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CONCRETE PAVEMENT CPTP TECHNOLOGY PROGRAM

Concrete Pavement Technology Update

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Falling-weight deflectometer testing in a multi-state investigation of the effectiveness of joint sealing (page 5).

**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. To place your name on the mailing list, call (202-347-6944), fax (202-347-6938), or e-mail hogrodnek@woodwardcom.com.

**In This Update**



U.S. Department of Transportation
Federal Highway Administration

# Doing It Fast, Doing It Right

## Accelerated Construction Paves the Way

Pavement rehabilitation and reconstruction, major activities for all U.S. highway agencies, have significant impact on agency resources and traffic disruptions because of extensive and extended lane closures. The traffic volumes on the primary highway system, especially in urban areas, have increased tremendously over the last 20 years, resulting in many instances in an earlier-than-expected need to rehabilitate and reconstruct highway pavements. Highway agencies continue to wrestle with the age-old problem: longer delays now and longer service life versus shorter delays now and shorter service life. In recent years, agencies have been investigating alternative strategies for pavement rehabilitation and reconstruction that allow for faster yet durable rehabilitation and reconstruction of pavements.

Accelerated construction, which minimizes construction impact on the driving public, is being implemented by many highway agencies that allow the use of concrete for rehabilitation and reconstruction of deteriorated pavements, both concrete and asphalt. Accelerated construction optimizes use of pavement design, available concrete materials, construction practices, and traffic management strategies to construct long-life concrete pavements. A key feature of accelerated construction is the recognition that pavement rehabilitation and reconstruction under traffic does not provide for longer lasting pavements and actually requires more extended lane closures with consequences on travel times and user and construction worker safety. Contractors typically prefer better management of the construction zones that include full road closure. As noted in a Federal Highway Administration (FHWA) report[1] on full closures, "Contractors that are given full access to the road gain efficiencies that often reduce project duration and costs as well as improve the quality of the end product. These positive effects usually lead to more favorable public sentiment and potentially reduce both short- and long-term user costs."

Full closures are being achieved using three strategies: nighttime, weekend, and extended closures. The selection of a specific strategy depends on several factors:

1. Project size
2. Traffic volume and traffic management issues
3. Availability of alternate routes to divert traffic
4. Public acceptance of a specific strategy
5. Impact on project duration
6. Project cost impact to agency and roadway users

continued on page 2

Accelerated Construction,
continued from page 1

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7. Roadway user and worker safety issues
8. Local/regional economic impacts
9. Environmental impacts, primarily noise

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9. Environmental impacts, primarily noise

Several agencies have successfully utilized these strategies to accelerate rehabilition and reconstruction on high-volume highway pavements, including the following examples.

## Nighttime Closures

**I-75, Georgia (Peach, Crawford, Bibb Counties).** Three lanes in each direction of a 23.7-km (14.7-mi) section of I-75 were successfully rehabilitated during 2003. The project scope comprised removal and replacement of the outside lane with jointed concrete pavement 250 mm (10 in.) thick; full- and partial-depth patching in the middle lane; diamond grinding of all three lanes; and reconstruction of the outside shoulder.

The project was completed in 16 weeks. All major work was performed during the night. The specification required a minimum curing time of 4 hours before opening to traffic. Based on limited maturity testing, the concrete had a strength of 8.3 to 10.3 MPa (1,200 to 1,500 lbf/in$^2$) at 4 hours. The mixture design was based on a strength of 17.2 MPa (2,500 lbf/in$^2$) at 24 hours and 24.1 MPa (3,500 lbf/in$^2$) at 3 days. The nightly work schedule is shown in Figure 1.

## Weekend Closures

**I-5, James to Olive Pavement Rehabilitation, Seattle.** The Washington State DOT has successfully carried out several weekend closure projects in the Seattle–Tacoma area along sections of heavily traveled I-5. This project was the first major rehabilitation of I-5 through downtown Seattle since its completion during the mid-1960s. The rehabilitation was planned to be conducted over four 55-hour weekends during April and May 2005. Two additional weekends were also available in case of inclement weather. Typically, lanes were closed at 10:00 p.m. on Fridays and reopened to traffic by 5:00 a.m. on Mondays. Project work included replacement of deteriorating asphalt over an unfinished portland cement concrete composite pavement section and removal and replacement of cracked concrete slab panels. In addition, two bridges were retrofitted with reinforced concrete approach slabs. A critical aspect of this project was construction noise impact. However, by optimizing use of demolition equipment, the project experienced only two noise complaints. Also, extensive public relations activities and traffic management strategies ensured that traffic backups around the work zones were kept at a low level. The concrete pavement rehabilitation included removal of the existing pavement, regrading the subgrade, placing a 75-mm-thick (3 in.) hot-mix asphalt base, and placing a 330-mm-thick (13 in.) jointed concrete pavement with dowel bars. Concrete was placed using both a slipform paver and hand placing operations. Concrete strength on the project was monitored using maturity meters. The opening-to-traffic strength on this project was 17.2 MPa (2,500 lbf/in$^2$). Use of high-early-strength concrete allowed opening of the roadway on schedule for Monday morning traffic, with the last concrete placed being only 12 hours old.

