CONCRETE PAVEMENT CPTP TECHNOLOGY PROGRAM

Concrete Pavement Technology Update

Concrete Overlays—An Established Technology With New Applications

The need for optimizing preservation and rehabilitation strategies used to maintain the Nation's highway pavements has never been greater. Concrete overlays have a long history of use to preserve and rehabilitate concrete and asphalt pavements, and many of the practices are well established. However, of recent origin are techniques that use thinner concrete overlays with shorter joint spacing. Field experience over more than 15 years with the thinner concrete overlays under a range of traffic and site conditions has demonstrated their viability as a cost-effective solution to extend the service life of deteriorated asphalt and concrete pavements.

The Federal Highway Administration (FHWA) has initiated several activities to support technology transfer related to concrete overlays. These activities include reviews, on a regional or statewide basis, of current applications of concrete overlays, identification of gaps in technology, and assistance in developing a program—jointly with State departments of transportation (DOTs) and industry—for technology transfer and demonstration projects. FHWA is assisting with organization of meetings at the State and regional levels to help coordinate concrete overlay technology transfer activities.

Overview of Concrete Overlays

Concrete overlays offer a broad range of applications for preserving and rehabilitating asphalt, concrete, and composite pavements. Concrete overlays can be designed for a range of traffic loading to provide long performance lives, 15 to 40+ years, to meet specific needs. Well-designed and well-constructed concrete overlays require low maintenance and can have low life-cycle costs. Applications include the following:

- Over existing asphalt pavements
  - Bonded overlay of asphalt pavements
  - Unbonded (directly placed) overlay of asphalt pavements
- Over existing concrete pavements
  - Bonded overlay of concrete pavements
  - Unbonded (separated) overlay of concrete pavements
- Over existing composite pavements
  - Bonded overlay of composite pavements
  - Unbonded (directly placed) overlay of composite pavements

Bonded overlays are typically thin, 2 to 6 in. (50 to 150 mm) in thickness. When bonded to a milled asphalt surface, the overlay panels are typically 6 by 6 ft (1.8 by 1.8 m) or less in dimension.

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CPTP has sponsored precast concrete pavement demonstrations in Missouri and other States (see page 3).

The Concrete Pavement Technology Program

CPTP is an integrated, national effort to improve the long-term performance and cost-effectiveness of concrete pavements by implementing improved methods of design, construction, and rehabilitation and new technology. Visit www.fhwa.dot.gov/pavement/concrete for more information.

About CPTP Updates

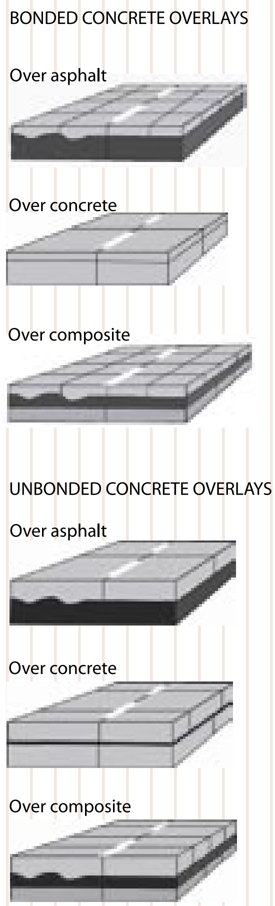
The CPTP Update is one facet of CPTP's technology transfer and implementation effort. Updates present new products and research findings that emerge from CPTP studies. Place your name on the mailing list with a call (202-347-6944), fax (202-347-6938), or e-mail (sstamey@woodwardcom.com).

In This Update

U.S. Department of Transportation
Federal Highway Administration

Overlays, continued from page 1

The *Guide to Concrete Overlay Solutions* (National Concrete Pavement Technology Center, January 2007) is available at www.cptechcenter.org/publications/overlays/. Print copies are available from ACPA (800-868-7633).



Construction of an unbonded concrete overlay on concrete pavement, I-44, Missouri.

When bonded to a prepared concrete surface, the overlay jointing pattern matches the jointing pattern of the existing jointed concrete pavement. In the case of continuously reinforced concrete pavement, transverse jointing is not provided.

Unbonded overlays are of two types:

- *Conventionally thick overlays,* 6 in. (150 mm) or thicker, are full-width and have transverse joint spacing of 12 to 15 ft (3.7 to 4.6 m).
- *Thinner overlays* are 4 to 6 in. (100 to 150 mm) thick, and the overlay panels are typically 6 by 6 ft (1.8 by 1.8 m) or less in dimensions.

Irrespective of thickness, unbonded overlays are always placed over an asphalt concrete surface—whether an asphalt pavement or an asphalt interlayer/resurfacing placed over a concrete pavement.

