Guidelines for Use of Precast Prestressed Concrete Pavements


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2007 Virginia Concrete Conference, Richmond, VA

CPTP

- Presentation is part of FHWA's concrete Pavement Technology Program implementation efforts
  - Presenting Best Practices for Concrete Pavement Design, Construction & Repair/Rehabilitation
  - Goal – Safe, smooth and durable concrete pavements for the Federal-Aid highway system

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Outline

- Precast Paving Concepts
- Current Precast Paving Activities
- Precast Pavement Systems (AASHTO TIG)
- Precast Prestressed Concrete Pavement (PPCP)
  - Concept
  - Demo Projects
  - Guidelines
- Future Directions

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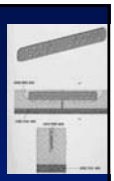
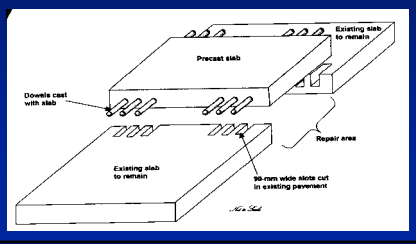
Precast Pavement Concepts

(For Accelerated Construction, R&R)

- Individual panel repairs – plain concrete panels
  - Full-depth full panel replacement
- Project level rehab (longer length/larger area) - for existing AC or PCC
  - Conventional panels
  - Prestressed panels – fewer active joints


Individual Panel Repair

Project Level Rehabilitation

- *Highway sections*
- *High volume ramps*
- *Toll plazas*
- *Urban intersections*
- *Airport aprons/taxiways*


Current Activities

- ACI 325 Task Force
  - Preparing a State of Practice document (Sam Tyson)
- PCI committee on Precast Pavement
  - Developing Guidelines (Dave Merritt)
- AASHTO TIG on Precast Pavement
  - Developing implementation package (Tim LaCoss, FHWA, Albany)

Current Activities

- CPTP demos (PPCP)
  - Iowa bridge approach slabs (2007?)
  - Indiana, Texas (possible demos)
  - Florida – possible intersection
- Ontario, MNDOT, Caltrans – continuing evaluation
- PANY&NJ – evaluating airport & highway applications
- Fort Miller – several active production projects

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AASHTO TIG on Precast Pavement

- To promote use of Precast Concrete Pavements for new construction, rehabilitation, and repairs
- First TIG meeting in New York, Sept. 06
- TIG Products & Services
  - AASHTO TIG website
  - Generic precast pavement design & construction guidelines
  - Workshops
  - Lead states member presentations

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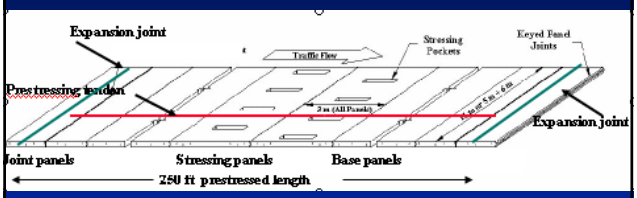
Current Techniques (AASHTO TIG)

- Full-depth/Full slab repairs
  - Single slab method (FHWA CPTP developed)
  - Uretek USA method
  - Super-Slab (Fort Miller)
  - Kwik Slab
- Rehabilitation/reconstruction
  - Precast prestressed method (FHWA CPTP developed)
  - Super-Slab (Fort Miller)
  - Uretek USA method
  - Kwik Slab

Precast Prestressed Pavement
(FHWA CPTP Task 58)



Developer/Project Manager:
David Merritt, The Transtec Group

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Typical Design Details

- 2-lane wide plus shoulders
- Panel size: upto 36 ft wide, 10 ft long, t ~ 8 in.
- Panel types:
  - Base, joint & central stressing panels (original)
  - Base & joint stressing panels (Missouri)
- Tongue & groove transverse epoxied joint
- Expansion joints @ ~ 250 ft
- AC base
  - Poly sheet over AC base
- Prestress force – residual prestress at mid-point

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Overall Process

- Fabricating precast panels at plant
  - o Controlled process
  - o Better quality control, better durability
- Transporting panels to the site
  - o Need sufficient no. of trucks
- Removal of old pavement/preparing base
  - o Or, place as an overlay
- Installing panels on finished base
  - o Over a pre-placed poly sheet



Overall Process

- Interconnecting panels
  - o Snug fit
- Post-tensioning panels
  - o 0.6-inch diameter 7-wire monostrand tendons
  - o 75% of ultimate load applied
  - o Residual prestress at mid-point
- Grouting post-tensioning ducts
- Injecting bedding grout to firmly seat panels


