Precast Concrete Pavement for Intermittent Concrete Pavement Repair Applications

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The Problem - Pavement Rehab

A very serious issue – coast to coast

♦ Need to rehab AC & PCC pavements AQAP

♦ Versus

♦ Traffic delays
♦ Durability concerns

♦ Shorter delays & shorter service life or Longer delays & longer service life vs.

♦ Shorter delays & longer service life
A Solution – Precast Concrete for Repair, Rehab & Reconstruction

- Specially for intermittent repairs
Why Precast Concrete Pavement?

- Heavy traffic volumes (highways & airports) dictate that repairs & rehab are carried out **rapidly**
- The advantages of precast pavement are:
  - better quality concrete,
  - better curing conditions – at fabrication plant,
  - minimal weather restrictions on placement
  - reduced delay prior to opening to traffic – no on-site curing of concrete.
- AND, precast concrete has a **great track record** in structural applications (bridges, buildings, etc)
Precast Concrete Pavement Systems

- Precast pavement systems are fabricated off-site, transported to the project site and installed on a prepared foundation (existing pavement or re-graded foundation).

- The system components require **minimal field curing or time** to achieve strength before opening to traffic.

- These systems are used for **rapid** repair, rehabilitation and reconstruction of asphalt and concrete pavements.
Precast Concrete Pavement Concepts

- Intermittent repairs – plain concrete panels
  - Full-depth or full panel replacement

- Continuous Applications (longer length/larger area) – Rehab of ACP or PCCP; bridge approach slabs
  - Conventional jointed systems
  - Prestressed panels – fewer active joints
Intermittent (Repair) Applications
Current State of Practice:
The Full-Depth Repair System (MSU)

Demos in Michigan & Ontario
Current State of Practice:
The Super Slab System (Fort Miller)

For repairs & continuous applications – numerous production projects
NJ I-295 (June 2008)
Intermittent Repairs using the Super Slab System

- 50+ years long jointed reinforced concrete pavement
- 78 ft panels - expansion joints and cracks deteriorated
- Large no. of panels replaced
- Length: 8, 10, 12, 14 ft long, full lane width, thickness: 9 in.
- Night-time placement – 8 PM to 6 AM
- 8 to 16 panels replaced per night
NJ I-295 (June 2008)
Intermittent Repairs using the Super Slab System

Process:
- Sawcut repair boundaries in advance
- Night of repair – remove damaged panel; prepare base; drill dowel holes in existing panels; insert dowel bars; install precast panel
- Next night – patch dowel slots; underseal panel
NJ I-295 (June 2008)
Intermittent Repairs
Current State of Practice
The Stitch-in-Time System
Colorado’s I-25 (2003)

Project Details:
- Uretek process
- Total Slabs Replaced = 450 at 18 Locations
- Length: 12 – 20 ft
- Panel Thickness: 5.5 - 7.25 in.

2004 - ~20 % of slabs exhibited cracks
2008 – Non-cracked panels performing well
Current State of Practice:
The Kwik Slab System (Kwik Slab LLC)
Current State of Practice: Agency Developed Generic Systems

- Several agencies are looking into developing generic plans and specification
- An example – Illinois Tollway Authority
  - Several projects carried out using the Super Slab system
  - Now, developing a generic system for intermittent repair applications
Illinois Tollway Generic System

- Illinois Tollway Authority has recently developed generic plans & specs customized for their specific needs
  - Typical slab removal/replacement is full width and 6 ft long
  - Larger replacement accommodated by using longer panels or multiple 6-ft long panels
Illinois Tollway Generic System
Illinois Tollway Trial Installation

- Trial conducted April 1, 2009
Field Applications - Repairs

- Caltrans – 2009/2010 projects
- Illinois Tollway Authority – in-place & future
- Iowa DOT – bridge approach slabs
- Ministry of Transportation, Ontario – in-place & future
- Ministry of Transportation, Quebec – bridge approach slabs
- Minnesota DOT – trial installation
- New Jersey DOT – in-place & future
- New Jersey Turnpike – in-place & future
- New York State DOT – in-place & future
- New York State Thruway Authority – in-place & future
- Virginia DOT – future
Intermittent Repair Performance

In-service systems

- Highways
  - Super Slab – no issues (7+ years max)
  - Michigan method – no production use yet; trial ~ 5 years
  - Stitch-in-Time – poor performance in longer lengths
  - Kwik Slab – only limited applications in Hawaii
Current Activities

- AASHTO Technology Implementation Group (TIG) – generic guidelines developed
- FHWA Highways for Life program – technology showcase
- SHRP 2 Project R05 – Improve technology
- ACI, PCI, NPCA, TRB – Developing guidelines & technology update reports
- Several production projects in the US and Canada
- Several showcase/demo activities during 2009
  - DelDOT - May 2009, Illinois Tollway, Caltrans

TECHNOLOGY IS HERE TO STAY!!
AASHTO TIG
Promoting Use of Precast Pavements for Rapid R&R

Developed following documents (June 2008)

Generic Specification for Precast Concrete Pavement System Approval

Guidance and Considerations for the Design of Precast Concrete Pavement Systems

Generic Specification for Fabricating and Constructing Precast Concrete Pavement Systems
SHRP2 Project R05: Modular Pavement Technology

Prime Contractor: FUGRO CONSULTANTS
Budget: $1,000,000
Duration: 36 months
Start Date: February 2008

Project objective is to develop tools for public agencies to use for the design, construction, installation, maintenance, and evaluation of modular pavement systems.

By necessity, the primary focus of this study will be precast concrete pavements.
R05. Modular Pavement Technology – Issues Being Addressed

- Agency/owner issues
- Contractor issues
- Precaster issues
- Engineering issues
- Construction and traffic management issues
- Performance issues

What is the market potential?
• Tracking several on-going and planned projects
  • New York DOT – Continuing
  • New Jersey DOT - Continuing
  • Delaware DOT – 2009 PPCP Demo
  • Illinois Tollway – Generic system; 2009 projects
  • Caltrans – several projects for 2009/2010
  • MTO, Canada - Continuing

• Submitted Interim Report – documents current state of technology
• Phase I report due April 2009
Precast pavement technology – ready to implement
  - Still lots of room for innovations

Aggressive T2 effort underway by FHWA /AASHTO-TIG, creating market demand.

Initial costs are higher compared to conventional procedures
  - However, rapid process and better durability may offset higher initial costs

Some technology gaps remain

A SUCCESSFUL PRECAST PAVEMENT SYSTEM REQUIRES SOUND PAVEMENT ENGINEERING