Regional Meetings

A keystone activity of FHWA's concrete overlay program is meeting with highway agency senior management to assist with reviewing their agency's application of concrete overlays, identifying gaps in technology, and developing a program, jointly with FHWA, highway agencies, and industry, for technology transfer activities. In November 2007, a meeting was held in Springfield, Virginia, among FHWA; senior management from highway agencies in Delaware, District of Columbia, Maryland, Virginia, and West Virginia; and the American Concrete Pavement Association (ACPA) Virginia Chapter. The mid-Atlantic experience with concrete overlays was reviewed, and the successful experiences of Colorado and Michigan with concrete overlays were discussed. Meetings were also held with the Louisiana DOT staff in Baton Rouge in April 2008 and the South Dakota DOT staff in Pierre in July 2008, where the North Dakota DOT staff participated as well. Local concrete overlay experience was reviewed and assistance discussed.

Concrete Overlays Guide

With support from FHWA, the National Concrete Pavement Technology Center (NCPTC) at Iowa State University developed a best practices *Guide to Concrete Overlay Solutions*. Prepared by a joint industry/State DOT Task Force on Concrete Overlays, the guide presents an overview of concrete overlay systems for resurfacing or rehabilitating pavements and includes detailed guidelines for overlay use:

- Evaluating existing pavements to determine whether they are good candidates for concrete overlays.
- Selecting the appropriate overlay system for a specific pavement condition.
- Managing concrete overlay construction work zones under traffic.
- Accelerating construction of concrete overlays when appropriate.

The guide is available from NCPTC and ACPA (see sidebar).

Best Practices Workshop

Under FHWA's Concrete Pavement Technology Program (CPTP), a 6-hour workshop based on the *Guide to Concrete Overlay Solutions* has been developed and is available to highway agencies. The concrete overlay workshop covers the following topics:

- Pavement fundamentals for overlay applications
- Existing pavement evaluation
- Technical discussion of concrete overlay design, construction, and materials
- Special considerations—geometrics, transitions, shoulders
- Concrete overlay case studies
- Maintenance of traffic
- Overlay performance and life cycle cost considerations
- FHWA/NCPTC Concrete Overlay Field Applications Program

The overlay workshop has been presented to State DOT staff from Pennsylvania, Louisana, North and South Dakota, and Washington State.

Field Applications Program

To advance the use of concrete overlays as cost-effective solutions for a wide variety of pavement conditions, FHWA and NCPTC

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Precast Pavement Technology—Moving Forward Fast

Precast pavement technology is a new and innovative construction method that can be used to meet the need for rapid pavement repair and construction. Precast pavement systems are fabricated or assembled off-site, transported to the project site, and installed on a prepared foundation (existing pavement or regraded foundation). The system components require minimal field curing time to achieve strength before opening to traffic. These systems are primarily used for rapid repair, rehabilitation, and reconstruction of asphalt and portland cement concrete (PCC) pavements in high-volume-traffic roadways. The precast technology can be used for intermittent repairs or full-scale, continuous rehabilitation.

In *intermittent repair* of PCC pavement, isolated full-depth repairs at joints and cracks or full-panel replacements are conducted using precast concrete slab panels. The repairs are typically full-lane width. The process is similar for full-depth repairs and full-panel replacement. Key features of this application are slab panel seating and load transfer at joints.

In *continuous applications,* full-scale, project-level rehabilitation (resurfacing) or reconstruction of asphalt concrete and PCC pavements is performed using precast concrete panels.

This article provides a summary of current initiatives related to precast pavement technology.

FHWA CPTP Initiative. Recognizing the need for effective, rapid rehabilitation methods, the Federal Highway Administration (FHWA), through its Concrete Pavement Technology Program (CPTP), and the Texas Department of Transportation (TxDOT), sponsored a study during the late 1990s that investigated the feasibility of using precast concrete for pavement rehabilitation. At the conclusion of the study, performed by the Center for Transportation Research (CTR) at The University of Texas at Austin, a concept for precast concrete pavement was developed. In March 2002, using this innovative concept, TxDOT completed the first pilot project that incorporated the use of post-tensioned precast concrete pavement along a frontage road near Georgetown, Texas. Since then, FHWA has actively promoted the concept of precast pavement systems to State departments of transportation (DOTs), and demonstration projects have been constructed in California, Missouri, and Iowa to develop field experience with this technology.

Demonstration of the precast post-tensioned concrete pavement system in Sikeston, Missouri.

FHWA's CPTP also sponsored the development of precast pavement technology for full-depth repair of concrete pavements. This work was conducted at Michigan State University and has resulted in several field trials of this technology in Michigan and Ontario, Canada.

For information, contact Sam Tyson, FHWA (sam.tyson@dot.gov).

FHWA Highways for Life Program Initiatives. The purpose of the Highways for LIFE (HfL) program is to accelerate the adoption of innovations and new technologies, thereby improving safety and highway quality while reducing congestion caused by construction. Since about 2006, the HfL program has identified precast concrete pavement technology as a high-priority, innovative technology to produce major benefits for the Nation's highways. In May 2008, the HfL program sponsored a web-based conference that attracted a large audience. The conference provided an update on precast concrete pavement technology and alerted participants to the HfL program's initiative to consider support for funding of several demonstration projects over next few years.

For information, contact Byron Lord, FHWA (byron.lord@dot.gov); www.fhwa.dot.gov/hfl.