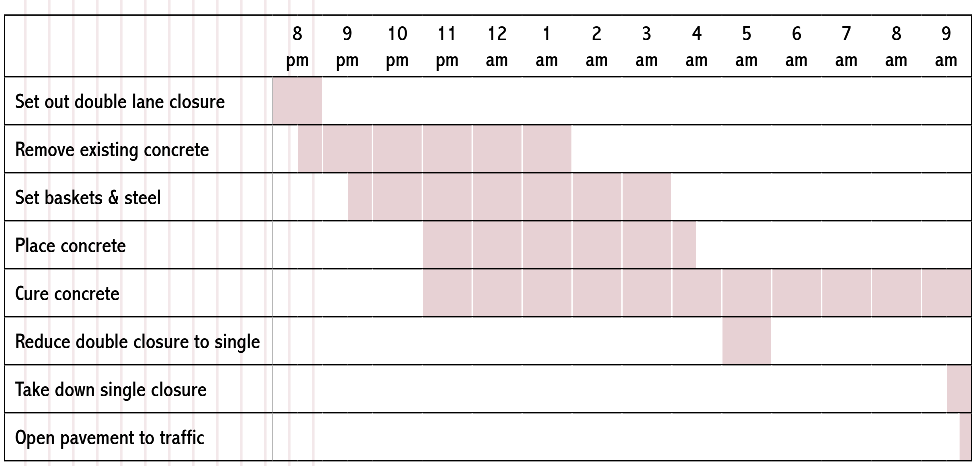



Figure 1. Nighttime work schedule on the I-75, Georgia, rehabilitation project.

**I-75, Georgia (Cobb and Cherokee Counties).** A section of asphalt pavement on I-75 northwest of Atlanta, carrying about 170,000 average daily traffic, is being reconstructed using 300-mm-thick (12 in.) jointed concrete pavement. Started in March 2007, the project involves 146 lane–km (91 lane–mi) of pavement. The paving portion of the project that requires lane closures is being constructed over 32 weekends and involves milling 300 mm (12 in.) of the existing asphalt pavement, leaving about 75 mm (3 in.) of the asphalt concrete in place and placing the 300-mm-thick (12 in.) jointed concrete pavement. The concrete strength requirement is 17.2 MPa (2,500 lbf/in$^2$) at 24 hours for the concrete being placed during weekend lane closures. However, the specifications allow traffic on the pavement after 4 hours of curing, but the contractor's schedule is based on a 12-hour curing period. Views of the project under construction are shown in Figure 2.

## Extended Closures

Although extended full closures are the most challenging strategies to implement, many agencies view them as the most effective way to rehabilitate high-volume traffic corridors, even in urban areas. Recent examples include the I-57 corridor in Chicago and the Lodge Freeway in Detroit.

**Lodge Freeway, Detroit.** The Lodge Freeway (M-10) project is reconstructing or rehabilitating 23 km (14 mi) of pavement, repairing or replacing 50 bridges, upgrading utilities, and replacing freeway signs between Lahser Road in Southfield and Jefferson Avenue in Detroit. The $140-million project started in February 2007 and is expected to be completed in November 2007. Full closure is being implemented on this project so that the work can be completed in one season. Otherwise, according to the Michigan DOT, the work would take 2 or more years to complete, with only one lane open in each direction. In addition, according to the Michigan DOT, maintaining two lanes of traffic in each direction would have doubled the cost of the project.

The pavement-related work involves removal of the existing 1960s-built jointed reinforced concrete pavement, constructing the subbase and a 150-mm (6 in.) base, and placing a 250-mm-thick (10 in.) jointed concrete pavement. The contractor has full access to both directions of the roadway. The concrete pavement is being placed 7.3 m (24 ft) wide, and dowels are placed using a dowel bar inserter. Joints are spaced at 4.3 m (14 ft). The concrete mixture incorporates combined aggregate gradation, and the concrete is produced using a dual drum plant with a production capacity of about 459 $m^3$ (600 $yd^3$) per hour. Figure 3 shows construction views of the project.

