

Technology Transfer, Delivery, and Implementation of Best Practices for Jointed Concrete Pavements

Summary Report
August 2018



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**Federal Highway
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16. Abstract This report summarizes the activities performed, products developed, and accomplishments under this task order as part of the above-referenced contract. The goal of this task order is to conduct technology transfer, delivery, and implementation of best practices for jointed concrete pavements. Activities such as those conducted under this task order are invaluable in ensuring that long lasting and sustainable pavement systems can be reliably designed, specified, constructed, and maintained. Advancements in technology resulted in the need for several topics addressing best practices for concrete pavements documented. Four topics were covered in a previous task order. The four topics covered under this task order include: (1) roller compacted concrete (RCC) pavement, (2) permeable concrete pavements, (3) bases and subbases for concrete pavements, and (4) internal curing of concrete pavements. Each of these topics has the potential to significantly improve the long-term performance and the sustainability of concrete pavements for highway agencies throughout the U.S.			
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OVERVIEW

In 2017, Task Order 7 was awarded under IDIQ Contract DTFH61-14-D-00005, for Technology Transfer, Delivery, and Implementation of Best Practices for Jointed Concrete Pavements. The objective of this task order was to document current information available and to deliver that information in the form of technical briefs, webinars, and workshops to highway agencies for their awareness and implementation, for the following four (4) technologies:

- (1) roller compacted concrete pavements
- (2) permeable concrete pavements
- (3) bases/subbases for concrete pavements
- (4) internal curing of concrete pavements.

Each of these topics has the potential to significantly improve the long-term performance and the sustainability of concrete pavements for highway agencies throughout the U.S. The interest shown by highway agencies regarding these topics point to the demand for new and improved technologies, products, processes, and techniques for the designing, specifying, constructing, and maintaining concrete pavements.

The tasks conducted included developing four technical briefs, developing and presenting ninety-minute webinar presentations for each topic, and developing and presenting workshops that addressed each topic.

TASKS, PRODUCTS, AND ACCOMPLISHMENTS

Task 1: Technical Briefs

Deliverable: Four Technical Briefs (Tech Briefs)

Four best practices Tech Briefs were developed and published. They are available on the Federal Highway Administration (FHWA) website and as linked documents (pdfs) from the CP Tech Center websites.

- [*Roller Compacted Concrete Pavement*](#), FHWA-HIF-16-003, June 2016, 10 pages (Zollinger 2016). This Tech Brief presents an overview of the best practices for roller-compacted concrete pavement. The Tech Brief discusses RCC pavement uses and provides information on RCC mixtures and construction of RCC pavements.
- [*Permeable Concrete Pavements*](#), FHWA-HIF-16-004, May 2016, 11 pages (Hein and Schaus 2016). This Tech Brief presents an overview of two types of permeable concrete pavement systems and their use. Information is provided on the structural and hydrological design, factors for successful construction and maintenance, and the performance of these systems.
- [*Bases and Subbases for Concrete Pavements*](#), FHWA-HIF-16-005, August 2017 (revised), 11 pages (Hein et al. 2017). This Tech Brief presents an overview of best practices for the design and construction of bases and subbases for concrete pavements and its effects on performance.
- [*Internal Curing for Concrete Pavements*](#), FHWA-HIF-16-006, July 2016, 7 Pages (Weiss 2016). This Tech Brief provides information on internal curing for concrete pavements by describing the primary concepts behind internal curing as well as describing aspects of practical applications, mixture design, construction, and quality control.

These Tech Briefs were distributed to participants of the relevant webinars and at the workshops discussed below.

Task 2: Webinars

Deliverable: Four webinars each presented twice during the course of the contract.

A total of eight webinars were presented as summarized in the following table. The webinars were presented as part of the Transportation Research Board's (TRB) webinar series and can be downloaded using the links included within the tables below. All webinars were sponsored by the two TRB committees "AFD50 – Design and Rehabilitation of Concrete Pavements" and "AFH50 – Concrete Pavement Construction and Rehabilitation."