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Precast, continued from page 3

A specification clearinghouse and other information on the use of precast concrete pavement is available at http://www.aashtotig.org/?siteid=57&pageid=1826.

Industry Initiatives. Parallel to FHWA's efforts, several organizations in the United States initiated independent development activities to refine precast concrete pavement technologies. These technologies have certain proprietary features and require licensing for product use. Privately developed technologies include the following:

1. The Fort Miller Super Slab system. For information, contact Peter J. Smith (psmith@fmgroup.com) or Michael Quaid (mquaid@fmgroup.com).

2. The Uretek Stitch-in-Time system. For information, contact Mike Vinton (mike.vinton@uretekusa.com).

3. The Kwik Slab system. For information, contact Malcolm Yee (info@kwikslab.com).

Since about 2001, the Fort Miller system has been used on several production projects (continuous and intermittent) for repair and rehabilitation applications. In continuous application, this system simulates conventional jointed plain concrete pavement sections. The Uretek system has also been widely used, according to the developer for intermittent repairs. The Kwik Slab system has been used on a limited basis in Hawaii. This system simulates long jointed reinforced concrete pavement sections. In addition to the proprietary precast concrete pavement systems, generic systems have also been used and are under development. The Port Authority of New York and New Jersey (PANY/NJ) installed generically developed precast concrete pavement test sections at La Guardia International Airport in New York to investigate the feasibility of rapid rehabilitation of a primary taxiway.

Intermittent repairs along a section of I-295 in New Jersey using the Fort Miller Super-Slab system (May 2008)..

Highway Agency Initiatives. In the last few years, several agencies have developed specifications that allow the use of precast concrete pavement systems. These agencies include the departments of transportation (DOTs) of New York State, Minnesota, Michigan, and Virginia, as well as the Ontario Ministry of Transport and PANY/NJ. Also, several agencies have installed test sections to demonstrate the feasibility of the precast concrete pavement systems. Accelerated testing of the Fort Miller precast concrete pavement system performed in California indicates that the system tested is capable of long-life service.

For information on agency initiatives, contact the following:

- New York State DOT: Mike Brinkman (mbrinkman@dot.state.ny.us).
- New Jersey DOT: Robert Sauber (rsauber@dot.state.nj.us).
- Caltrans: Tom Pyle (Tom_Pyle@dot.ca.gov).
- New York Thruway: Tom Gemmitti (tom_gemmitti@thruway.state.ny.us)
- Illinois Tollway: Steve Gillen (sgillen@getitpass.com).
- PANY/NJ: Scott Murrell (smurrell@panynj.gov).

AASHTO Technology Implementation Group Activities. Recognizing the increasing interest in precast concrete pavement technologies, AASHTO established a Technology Implementation Group (TIG) during 2006 to support technology transfer activities related to precast concrete pavements. The mission of this AASHTO TIG is to promote the use of precast concrete panels for paving, pavement rehabilitation, and pavement repairs to transportation agencies and owners nationwide and to present an unbiased representation to the transportation community on the technical and economic aspects of the precast paving systems currently available in the market place. In June 2008, the AASHTO TIG completed work on the following documents:

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.

The AASHTO TIG, in cooperation with the FHWA HfL Program, is planning to conduct several technology outreach activities. Roadshows are planned in Delaware, New

Jersey, and Illinois (Illinois Tollway Authority), and at other locations during late 2008 and in 2009.

For information, contact Tim LaCoss (timothy.lacoss@fhwa.dot.gov).

Strategic Highway Research Program 2 (SHRP 2) Project R05, Modular Pavement Technology. The objective of SHRP 2 activities is to achieve highway renewal that is performed rapidly, causes minimum traffic disruption, and produces long-lived facilities. A related objective is to achieve such renewal not just on isolated, high-profile projects, but consistently.

The focus of Project R05 is to develop tools that public agencies can 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. Project funding was established at $1 million. Phase I of the study, to be completed by December 2008, includes a review of modular pavement systems, review of highway agency and industry experience, and identification of successful strategies, promising technologies, and future needs related to modular pavement systems.

For information, contact James Bryant (jbryant@nas.edu; www.trb.org/shrp2/SHRPII_ETG.asp).

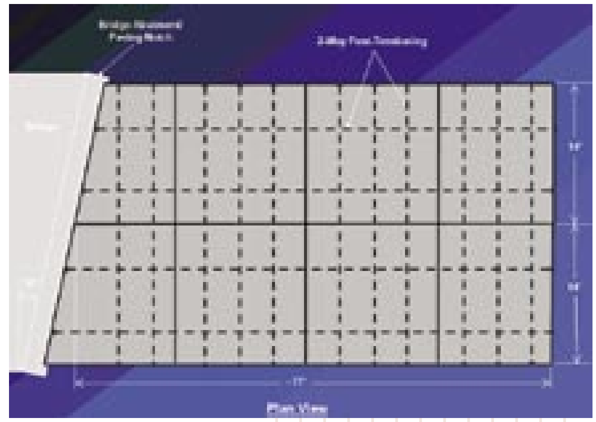
Technical Society Activities. Recognizing the high level of interest in precast concrete pavement technologies and to support their members' need for technical information, the following technical organizations have formed task forces to develop technical information on precast concrete pavement technologies:

American Concrete Institute—ACI's Committee 325 established the Subcommittee on Precast Concrete Pavements. The subcommittee is developing a document summarizing current technologies and providing case studies. For information, contact Shiraz Tayabji, Fugro Consultants, Inc. (stayabji@Fugro.com; 410-997-9020).