## Summary

As noted in this article, asphalt and concrete pavements in high-traffic areas can be effectively rehabilitated or reconstructed with long-lasting concrete pavements using accelerated construction techniques. Many U.S. highway agencies are successfully using these accelerated concrete pavement construction techniques to reduce construction costs, reduce lane closures, improve construction worker safety, and, importantly, reduce negative impacts on road users.

A conference on Optimizing Paving Concrete Mixtures and Accelerated Concrete Pavement Construction and Rehabilitation, sponsored by FHWA, will be held in Atlanta, November 7 to 9, 2007. A highlight of the conference will be two forums that will present case studies on accelerated concrete pavement rehabilitation/reconstruction using nighttime, weekend, and extended full closure strategies. The Georgia, Washington State, and Michigan projects will be discussed at the forums. For more details on the Atlanta conference, see page 12.

Article prepared by Shiraz Tayabji, stayabji@ctlgroup.com.

[1] Federal Highway Administration. 2004. *Full Road Closure for Work Zone Operations: A Case Study,* FHWA-HOP-05-014. http://ops.fhwa.dot.gov/wz/docs/Portland_v3/index.htm

Figure 2. The I-75, Georgia, reconstruction of asphalt pavement using jointed concrete pavement during 32 weekend full closures.

Figure 3. Lodge Freeway, Detroit, reconstructed during an extended closure for placement of jointed concrete pavement.

# Traffic Management on High-Volume Roadways

The Traffic Management Studies for High-Volume Roadways project, sponsored by FHWA, in collaboration with the Texas Transportation Institute, has made significant contributions to the state of knowledge regarding the effectiveness of traffic and construction management strategies for rigid pavement preservation, rehabilitation, and reconstruction in high-traffic environments.

The investigation was successful in many ways. Through teamwork and extensive research, the project was able to accomplish the following key tasks:

- Gather and summarize existing information and surveys of motorists and local residents that identify perceptions about road closure and disruption due to pavement rehabilitation and reconstruction.
- Study and document existing projects (during construction) to identify key factors that affect the success of concrete paving projects.
- Demonstrate viable approaches—citing specific projects—for determining the public's needs and expectations and how these were incorporated into the traffic management process. •
- Identify and recommend proposed reconstruction projects suitable for conducting conceptual traffic management studies.
- Organize, conduct, and document conceptual studies.
- Summarize the information gathered from the studies of existing projects and conceptual studies in formats suitable for technology transfer.

These activities and related findings are documented in reports, case studies, technical briefs, and conceptual studies. To further facilitate technology transfer, these products are being made available on navigable DVDs. The products are in the publication process and will be utilized in workshops that are being developed for delivery to State highway agencies and industry organizations to address the following issues:

- Motorist and resident perceptions related to construction activities.
- Successful rehabilitation and reconstruction of high-volume roadways.
- Methods to exchange and evaluate construction information during the early design phase of a project.
- Traffic management and public information strategies.
- Technology transfer through innovative formats.

For more information on products from the Traffic Management Studies project, contact Sam Tyson, FHWA Office of Pavement Technology (sam.tyson@dot.gov).

# Concrete Pavement Road Map Leads the Way

Implementation of the CP Road Map is underway. FHWA is funding critical, short-term administrative services for implementation through the CP Tech Center, Iowa State University's National Concrete Pavement Technology Center. The newly appointed executive committee met in March 2007.

A unique model for managing the research tracks outlined in the Road Map has been developed, where, instead of a dedicated pool of funds for research with a single oversight organization, sponsors will collaborate to fund projects based on their common goals and priorities. The mix design and analysis track (1), recently organized, serves as an example of the new working model: 1. Expert champions identified themselves for participation. 2. Champions organized track leadership (in this case, a three-way partnership between the FHWA, State DOTs, and industry). 3. The champions agreed on a mechanism for funding administrative support. Efforts will be coordinated among the three partners. FHWA will identify needed improvements and simplify user interfaces for mix design models, such as COMPASS, HIPERPAV, and others. The States will ensure that critical new tests are ready for implementation. Industry will develop a comprehensive mix design manual that incorporates up-to-date modeling and testing information compiled by FHWA and the States.