Topic	Date	Presenters	Moderator
Roller Compacted Concrete Pavement	1/23/2017	Dan Zollinger (Texas A&M University, Shabbir Hossain, Virginia Department of Transportation)	Sam Tyson
Internal Curing for Concrete Pavements	2/16/2017	Jason Weiss (Oregon State University), Dennis Morian (Quality Engineering Solutions), Steven Gillen (Illinois Tollway)	Sam Tyson
Permeable Concrete Pavements	3/9/2017	David Hein (Applied Research Associates, Inc.)	Sam Tyson
Bases and Subbases for Concrete Pavements	4/17/2017	David Hein (Applied Research Associates, Inc.), Shreenath Rao (Applied Research Associates, Inc.)	Sam Tyson
Roller Compacted Concrete Pavement	2/14/2018	Dan Zollinger (Texas A&M University), Andy Johnson (Southeast Cement Promotion Association), Will Gray (A. G. Peltz Group, LLC)	Sam Tyson
Permeable Concrete Pavements	3/15/2018	David Hein (Applied Research Associates, Inc.), Todd Hill (City of Atlanta)	Sam Tyson
Bases and Subbases for Concrete Pavements	4/17/2018	David Hein (Applied Research Associates, Inc.), Bernard Izevbekhai (Minnesota Department of Transportation)	Sam Tyson
Internal Curing for Concrete Pavements	5/24/2018	Jason Weiss (Oregon State University), Don Streeter (New York State Department of Transportation)	Sam Tyson

The table below shows the attendance records and satisfaction statistics for the eight webinars as provided by TRB.

Topic	Date	Sites Logged	Attendees Estimate	Satisfied or Very Satisfied
Roller Compacted Concrete Pavement	1/23/2017	258	303	91%
Internal Curing for Concrete Pavements	2/16/2017	269	334	95%
Permeable Concrete Pavements	3/9/2017	323	427	98%
Bases and Subbases for Concrete Pavements	4/17/2017	296	353	96%
Roller Compacted Concrete Pavement	2/14/2018	300	352	95%
Permeable Concrete Pavements	3/15/2018	278	332	98%
Bases and Subbases for Concrete Pavements	4/17/2018	300	401	90%
Internal Curing for Concrete Pavements	5/24/2018	170	198	100%
TOTAL		2,194	2,700	

Task 3: Workshops

Deliverable: One full day workshop, presented at four locations.

Four workshops were held as listed in the table below.

Location	Date	Presenters	Participants
Los Angeles, CA	11/15/2017	Dan Zollinger (Texas A&M University)	37
Sacramento, CA	11/16/2017	Dan Zollinger (Texas A&M University)	25
Columbus, OH	2/8/2018	David Hein (Applied Research Associates, Inc.), Lori Schaus (Applied Research Associates, Inc.)	148
Chicago, IL	4/18/2018	David Hein (Applied Research Associates, Inc.)	91

Agendas for the workshops are included in Appendix A.

Note that per request of the host agency, the workshops focused on in-depth coverage of a specific topic with just an introductory discussion summarizing the other three topics. Participants and host agencies were specifically interested in one specific topic rather than all four topics and as a result, based on discussions with FHWA, only one topic was covered in detail in each of the four workshops.

Task 4: Summary Report

Deliverable: Monthly progress reports and a report summarizing the activities and deliverables under the task order.

All monthly progress reports and other documents have been provided to FHWA in electronic format. This report is the summary report developed as part of this task.

CONCLUSIONS

This document presents a summary of the work performed under this task order and includes:

- Details of the tasks performed.
- Links to electronic copies of the products developed and presented.
- Workshop agendas and other materials.

The four topics covered under this task order as follows:

- (1) roller compacted concrete (RCC) pavement;
- (2) permeable concrete pavements;
- (3) bases and subbases for concrete pavements; and,
- (4) internal curing of concrete pavements.

Under this task order, information on these four topics was developed and disseminated through Tech Briefs, webinars, and workshops. Agencies across the U.S. benefited from learning about these technologies and getting an in-depth understanding of key aspects relevant to these topics thus enabling them to stay on the forefront of advancements in the area of materials, design, specifications, and construction for concrete pavements. These kind of technology transfer activities are crucial to the education and development of agency staff and workforce who are involved in various aspects of concrete pavements.

REFERENCES

Hein, D. and Schaus, L. 2016. *Permeable Concrete Pavements*. Publication Number FHWA-HIF-16-004. Federal Highway Administration, Washington, D.C.

Hein, D., Rao, S., Tayabji, S., and Lee, H. 2017. *Bases and Subbases for Concrete Pavements*. Publication Number FHWA-HIF-16-005. Federal Highway Administration, Washington, D.C.