Precast/Prestressed Concrete Institute—PCI has established a Pavement Committee to develop interest in pavement applications by the precast industry and to develop guidelines for use of precast concrete pavements. For information, contact David Merritt, the Transtec Group (dmerritt@thetranstecgroup.com).

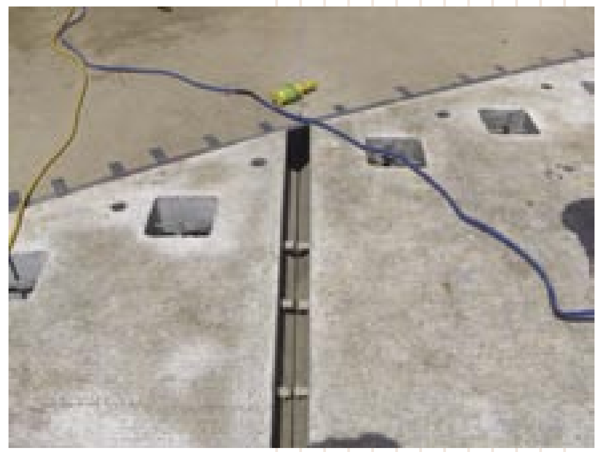
National Precast Concrete Association—NPCA has established a Pavement Committee to develop interest in pavement applications by the precast industry and to develop guidelines for use of precast concrete pavements. For information, contact Peter Smith, The Fort Miller Group (psmith@fmgroup.com).

Developments Outside the U.S.A. Recently, several European countries have started to investigate the use of precast concrete and other precast concrete systems for rapid repair and rehabilitation of pavements. The Dutch have developed the ModieSlab system. The Japanese have used precast concrete slab systems for high-speed slab track applications, tunnel roadways, and airports.



Plan for the precast slab system approach for a Highway 60 bridge near Sheldon, Iowa.

Below, the integrally tied approach using precast post-tensioned concrete slabs on the Sheldon bridge.



Summary

Precast concrete pavement technologies have come of age and are ready to be implemented. There is still room for innovations to optimize system components and to reduce costs. Current systems have higher initial costs compared to conventional procedures. However, the rapid process (fewer traffic control issues and shorter lane closure times) and better pavement durability can easily offset current higher initial costs. Properly engineered and well-constructed precast concrete pavement systems are capable of providing long service life.

Article prepared by Shiraz Tayabji, FHWA CPTP Implementation Team (stayabji@Fugro.com; 410-997-9020).

MEPDG Development Continues

The MEPDG documentation and the latest version of the MEPDG software are available at http://www.trb.org/mepdg.

Pavement design has come a long way and is preparing to take a new turn—a turn to the future with the development and eventual implementation of a new pavement design procedure. Referred to as the *Mechanistic–Empirical Pavement Design Guide* (MEPDG), the procedure analyzes basic pavement system responses (stresses, strains, and deflections) and relates them to pavement performance in terms of common distress types (e.g., cracking, faulting). This process allows engineers to design for allowable levels of distress over the selected design period.

Development of the MEPDG was sponsored by the National Cooperative Highway Research Program (NCHRP) under Project 1-37A. Initiated in 1996, the project developed a comprehensive approach to the design of pavement structures, with formal documentation produced in 2004 and ongoing refinements to the accompanying software program culminating in the release of version 1.0 in 2007.

Primary benefits of the new design guide are the improved reliability of the resultant designs and the ability to handle any and all combinations of materials, traffic, and climatic conditions. This capability is a major improvement over the widely used 1986/1993 *AASHTO Design Guide for Pavement Structures*, which was based on the limited materials, short test period, single climatic zone, and low traffic levels associated with the conduct of the AASHO Road Test from 1958 to 1960.

Strictly speaking, the MEPDG is not a design tool, but rather a pavement analysis tool. In other words, an initial design is first selected, along with definitions of material properties, climatic conditions, and traffic loadings. The response of that initial design to the climatic and traffic loading conditions is determined, and related to the development of pavement damage and distress. If the projected distress is within tolerable limits, the design is considered adequate; if not, the pavement design is modified and another iteration is performed to determine its suitability. This process is illustrated below, left.

