

Tech Brief

PRECAST CONCRETE PAVEMENT TECHNOLOGY RESOURCES

INTRODUCTION

Precast concrete pavement (PCP) technology is gaining wider acceptance in the US for rapid repair and rehabilitation of concrete pavements as well as for reconstruction of heavily trafficked asphalt concrete intersections. While widespread use of PCP technology in the US is of recent origin, with most projects in service less than about 14 years, tens of projects have been constructed and many advances have been made and continue to be made in all aspects of the technology including panel design, fabrication, and installation. In the US, PCP technology is being used for intermittent repairs (both full-depth repairs and full panel replacement) and for continuous applications (longer-length/wider-area rehabilitation) with service life expectations of at least 20 years for repairs and at least 40 years for continuous applications, without significant future corrective treatment. Available PCP systems include jointed PCP with reinforced or prestressed panels installed singly or in a continuous series; and, prestressed PCP that typically incorporates thinner panels installed and posttensioned in a continuous series resulting in fewer joints.

The use of PCP technology can significantly reduce traffic impacts of roadway repair and reconstruction projects, particularly on heavily traveled routes. The technology is applicable to both small segments, enabling flexibility in construction phasing, as well as for use in corridor-wide pavement rehabilitation/reconstruction. The review of projects constructed in the US and field testing of selected projects indicate that sufficient advances have been made to reliably design and construct PCP systems to achieve five key attributes of successful pavements, as follows:

- Constructability – Techniques and equipment are available to ensure acceptable production rates for the installation of PCP systems.
- Concrete durability – Plant fabrication of precast panels results in excellent concrete strength and durability.
- Load transfer at joints – Reliable and economical techniques are available to provide effective load transfer at transverse joints in both jointed and prestressed PCP systems.
- Panel support – Techniques to provide adequate and uniform base support conditions are available and continue to be improved.
- Efficiency – Panels are thinner than standard cast-in-place concrete and last longer because of prestressing and/or reinforcing elements in the PCP systems.



U.S. Department
of Transportation

**Federal Highway
Administration**

The use of both jointed and prestressed PCP systems has advanced during the last decade due to a combination of work sponsored by the Federal Highway Administration (FHWA), projects constructed by highway agencies, and innovations by the construction industry during the last decade. PCP has been adopted for routine use in California, New Jersey, New York, and Utah. Also, Illinois Tollway uses PCP for intermittent repairs and for ramp rehabilitation. Currently, FHWA is working with fifteen highway agencies to implement the use of PCP for pavement repair and rehabilitation. These agencies have received funding awards under Round 3 and Round 6 of the Strategic Highway Research Program 2 (SHRP2) Implementation Assistance Program (<http://www.fhwa.dot.gov/goshrp2/ImplementationAssistance>). The Lead Adopter awards will supplement the cost of a PCP project constructed by each recipient; and, the User Incentive awards will help recipients to make PCP technology available for use on an agency-wide basis.

This TechBrief provides a summary of the technical resources available to engineers and planners seeking an understanding of PCP technology. Weblinks are provided for access to recent documents covering a range of PCP topics.

RESOURCES

A brief description of selected technical resources concerning PCP is presented in each of the following paragraphs

SHRP2 Project R05 Documents

The SHRP2 R05 report on Precast Concrete Pavement Technology was published in 2012. The report includes the following:

- Guidelines for PCP design, fabrication and installation
- Guidelines for project selection
- Guidelines for PCP system acceptance
- Findings based on field testing of 15 PCP projects in the US
- Model specifications for both jointed and prestressed PCP systems

Links: [Final R05 Report](#), Model [Specifications](#)

Several documents related to the implementation of SHRP2 Project R05 products are available online, as follows:

- [Tools for using precast concrete pavement \(PCP\) systems to reduce the duration of construction closures on critical roadways and](#)

[to provide long-life performance](#) – provides a summary of findings from the SHRP2 Project R05 study.