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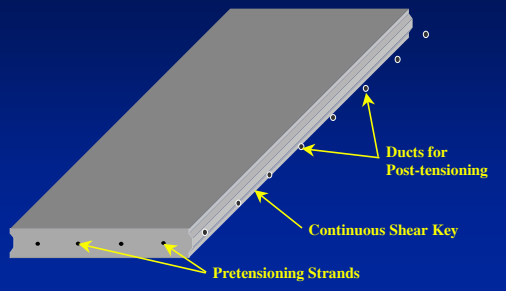
Precast Panels



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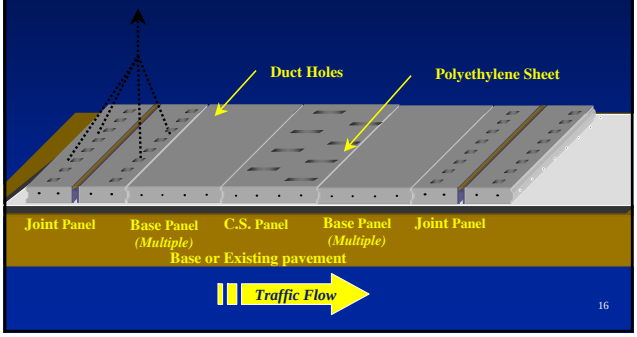
Panel Assembly



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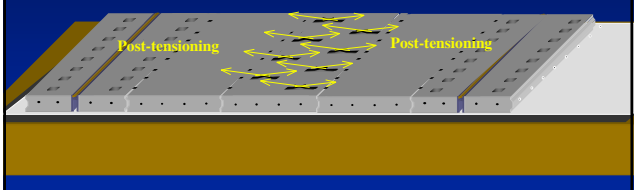
Panel Assembly



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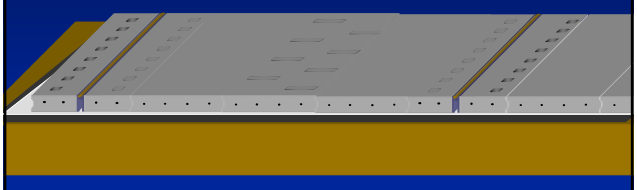
Panel Assembly

Once post-tensioned, pavement behaves like a conventional prestressed pavement



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Fabrication & Delivery

Installation

Benefits of Precast Prestressed Concrete Pavement

- Speed
- Durability
- Thinner slabs (8 in. PPCP vs. 12 to 14 in. JPCP)
- Longer construction season
- Existing technology & established industry procedures

Get in, do it right, get out, and stay out

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Demo Projects

- Pilot – Frontage Road, Austin, Texas – 2001
  - 2,300 ft, 2 lanes plus shoulders
- Demos
  - 2004 – California – I-10 (Night-time) - ~ 500 ft
  - 2005 – Missouri – I-57 (Rehab) – 1,000 ft
  - 2006 – Iowa – Bridge approach slab
  - 2007 – Florida – Intersection (proposed)

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Precast Prestressed Concrete Pavement Missouri I-57 Demonstration Near Sikeston - December 2005

Project Length: 1,000 ft (2 lanes plus shoulders)
Panel Dimensions: 10 by 38 ft with t of 5.75 to 11 in.
No. of panels: 100
No. of post-tensioned sections: 4 @ 250'
Installation Rate: 12 panels/6 hours
Features:
- Pavement crown cast into the panel surface.
- Non-continuous keyways between panels

Missouri I-57 Precast Panels – Fabrication in Memphis, TN

← Plant site storage

Delivery from Memphis to Sikeston site ➔

Installation & Prestressing

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I-57 Missouri

Completed Section

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Sheldon, Iowa

PPCP anchored to integral abutment of new bridge

Project Length: ~160 ft (2 approach slabs)
Panels: 14' x 20' x 12" (typical); No. of panels used: 16
No. of slabs: 2 @ ~ 80' long x 24' wide
Features: 2-way post-tensioned partial width panels

Summary of PPCP Activities

Fabricate – Stockpile – Deliver & Install

Fabricate

Stockpile

Deliver & Install

General Guidelines

- Candidate projects
  - Any new or rehabilitation project that cannot have extended lane closures
  - Initial cost is not a criterion
- Design
  - Thickness about 7 to 8 in.
  - Expansion joints at 250 to 300 ft
  - Needs a well-finished AC base or existing ACP or PCCP with AC interlayer

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General Guidelines

- Construction
  - Conventional concrete mixtures
  - Nearby precast plant
  - Site access necessary – to accommodate large no. of delivery trucks
  - Site access for heavy-duty crane
  - Construction not affected by weather

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Future Directions

- FHWA demo program will continue – several demo projects are under discussion for 2007 and 2008
- As there is more use and more experience and competition, construction costs are expected to be competitive compared to other alternatives

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Summary

- Precast prestressed paving technology has improved
- Construction is feasible under traffic conditions
- Rapid re-opening to traffic is possible

A technology whose time has come!!!

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