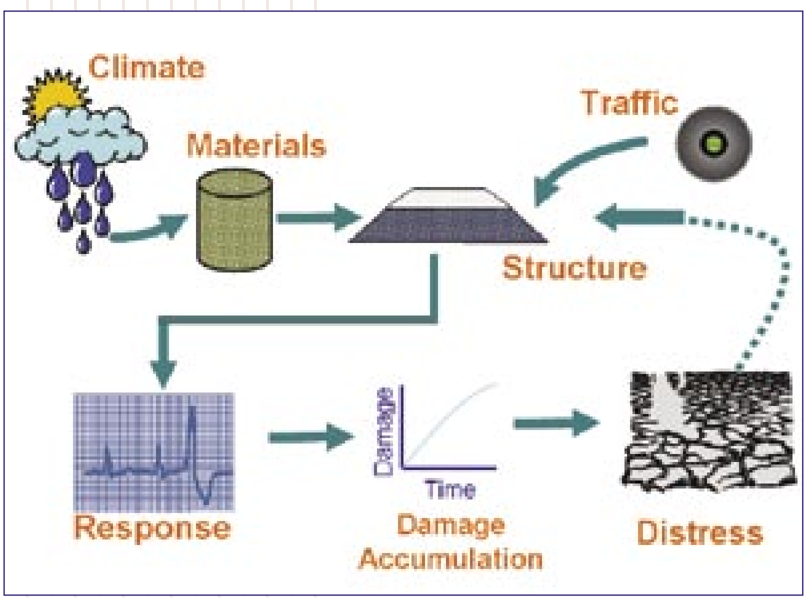
Since the release of the research version in 2004, a number of state highway agencies have been conducting investigatory and feasibility studies on the MEPDG, with an eye towards implementing the procedure. A separate report providing recommended calibration procedures for the MEPDG will be available from NCHRP soon, which should help agencies in their implementation efforts.

During the summer of 2007, the American Association of State Highway and Transportation Officials (AASHTO) Highway Subcommittee on Design and Highway Subcommittee on Materials approved the MEPDG, and in late 2007 the AASHTO Standing Committee on Highways voted to adopt the MEPDG as an interim specification. Much of the work now is focusing on enhancement and refinement of the current version of the MEPDG software and turning it into an AASHTOWare® software program, DARWin ME.

The overall timeline for DARWin ME calls for the development of the program to begin in late 2008 or early 2009 and to be completed in 15 to 18 months. Following the release of DARWin ME, the current version of DARWin will be retired within 12 months.

Article prepared by Kurt Smith, CPTP Implementation Team (ksmith@pavementsolutions.com).

The MEDPG allows engineers to predict how a pavement system with given material properties might respond to climatic conditions and traffic loadings over time.



Ongoing Surface Characteristics Research Activities

On March 31, 2008, the American Concrete Pavement Association (ACPA) Noise and Surface Characteristics Task Force was updated on ongoing research activities by Iowa State University (ISU), the Federal Highway Administration (FHWA), Purdue University, and ACPA.

Paul Wiegand, ISU, reported the results of on-board sound intensity (OBSI) testing of 500 unique surface textures and 1,200 unique pavement test sections. Noise emissions ranged from 98 to 109 dBA. Results indicated that sub-100-dBA projects can be obtained using any of the conventional tining or diamond grinding treatments. The causes of excessive noise levels were identified as a too-smooth or too-bumpy surface texture, presence of an ill-designed repeating pattern, and impulse loading effects from joints. ISU will produce a report on texturing guidelines.

Mark Swanlund, FHWA, highlighted some activities of the Pavement Surface Characteristics Program, which covers smoothness, friction, tire–pavement noise, and vehicle splash/spray:

- Working toward an improved functional performance indicator, particularly important as more distress data will be available in the Highway Performance Monitoring System, that may be a better indicator of functional performance than the International Roughness Index alone.
- Updating the 1980 Technical Advisory on skid crash reduction programs.
- Continuing the High Friction Surface Demonstration project. Plans are for three to five States to identify up to 10 locations in each where a high-friction surface can be applied, before-and-after crash data monitored, and effectiveness evaluated. Friction testing equipment (fixed slip or variable slip) other than the locked wheel skid trailer may be recommended. FHWA is conducting an equipment loan program featuring the Dynamic Friction Tester, the Circular Track Meter, and the Grip Tester.
- Enhancing the Traffic Noise Model, which will evaluate the impact of pavement type on tire–pavement noise emissions. An Expert Task Group developed provisional standards for OBSI measurement that were adopted by AASHTO. Projects are also underway to develop quieter pavement technology for both portland cement concrete and hot-mix asphalt surfaces.
- Developing a model to predict the likelihood of splash and spray conditions on existing pavement considering factors like cross-slope, longitudinal profile grade, texture, and rainfall (intensity, duration, and frequency). FHWA's review of methods for quantifying splash and spray found none to be particularly well suited for use with existing roads.

Robert Bernhard, Ph.D., provided an overview of the three-phase research effort on diamond grinding, sponsored by ACPA, at Purdue. One of the more interesting findings is that the results tend to be tire dependent. The grooving experiment involved including an acoustic medium in the groove, and this appeared promising. Innovative textures of various geometric patterns (circles, waffles, or variations) are being evaluated.

Larry Scofield, ACPA, briefed the Task Force on several topics. Current noise and friction testing results on the Next Generation Concrete Surface were presented; three test sections have been placed, and four more potential locations are being pursued. ACPA is collecting friction data to compare longitudinal- and transverse-tined concrete surfaces. In addition, the use of longitudinal grooving to affect roadway surface drainage is being evaluated. ACPA is developing an interactive sound demonstration system that will provide audio comparisons of roadways with different surfaces and textures, to be available soon.