For more information about the CP Road Map and how to get involved, contact Dale Harrington, Snyder & Associates (515-964-2020) or the CP Tech Center (515-294-8103).

http://www.cptechcenter.org

# Joint Sealing: New Outlook on an Old Approach

The sealing of transverse contraction joints in concrete pavements has been standard practice throughout much of the United States for many years. The common belief is that sealing joints improves concrete pavement performance by reducing water infiltration into the pavement structure, thereby reducing the occurrence of moisture-related distresses such as pumping and faulting. Additionally, sealing is believed to prevent the infiltration of incompressibles (i.e., sand and small stones) into the joints, thereby reducing the likelihood of pressure-related joint distresses such as joint spalling and blowups. While these assumed benefits appear logical, the question of whether sealing joints is cost effective for all pavement designs and climatic conditions remains unanswered.

In hopes of finding an answer to this lingering question, FHWA sponsored a research project to evaluate the effectiveness of joint sealing. Initiated in 1993, the following project objectives were developed:

- Investigate the effects of different pavement cross sections and slab dimensions, traffic levels, and climatic conditions on the long-term performance of narrow, single-cut, unsealed transverse joints in concrete pavements.
- Investigate the effect of different transverse joint sealant materials and configurations on the long-term performance of concrete pavement in various climatic conditions (climatic zones).
- Assist States in determining if sealing contraction joints is warranted for their pavement cross sections and slab dimensions, materials, and climatic and traffic conditions.

To accomplish these project objectives, the following research activities were conducted.

**Assessment of State of the Practice**—The first two tasks of the study focused on determining the state of the practice in joint sealing activities around the country. First, a comprehensive literature review was conducted to review and summarize existing published studies on transverse joint sealing practices, with special attention to their performance and cost-effectiveness. Second, a survey of concrete pavement construction contractors and equipment and materials suppliers was conducted to solicit industry opinions of concrete pavement joints and sealing, sealant types, sealing practices, performance, and costs.

**Field Inspection and Testing**—Between February 2004 and June 2006, field testing was conducted on 117 different individual test sections, with 26 different projects located in 11 States. These projects represent a range of concrete pavement designs, sealant material types, and transverse joint configurations. For each test section, the host State highway agency conducted falling-weight deflectometer testing, while the project team conducted field survey activities that included mapping all distresses in the outer lane, measuring joint faulting and nominal joint widths, and evaluating joint sealant performance in detail.

Projects were conducted in 26 locations representing various climatic conditions: Arizona (1), Colorado (2), Florida (1), Georgia (1), Illinois (4), Indiana (1), Iowa (1), Minnesota (8), New York (4), Ohio (1), and Wisconsin (2).

**Data Analysis**—The collected distress and deflection data were analyzed to assess the effects of joint sealing alternatives on joint spalling, joint seal damage, faulting, and midslab and joint deflections. In addition to the condition and deflection data analyses, the cost-effectiveness of joint sealing practices was also examined.

Based on an initial evaluation of the data, the following general preliminary observations and results were provided:

- It is not uncommon to have sealed joints acting as "unsealed" joints due to sealant failures.
- When joints are doweled, any differences in faulting between sealed and unsealed joints, or among joints with different types of sealant, are slight and inconsistent. The data from the test sections with nondoweled joints did not demonstrate a consistent difference in faulting between sealed and unsealed joints.

continued on page 6

# Equipment Loan and Demonstration Activities

The MIT Scan-2 (shown above), air-void analyzers, impact-echo devices, and maturity meters are available to State highway agencies on loan from the CPTP program.

To arrange a demonstration or to borrow testing equipment, contact Sam Tyson, FHWA Office of Pavement Technology, at 202-366-1326 or sam.tyson@dot.gov.

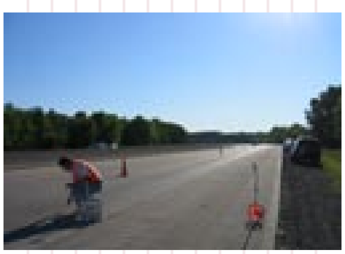
The CPTP Equipment Loan Program was established in 2005 to promote implementation of promising, implementation-ready technology. The program enables State DOTs to evaluate new testing devices first hand, without having to purchase the device. DOTs can request a demonstration or a loan. The standard loan period is 1 month, and the CPTP Technology Implementation Team provides onsite training and technical support for loans. Devices available are the MIT Scan-2, air-void analyzer, impact-echo for slab thickness measurements, and maturity meters.

To date, the most popular loan item has been the MIT Scan-2 (above left), a state-of-the-art, nondestructive testing device for measuring the position and orientation of dowel or tie bars encased in concrete. The device is accurate and easy to use, and the results can be printed using the onboard printer immediately after scanning. Three units of MIT Scan-2 are available for loans and demonstrations. So far, the device has been demonstrated or loaned to 21 States and Ontario; loans to 4 other States are pending.