Taylor, P. 2017. *Technology Transfer, Delivery, and Implementation of Best Practices for Jointed Concrete Pavements: Summary Report*. Publication Number FHWA-HIF-17-045. Federal Highway Administration, Washington, D.C.

Weiss, J. 2016. *Internal Curing for Concrete Pavements*. Publication Number FHWA-HIF-16-006. Federal Highway Administration, Washington, D.C.

Zollinger, D. 2016. *Roller Compacted Concrete Pavement*. Publication Number FHWA-HIF-16-003. Federal Highway Administration, Washington, D.C.

APPENDIX A: WORKSHOP AGENDAS

Caltrans/FHWA Workshop

ROLLER COMPACTED CONCRETE PAVEMENTS State of Practice, Applications & Quality Construction

Nov 15, 2017 – Caltrans D7 Conf. Room, 7th Floor, 100 S Main St, Los Angeles, CA

Nov 16, 2017 – 3390 Lanatt Street, Room 1B, Sacramento, CA

8:30 AM to 12:30 PM

Roller compacted concrete (RCC) is a no-slump concrete that is placed using AC paving machines and compacted by vibratory rollers. RCCP is a lower cost alternative to conventional jointed concrete pavements and generally provides structural performance that is equivalent to that of conventional jointed concrete pavements for equal design features. However, RCCP does not incorporate all the features of conventional jointed concrete pavement. Most of the larger RCCP projects in the U.S. have been constructed since the early 1980s. Most of the early applications were for off-highway facilities, such as log sorting yards, forest haul roads, and port facilities. The RCCP construction technology has improved considerably over the last 30 years, and new well-designed and well-constructed RCC projects can be expected to provide the desired long-term performance for a range of applications, including roadway applications. For highway applications, the RCCP surface is typically diamond ground to provide surface smoothness and surface friction properties comparable to conventional concrete pavements.

This workshop, offered by the Federal Highway Administration, will cover state of practice for RCC pavements, with emphasis on construction and quality requirements, to address Caltrans needs. Case studies of RCC pavements will also be presented. The workshop outline is as follows:

Introduction to RCC Pavement and Applications

RCC Behavior and Design

RCC Pavement Specification Review & Quality Control Material Testing

- Equipment, Mix Design Process, Mix Production & Trucking
- Paving & Rolling, Curing & Sawcutting
- QC/QA

All workshop participants will receive a copy of the workshop booklet and PDH certificate.

Workshop Instructors (FHWA RCC Pavement Implementation Team):

- Dan Zollinger, Ph.D., PE; Texas A&M University, College Station, Texas

To register and for additional information on the workshop, contact:

Flor Bautista, PE

Headquarter Maintenance, Office of Concrete Pavements, Sacramento

Office Phone: 916-227-5843, Email: Florante_bautista@dot.ca.gov

For information on the FHWA Roller Compacted Concrete Pavement Technology Implementation Program, contact:

Sam Tyson, P.E., FHWA, Washington, DC

Phone: 202-366-1326; Email: sam.tyson@dot.gov

Permeable Pavements Workshop Agenda

Date: February 8, 2018

Location: Columbus, Ohio

Time	Topic
8:00 - 8:30	Registration
8:30 - 8:35	Welcome/logistics
8:35 - 9:00	Introduction to Permeable Pavements Lori Schaus, P.Eng.
9:00-10:30	Design of Permeable Pavements David Hein, P.Eng.
10:30 - 10:45	Break
10:45 - 11:15	Permeable Design Pro David Hein, P.Eng.
11:15 - 11:30	Live Demonstration David Hein, P.Eng.
11:30 - 12:30	Lunch, on your own
12:30 - 1:45	Construction and Maintenance of Permeable Pavements Lori Schaus, P.Eng.
1:45- 2:45	Case Studies David Hein, P.Eng.
2:45	Wrap-up

Permeable Pavements Workshop Agenda

Date: April 18, 2018

Location: Chicago, IL

Time	Topic
8:00 - 8:30	Registration
8:30 - 8:35	Welcome/logistics David Hein, P.Eng.
8:35 – 9:30	Introduction to Permeable Pavements
9:30-10:30	Design of Permeable Pavements
10:30 - 10:45	Break
10:45 – 11:15	Permeable Design Pro
11:15 - 11:30	Live Demonstration
11:30 - 12:30	Lunch, on your own
12:30 - 1:45	Construction and Maintenance of Permeable Pavements
1:45- 2:45	Case Studies
2:45	Wrap-up