It is only recently that significant research has been devoted to functional performance of concrete pavements, which is heavily influenced by pavement surface characteristics. Perhaps the most challenging task will be to relate those characteristics to the prediction of highway crashes. The results of this research will help bring safe, quiet, durable, and economical pavements to the traveling public.

Two of the 500 unique surface textures tested for on-board sound intensity at Iowa State University. Above, diamond grinding; below, longitudinal tining.

More information on surface characteristics research is available at these sites:

http://www.cptechcenter.org/projects/detail.cfm?projectID=1106856762

http://www.cproadmap.org/research/probstatement.cfm?psID=1646

http://www.tcpsc.com/LittleBookQuieterPavements.pdf

Article prepared by Roger Larson (rlarson@pavementsolutions.com), CPTP Implementation Team.

Overlays, continued from page 2

FHWA, South Dakota, and consultant staff visit a candidate concrete overlay site.

For more information:

Field Applications Program:
– Sam Tyson, FHWA (sam.tyson@dot.gov)
– Dale Harrington, NCPTC (dharrington@snyder-associates.com)

CPTP Concrete Overlay Workshop:
– Sam Tyson, FHWA (sam.tyson@dot.gov)
– Shiraz Tayabji (stayabji@aol.com)

Article prepared by Shiraz Tayabji, CPTP Implementation Team.

are implementing the Field Applications Program. The overall objective of this 2-year program is to increase awareness and knowledge related to concrete overlay applications among State DOTs, cities, counties, contractors, and engineering consultants by demonstrating and documenting various concrete overlay applications. At least six States from diverse regions will participate in the selection, design, and construction of concrete overlay demonstration projects.

The Field Applications Program includes the following components:

- A workshop based on the *Guide to Concrete Overlay Solutions* through CPTP.
- Site visits to select candidate concrete overlay demonstration projects.
- Meetings with an expert team managed by NCPTC for guidance on design and construction of the projects.
- Access to Iowa State University's mobile concrete testing laboratory to document quality control at the project sites.
- Documentation of the design and construction processes.
- Development of recommendations for updating concrete overlay practices.

The Louisiana and South Dakota DOTs have agreed to participate in the FHWA/NCPTC Concrete Overlays Field Applications Program, have hosted the Best Practices workshops, and are in the process of identifying candidate projects.

CPTP Update – New Products and Recent Activities

Products and Reports

Several CPTP reports and related products have been completed recently. These include:

- Cost-Effectiveness of Sealing Transverse Contraction Joints in Concrete Pavements (CPTP Task 9). This report reviews the history of transverse joint construction and sealing in concrete pavements, summarizes the results of a field survey program in which distress and deflection data were collected from 117 test sections, and presents the findings of a detailed analysis of that data.
- Inertial Profile Data for PCC Pavement Performance Evaluation (CPTP Task 63). The ProVal software program (which allows users to view and analyze pavement profiles in many different ways) was employed to help minimize the harmful effects of thermal curling and moisture warping in concrete pavement slabs. Work conducted under this CPTP task contributed to the development of ProVal 2.0.
- Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete (CPTP Task 64). A beta-version software program called COMPASS has been developed to assist engineers in determining the ideal paving mixture for a particular project (see page 9).

A complete listing of CPTP-related reports and products is available at www.fhwa.dot.gov/pavement/pub_listing.cfm.

ETG Plans Next Steps

The CPTP Engineering Expert Task Group met on November 6, 2007, in conjunction with a CPTP-sponsored international conference. The group heard updates on CPTP and related projects and discussed priorities for CPTP activities during the coming months. The following action items were identified:

- Conduct an aggressive marketing effort to promote the CPTP Best Practices workshops.
- Develop a TechBrief on joint sealing following approval of final report.
- Emphasize the need for more concrete pavement training at all levels.
- Update and emphasize the CPTP Product Catalog.
- Consider a TechBrief on COMPASS after the final report is available.
- Organize a conference in spring 2009 focused on effective strategies for concrete pavement maintenance and rehabilitation.

In addition, Bill Farnbach summarized activities at Caltrans related to concrete pavement with a focus on “green” concrete, environmental impact, and long-life pavements.

COMPASS—
Concrete Mixture Performance Analysis System Software

With the emphasis on accelerated construction and long-lasting pavements coupled with a wider variety of materials options, concrete mixture optimization has become more challenging than ever. Mixture design requires the consideration of a wide array of aggregate sources, cement sources and types, chemical admixtures, supplementary cementitious materials, and recycled materials. The designer must also consider the interaction of ingredients within the mixture and how a given environment may affect the construction and the long-term performance of the pavement. “What was needed was a mixture optimization tool that could simplify the approach to the mix design and proportioning process based on job-specific conditions,” said Peter Kopac of the Federal Highway Administration’s (FHWA) Office of Infrastructure Research and Development. To meet that need, FHWA developed the new COMPASS software.

