prestressed 101
  – Architectural Precast
  – Structural Precast
  – Innovations in Design
  – Precast Concrete Pavement Systems (PCPS)
  – Bridges – Curved U-Beam
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FHWA Highways for LIFE

• Purpose: to advance Longer-lasting highway infrastructure using Innovations to accomplish the Fast construction of Efficient and safe highways and bridges

• Characteristics:
  – 40+ years service life
  – No premature construction defects or mat’l-related distress
  – Reduce potential for cracking, faulting & spalling
  – Smoothness & surface texture easily maintained
FHWA Highways for LIFE

• Benefits of Long-Life Concrete Pavement
  – Reduced maintenance & reconstruction costs
  – Reduced work zones, traffic disruptions & user delays
  – Improved user satisfaction
  – Improve safety
FHWA Highways for LIFE

- Precast Concrete Pavement System (PCPS)
  - Durable, high-strength concrete delivered from PCI Certified Plants
  - Concrete mixture adjustments onsite eliminated
  - Higher quality: materials, fabrication, end products
  - Immediate opening to traffic
  - Mild prestressing, continuous reinforcement and/or Post-tensioning for added structural capacity and extended life
FHWA Highways for LIFE

- Applications of Precast Concrete Pavement (PCPS)
  - Doweled & Prestressed Systems
  - Temporary Night-Time & Weekend Closures
  - Mainline Interstate Replacement
  - Ramp Rehabilitation
  - Traffic Lane/Shoulder Reconstruction
  - Bridge Approach Pavement
  - Underpass Upgrade and/or Clearance
  - Continuous and/or Intermittent Repairs
Post-tensioning of a series of 30-ft x 12-ft precast concrete panels on I-680 in California.
Four lanes (including outside rush-hour shoulder lane) replaced with precast prestressed concrete panels on I-66 in Virginia.
Pre-tensioned concrete panel spanning two traffic lanes on I-66 in Virginia; conduits for post-tensioning strands visible in keyway.
Placement of jointed precast concrete panels on Trunk Highway 62 in Minnesota.
Outside lane and shoulder replaced with precast prestressed concrete pavement on Rte. 896 in Delaware.
Who’s Using Precast-Prestressed Concrete Pavement?

Precast Concrete Pavement is an innovative paving solution that agencies in 20 states across the country have used independently or as part of the second Strategic Highway Research program (SHRP2).
Repair or Individual Replacement of Existing Slabs
Replace Specific Sections on a Highway
Reconstruction of Longer Sections of Existing Roadway
Bridges Approaches
Multiple Lanes
Heavy Loads or Turn Lanes
New Construction?
In-Service Pavements

- Maintenance Challenges
- Common Distresses & Traditional Repairs
- Alternative Strategies & Benefits
- Precast/Post-Tensioning Concrete Pavement (PCPS)
- Design Considerations
  - Installation & Innovations
  - Recommendations
Maintenance Challenges

• Aging Infrastructure (> 40 yrs)
• Heavy Traffic
• Worker Exposure to Traffic Hazards
• Short & Limited Traffic Closure Periods (10pm – 5am)
• Limited Budgets & Increase Costs
  – Equipment, Fuel, Personnel Hours, Materials
• Durable, Temporary & Emergency Repairs
  – How long should it last?
• Willingness to Innovate (Doing something new!)
### Common Distresses (Repair Strategies*)

<table>
<thead>
<tr>
<th>Distress</th>
<th>Repair Strategy</th>
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</thead>
<tbody>
<tr>
<td>Faulting</td>
<td>Grinding, Dowel Bar Retrofit</td>
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<tr>
<td>Spalling</td>
<td>Patching – cold mix, hot mix, cement grouts, polymer resins, etc.</td>
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<tr>
<td>Subbase Erosion</td>
<td>Sub-sealing – cement grout, urethane foam, etc.</td>
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<tr>
<td>Rutting</td>
<td>Milling &amp; resurfacing</td>
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Common Distresses (Repair Strategies)

• Cracking
  – Crack Sealing –bituminous, silicone, epoxy, etc. OR,
  – Slab Replacement –hot mix asphalt, ready-mixed concrete, etc.
  – Milling & resurfacing