- [PCP Implementation Plan \(2014\)](#) – presents the details and results of the SHRP2 implementation assistance program's Round 3 funding related to PCP implementation.
- [Who is using Precast Concrete Pavements](#) – shows graphically the status of PCP usage throughout the US. Also, provides agency contact information.
- FHWA's PCP [Marketing plan](#) - This marketing plan, published during early 2014), provides an overall framework for carrying out activities that will support delivery and implementation of promising PCP technology products.

FHWA Highways for LIFE Program Reports

The Highways for LIFE (HfL) program, FHWA's initiative to accelerate innovation in the highway community, provided incentive funding prior to 2014 for demonstration construction projects. Through these projects, the HfL program promoted and documented improvements in safety, construction-related congestion, and quality that could be achieved by setting performance goals and adopting innovations. The HfL support of the PCP technology is documented by information that can be accessed using the following weblinks.

- HfL [PCP Overview](#) – presents an overview of the HfL program related to PCP implementation.
- [California PCP Project](#) – A jointed PCP system was used to rehabilitate a section of I-15 in Ontario, California during 2010.
- [Florida PPCP Project](#) – A prestressed PCP system was used during January 2012 as an unbonded overlay to rehabilitate a section of US 92 between DeLand and Daytona Beach, Florida.
- [Utah PCP Project](#) – A jointed PCP system was used to rehabilitate a section of southbound I-215 during mid-2011.
- [Virginia Prestressed and Jointed PCP Projects](#) – A prestressed PCP system was used to replace a section of mainline I-66; and a jointed PCP system was used to replace a ramp exiting I-66; both in Fairfax County, Virginia during 2009.
- [Georgia PCP Project](#) – A jointed PCP system was used to rehabilitate a street corridor in downtown Winder, Georgia during 2013.

- [Delaware Prestressed PCP Project](#) – A prestressed PCP system was used during 2009 to rehabilitate a left-turn lane and the outside lane and shoulder along a section of northbound Route 896.

FHWA Tech Briefs

- [2009 Tech Brief: Precast Prestressed Concrete Pavement for Reconstruction and Rehabilitation of Existing Pavements](#) - This Tech Brief discusses the application of precast prestressed concrete pavement for new construction and for rehabilitation of existing asphalt and concrete pavements. The background of the development of precast prestressed pavement technology is briefly summarized. The details of several field trials of this innovative technology are presented and recommendations for ensuring successful precast prestressed concrete pavement installation are provided.
- [2008 Tech Brief: Precast Concrete Panels for Repair and Rehabilitation of Jointed Concrete Pavements](#) - This Tech Brief discusses the application of precast concrete pavements for repair for distressed concrete pavements. The background of the development of precast repair technology is briefly summarized. The results of recent field trials of precast concrete pavement repairs are presented and recommendations for ensuring successful precast repair installation are provided.

Industry Resources

The Precast/Prestressed Concrete Institute (PCI) published a report on PCP in 2012 to summarize the various aspects of using PCP. The report, which is available at the following weblink, [PCI State-of-the-Art Report on Precast Concrete Pavements](#) (PP-05-12), was developed through a cooperative agreement between PCI and FHWA. The four documents consolidated in the report include: Applications for Precast Concrete Pavements, Design and Maintenance of Precast Concrete Pavements, Manufacture of Precast Concrete Pavement Panels and Construction of Precast Concrete Pavement. This document constitutes a state-of-the-art report on the use of PCP through 2012.

PCI

- PCI Papers:
 - [Precast concrete pavements: Technology overview and technical](#)

[considerations](#) – presents a summary of the SHRP2 Project R05 study.

- [Engineering a better road: Use of two-way prestressed, precast concrete pavement for rapid rehabilitation](#) – presents the use of two-way prestressed panels to rehabilitate a section of I-896 in the San Francisco area during 2012.
- [PCP Repository](#) – Information on PCP maintained by PCI. The intent is to share professional information on PCP technology in an attempt to benefit all stakeholders. PCI makes no claim for the completeness or accuracy of the information. The website is owned and operated by PCI.