The Windows-based system consists of two main parts, a knowledge base (expert system) and four computer modules. The optimization process is illustrated below.

The knowledge base is a compilation of information on concrete properties, testing methods, material characteristics, and material compatibilities with one another and with the environment. The information is interactively accessed, filtered, and logically presented to the user.

Four computer modules accept user defined job-specific inputs and perform the analysis:

1. Mix Expert
2. Gradation
3. Proportioning
4. Optimization

Each module has the ability to be used independently, or the user can perform a comprehensive analysis across modules 1 to 4 building upon each consecutive module’s analysis. The flow for the comprehensive analysis is as follows:

1. Identify the performance criteria relative to site-specific conditions (Module 1–Performance Criteria).
2. Select materials that best suit the conditions (Module 1–Materials Selection).
3. Determine optimal aggregate gradations for maximum packing density and workability (Module 2–Gradation).
4. Determine preliminary mixture proportions (Module 3–Proportioning).
5. Optimize the concrete mixture proportions based on job-specific criteria (Module 4–Optimization).

The inputs to the first module are cross-referenced with the information in the knowledge base to help guide the user in selecting the performance criteria and materials to meet those criteria. This information is used to optimize the paving mixture for the environment at the pavement project. Modules 2 to 4 include analytical subroutines to optimize materials proportions based on job-specific criteria. Yet, to simplify and reduce training requirements, a number of input options are fixed.

The COMPASS system has undergone extensive peer review and field application testing, and the draft final report and a user’s manual have been completed and are undergoing FHWA review.

For more information, contact Peter Kopac at FHWA (peter.kopac@fhwa.dot.gov) or J. Mauricio Ruiz at Transtec (mauricio@thetranstecgroup.com).

To download the beta version of COMPASS, visit http://www.pccmix.com.

Resources:

“Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete, Final Report,” The Transtec Group, Inc., Austin, TX, February 2008.

Focus. Federal Highway Administration, FHWA-HRT-08-008, Washington, DC, November 2007.

Article prepared by Ken McGhee, CPTP Implementation Team (kvmcghee3@aol.com).

Optimization Process Employing a Knowledge Base and Computerization

Concrete Pavement Research Roadmap Tracks Underway

Over the past few years the FHWA, in cooperation with Iowa State University (ISU) and the American Concrete Pavement Association (ACPA), has developed the Concrete Pavement Road Map, which outlines a collaborative approach to strategic concrete pavement research and technology transfer for the future. The development process relied heavily on input from the stakeholder community. Twelve research tracks were identified and defined.

The Road Map Operations Group, a team assembled by ISU's National Concrete Pavement Technology Center (CP Tech Center) under contract to the FHWA, is working with industry and government partners to get the research off the ground. Although some work is ongoing in all 12 tracks, in early 2008 three tracks had framework documents developed and are now "officially" getting underway. These are the Mix Design and Analysis track, the Nondestructive Testing track, and the Surface Characteristics track. While these framework documents cannot be released until reviewed by the Roadmap Executive Committee, the research addressed is briefly described below.

Track 1: Performance-Based Concrete Pavement Mix Design System. The final product of this track will be a practical yet innovative concrete mixture design procedure with new equipment, consensus target values, and common laboratory procedures. Full integration of both structural design and field quality control will define a "lab of the future." This track also lays the groundwork for the concrete paving industry to assume more responsibility for mixture designs as State highway agencies move from method specifications to more advanced acceptance tools.

Track 1 has four subtracks:

- Tests
- Models
- Specifications
- Communication

Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems. This track will develop high-speed, nondestructive quality control systems to monitor pavement properties continuously during construction. As a result, immediate adjustments can be made to ensure the highest quality finished product that meets given performance specifications. Many problem statements in this track relate to track 1 and others.

Three subtracks have been identified:

- Field Control
- Nondestructive Testing Methods
- Nondestructive Testing and Intelligent Construction Systems Evaluation Implementation

Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements. This track will improve understanding of concrete pavement surface characteristics. Results will provide tools to help engineers meet or exceed predetermined requirements for friction/safety, tire–pavement noise, smoothness, splash and spray, wheel path wear (hydroplaning), light reflection, rolling resistance, and durability. While each of these functional elements of a pavement is critical, the challenge is to improve one characteristic without compromising another, especially when safety is an issue.

Track 4 has the following subtracks:

- Innovative and Improved Concrete Pavement Surfaces
- Tire–Pavement Noise
- Concrete Pavement Texture and Friction
- Safety and Other Concrete Pavement Surface Characteristics
- Concrete Pavement Profile Smoothness
- Synthesis and Integration of Concrete Pavement Surface Characteristics
- Technology Transfer and Implementation of Concrete Pavement Surface Characteristics Research

Article prepared by Ken McGhee, CPTP Implementation Team (kvmcghee3@aol.com).

FHWA Cooperative Agreements to Advance Concrete Pavement Technologies

The Federal Highway Administration (FHWA) recently entered into three cooperative agreements with outside agencies to advance concrete pavement design and construction technologies in support of the Concrete Pavement Technology Program (CPTP). Each agreement provides an initial year of funding with up to four additional years at FHWA's discretion and available funding.