• Most distresses lead to eventual slab replacement or perpetual repair

• Not all repair strategies are effective
Alternative Strategies & Benefits

• Looking for *longer lasting* alternatives
  – High Early Strength Concrete
  – Precast Concrete

• Work completed in *shorter windows*

• *Open* to traffic *sooner*

• *Fewer repairs*, reduces worker exposure

• Cost of *durable repairs*
  – Potentially higher initial cost
  – Potentially lower long term / life-cycle costs
Durable Repairs vs. Temporary

• Durable repairs/replacement
  – Last longer
  – Need fewer repairs over time
  – Cost less over time
  – Reduce worker exposure over time

• Temporary Repairs
  – Need to open quickly
  – Need to last until they can be replaced
  – Uncertain durability may require repeated repairs
  – Increase in worker exposure due to repeated repairs
  – Uncertain costs due to repeated repairs
Durable Repairs vs. Emergency

• Emergency Repairs
  – Usually during adverse weather & traffic
  – Must open quickly
  – Similar to temporary repairs
    • Need to last until they can be replaced
    • Uncertain durability may require repeated repairs
    • Increase in worker exposure due to repeated repairs
    • Uncertain costs due to repeated repairs

What if...

Durable, rapid, and early opening pavement is possible?
Precast Concrete Pavement System

• Durability
  – Fabricated in Controlled, Plant Conditions
  – HVS Testing: 8” PCP carried > 150 Million ESALs with NO Distress (240 Million ESALs to Failure)

• Opens to Traffic Quickly
  – 300 Lane-Feet in 3 hrs, Lake Hughes Rd., CA
  – 375 Lane-Feet in 3 hrs, Peck Rd., CA

• Adverse Weather Condition
  – Drizzle, Rain
  – At 34° F (near freezing) Temperature
Precast Concrete Pavement System

• Applications
  – Individual Slab Replacement
  – New Construction/Full-Depth Replacement
  – Bus Stops/Landing
  – Intersections
  – Curved Alignments/ Round-Abouts

• Installation
  – Contractor Purchase Order
  – In-House Maint’ Crews
  – Competitive Bid Contracts, etc.
Precast Concrete Pavement System

• Reduced Thickness
  – Reinforcing and/or Prestressed for in-kind Thickness & Handling Stresses

• Reusable
  – Panels can be used on another project
  – Stockpiled for Emergency/Temporary use
DESIGN CONSIDERATIONS
Design Considerations: Existing conditions

➢ Existing Material: Concrete/Asphalt
➢ Subsurface Conditions:
  ➢ Concrete/Asphalt
  ➢ Soil Cement
  ➢ Subgrade or Soft Soils
➢ Heavy Traffic: Volume & Loads
Design Considerations: Existing conditions

- Existing Structures:
  - Bridges/Overpass
  - Pedestrian Bridges
  - Other Structures
Design Considerations: Which System to Use

Generic or Patented Systems?
(Some grouting pockets are proprietary)
Design Considerations: Which System to Use

Prestressing

Mild Steel Reinforcing
Design Considerations: Which System to Use

Post-Tensioning (continuous system) up to 216’
Design Considerations: Which System to Use

Simple Span
Design Considerations: Leveling/Lifting

“Level Lifters” to speed installation and level exact heights
Design Considerations: Size of Panels

- 1 lane
- 2 lanes
- 2 lanes and a shoulder

Recommendation, not longer than 36’
Design Considerations: Joints

All transverse and longitudinal joints of the repair areas should be sealed in accordance with the agency’s joint sealing practices.

Strategic Highway Research Program 2
Design Considerations: Grouting Pockets/Systems
Summary

• Maintenance Challenges
  – Aging Infrastructure
  – Heavy traffic demands quick repairs due to limited closure period
  – Repeated repair failures increases risks of worker exposure to traffic hazards
  – Limited budgets & increasing costs beg for more cost-effective & durable repairs
  – Limited repair strategies beg for innovative solutions

• Precast Concrete Solutions
  – Durability reduces worker exposure & cost of repeated repairs
  – Opens to traffic quickly, even under adverse weather conditions
  – Reduced thickness reduces time & costs of construction
  – Many applications, not just repair
  – Reusability reduces costs, improves sustainability
  – An innovative tool for Roadway Construction with Concrete Pavement
How Can I Help?

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