National Precast Concrete Association (NPCA)

- <http://precast.org/precast-product/paving-slabs/> - information on PCP.
- [Map](#) - Interactive map, maintained online by NPCA, detailing PCP projects currently completed or underway throughout the United States. Click on a map marker for more information about individual projects.
- [ACPA: Designing and Putting Together a Jointed Precast Concrete Pavement Project](#) (available for a fee) – Video of a seminar presented by the National Precast Concrete Association and the American Concrete Pavement Association during 2013.

American Association of State Highway and Transportation Engineers

- [AASHTO TIG](#) - <http://aii.transportation.org/Pages/PrecastConcretePavingSlabs.aspx> – The AASHTO Technology Implementation Group (TIG), now the AASHTO Innovation Initiative (All), advances innovation by identifying and championing the deployment and implementation of a select few proven technologies, products or processes that are likely to yield significant economic or qualitative benefits to highway users. During 2005, a TIG on PCP Technology was established to promote the use of PCP for Paving, Pavement Rehabilitation, and Pavement Repairs by transportation agencies and contractors nationwide.

Best Practices Webinars

Several webinars were presented over the last few years to highlight PCP best practices and recent innovations to support wider implementation of the

PCP technology. Weblinks to the webinars are available, as follows:

1. [TRB's SHRP 2 Tuesdays Webinar: Precast Concrete Pavement Technology \(R05\)](#)
2. 2014 TRB Webinars: Planning and Design Considerations for Precast Concrete Pavement Implementation – [Part 1](#), [Part 2](#)
3. ACPA Webinars: (Available for a fee)
 - [Part 1: Straight Facts about Precast Concrete Pavement Systems](#)
 - [Part 2: An Owner and Designer's Guide to Using Jointed Precast Concrete Pavement](#)
 - [Part 3: Designing and Putting Together a Jointed Precast Concrete Pavement Project](#)
 - [Part 4: Fabricating and Installing a Jointed Precast Concrete Pavement Project](#)
 - [Part 5: Straight Facts about Jointed Precast Concrete Pavements](#)

Caltrans Design Report

This report provides an approach to develop structural pavement designs for jointed and prestressed PCP systems: [Proposed Process for Design of Precast Concrete Pavements - Sacramento, California.](#)

SUMMARY

PCP technology is gaining wider acceptance in the US, and advances have been made to reliably

design and construct PCP systems to achieve five key attributes of successful pavements, as follows:

- Constructability – Techniques and equipment are available to ensure acceptable production rates for the installation of PCP systems.
- Concrete durability – Plant fabrication of precast panels results in excellent concrete strength and durability.
- Load transfer at joints – Reliable and economical techniques are available to provide effective load transfer at transverse joints in both jointed and prestressed PCP systems.
- Panel support – Techniques to provide adequate and uniform base support conditions are available and continue to be improved.
- Efficiency – Panels are thinner than standard cast-in-place concrete and last longer because of prestressing and/or reinforcing.

This TechBrief provides a summary of the technical resources readily available to engineers and planners seeking to implement the use of PCP. Weblinks are provided for access to documents covering a wide range of PCP guidelines from panel design, fabrication and installation to project selection, PCP system acceptance, and model specifications.

This Tech Brief was developed under FHWA contract DTFH16-14-D-0005. For more information please contact:

Contracting Officer’s Representative:

Sam Tyson, P.E., Concrete Pavement Engineer
 Federal Highway Administration
 1200 New Jersey Avenue, S.E. – E73-440
 Washington, DC 20590
 202-366-1326, sam.tyson@dot.gov

Authors:

Shiraz Tayabji, Ph.D., P.E., and Wouter Brink, Ph.D.
 Applied Research Associates, Inc.
 410-707-4902, stayabji@ara.com; wbrink@ara.com

Distribution and Availability—This Tech Brief can be found at <http://www.fhwa.dot.gov/pavement> under “Publications.”

Key Words—Precast concrete pavement, concrete pavement rehabilitation, concrete pavement repair, precast concrete panels, precast prestressed concrete pavement, precast jointed concrete pavement;

Notice—This Tech Brief is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document. The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers’ names appear in this report only because they are considered essential to the objective of the document.

Quality Assurance Statement—The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.