Technology Transfer of Best Practices for Concrete and Concrete Pavements (American Concrete Institute). This agreement will provide education and training activities for FHWA's customers and partners. Deliverables include—

– Training materials for seminars, workshops, and conferences, including a training syllabus and related materials needed by State departments of transportation (DOTs) to prepare their inspectors for the ACI Transportation Inspector Certification test; and updates of materials used in FHWA-sponsored seminars.

– Seminars and related training activities for State DOTs, FHWA's field offices, and members of the concrete industry.

– Conferences for the highway community, including the coordination of a process for FHWA's participation in and funding of up to three conferences per year.

Advancement of Continuously Reinforced Concrete Pavement (CRCP) Through Technology Transfer and Delivery of Industry Guidance for Design and Engineering (Concrete Reinforcing Steel Institute). Products of the ongoing FHWA CPTP include technical guides addressing the design, construction, and repair and rehabilitation of CRCP that are available for review and implementation by highway agencies. FHWA found that new efforts are needed to create, across the entire pavement community, a national awareness of and a willingness to accept CRCP as a proven pavement technology. The agreement provides for an advisory Expert Task Group (ETG) of pavement community representatives. Deliverables include—

– A strategy for technology transfer of CRCP guidance, including a national communications plan to develop a shared sense of purpose among all of FHWA's partners and customers in the States, the concrete pavement industry, and related supplier groups; and conferences, seminars, and workshops for those stakeholders.

– A strategy for assisting State DOTs in accepting and implementing industry guidance for design and engineering of CRCP. Working groups will meet with State DOTs and prepare lists of action items and a timeline for review and modification, as needed, of FHWA's guidance documents.

Advancement of the Precast-Prestressed Concrete Pavement (PPCP) System Through Technology Transfer and Development of Industry Guidance for Design and Engineering (Precast-Prestressed Concrete Institute). This agreement will encourage timely acceptance and technically sound implementation of PPCP as a proven alternative pavement system. A strategic, national communications plan will be structured to gain the support of decision makers across all elements of the pavement community. Deliverables include—

– A strategy for technology transfer for the PPCP system in the agency/owner and industry communities, including preparation and distribution of informational flyers, videos, and technical reports. An ETG comprised of representatives from industry, State DOTs, and FHWA will advise the contractor.

– A strategy for industry guidance of design and engineering of the PPCP system, including organization of program activities among agency/owner and industry communities through technical committee meetings and related activities. FHWA anticipates that the Institute's recently established Pavement Committee will play a key role in developing and disseminating PPCP guidance.

To support the Concrete Pavement Technology Program's technology transfer mission, FHWA is partnering closely with technical societies:

- American Concrete Institute
- Concrete Reinforcing Steel Institute
- Precast-Prestressed Concrete Institute

Products of the new partnership agreements will include training materials, workshops and conferences, and refinement and dissemination of technical guidance.

Article prepared by Ken McGhee, CPTP Implementation Team (kvmcghee3@aol.com).

Sponsors

Federal Highway Administration • American Association of State Highway and Transportation Officials • American Concrete Pavement Association • Concrete Reinforcing Steel Institute • Missouri Department of Transportation • National Concrete Pavement Technology Center • Portland Cement Association • Transportation Research Board

Preconference Workshop on April 21 — Concrete Pavement Preservation

Conference Forums

- The Decisionmaking Process: Where, When, Why?
- State DOT Practices and Directions
- Alternate Delivery Methods

National Conference on Preservation, Repair, and Rehabilitation of Concrete Pavements

April 22–24, 2009 — St. Louis, Missouri

In today's environment, where highway agency budgets cannot fully meet pavement management needs, it is important that the limited funds available be expended in an optimum manner—to extend the useful life of pavements at the least life cycle cost.

Over the past two decades, there has been much progress in developing effective preservation, repair, and rehabilitation (PRR) techniques. However, many gaps remain, and many practices are not implemented consistently from one region to another. This conference will gather information from around the country to close those gaps.

The conference program will present best practices in the use and timing of various PRR treatments to extend the structural capacity and functional characteristics of concrete pavements. In peer-reviewed papers and invited presentations, the program will address evaluation of concrete pavement condition and new advances in PRR technology. Case studies from highway agencies and industry will be highlighted.

The conference will explore closely related topics such as sustainability, accelerated construction, alternative contracting methods, remaining service life and economic tradeoffs, forensic investigations, mitigation of materials-related distresses, and the latest equipment, materials, and testing methods.

Details on paper submission, program, and venue are posted at http://www.fhwa.dot.gov/Pavement/2009conf.cfm and updated periodically.

For more information, contact Shiraz Tayabji (stayabji@aol.com; 410-997-9020).

For more details, visit http://www.fhwa.dot.gov/Pavement/concrete/2009cptpconf.cfm

Register at http://registeruo.niu.edu/iebms/coe/coe_p2_details.aspx?eventid=9087&OC=40&cc=OTHER

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