In most cases, DOTs have borrowed MIT Scan-2 simply to try out the device. However, the device has proved useful in settling questions regarding dowel or tie bar placement even on these trials. In other cases, DOTs requested the scanner because of specific concerns over dowel placement on a current project. On projects where dowel bar inserters (DBIs) were used, MIT Scan-2 results were particularly useful both for verifying the dowel bar positions and for optimizing concrete mixtures, which is very important to achieve good dowel alignment when using DBIs. As a result of CPTP's equipment loan program, Florida, Colorado, and Wisconsin plan to implement the use of MIT Scan-2. Several other States are also interested in acquiring their own MIT Scan-2 and are using the loan equipment to conduct further evaluations.

The CPTP equipment loan program proved valuable to the States by helping them resolve problems. For example, in one case, MIT Scan-2 results showed severe problems with tie bar placement over a significant length of a project where no problems had been suspected. On another occasion, the project engineer suspected that one end of dowel baskets had been run over during paving. The MIT Scan-2 results clearly showed that the baskets were damaged during paving. On several DBI projects, MIT Scan-2 showed excellent results with respect to dowel alignment, giving the DOT and the contractor peace of mind.

Joint Sealing, continued from page 5



For further information on the joint sealing project, contact Jim Sherwood, FHWA Office of Infrastructure Research and Development (jim.sherwood@dot.gov), Sam Tyson, FHWA Office of Pavement Technology (sam.tyson@dot.gov), or Kurt Smith, ApTech (ksmith@pavement solutions.com).

- Unsealed joints had a higher incidence of low-severity joint spalling than sealed joints, but not a higher incidence of medium- or high-severity spalling. Spalling that is the result of the infiltration of incompressibles and progresses from low to medium and high severities was not shown to be any greater a problem for unsealed joints than for sealed joints.
- Joints with hot-pour sealant tended to have the highest incidence of joint sealant distress (adhesive failure, cohesive failure, or sealant absence), followed by joints with silicone sealant, and then by joints with preformed sealant. The differences in sealant performance did not, however, correspond directly to differences in faulting or infiltration of incompressibles.
- The analysis of deflection testing results showed that the quality of support at slab edges was not related to whether or not the joints were sealed. If joints were, in fact, sealed, the analysis did not show with what type of sealant.

Also, it should be noted that most of the pavement sections evaluated in this study were relatively young (between 5 and 13 years old) and did not exhibit a tremendous amount of distress prior to the testing.

A draft final report for this study was submitted to FHWA in May 2007, and the final report is expected in fall 2007.

# Texture Research Pursues Quiet Pavements

A great deal of pavement research, including the efforts of the Concrete Pavement Technology Program, is directed at achieving quiet pavement practices, especially in urban, high-trafficked areas. The FHWA's Technical Advisory T 5040.36 (Surface Texture for Asphalt and Concrete Pavements) provides information on state-of-the-practice of surface texture–friction on pavements and guidance on selecting techniques that will provide adequate wet pavement friction and low tire–surface noise (FHWA 2005). However, before these techniques are embraced, there must be an overall understanding among the pavement community of the cause of the noise generated at the tire–pavement interface. Additionally, the public must accept that pavement safety concerns are increasingly more important than noise issues and that sometimes both needs cannot be met simultaneously.

There are two major areas of tire–pavement noise concern: the noise experienced by vehicle passengers, often referred to as on-board sound intensity (OBSI) and noise experienced by those in close proximity to a highway, sometimes referred to as wayside noise. In 2005, the Institute for Safe, Quiet, and Durable Highways at Purdue University summarized much of the recent tire–pavement noise research in the report, "An Introduction to Tire–Pavement Noise." That report established relevant topics in acoustics and noise, explained how noise is created at the tire–pavement interface, summarized the concepts used to create reduced noise pavement, described tire–pavement noise measurement methods, and presented an overview of U.S. traffic noise policy.

The effect of texture on tire–pavement noise is complex. In general, macrotexture (related to pavement finishing operations) wavelengths of 2 mm to 10 mm (0.08 to 0.40 in.) tend to decrease the exterior noise generated at the tire–pavement interface, while increased megatexture (roughness) of 50 mm to 500 mm (2.0 to 20.0 in.) has shown to increase interior noise in vehicles. Much of the current research is directed at achieving an optimized texture that could provide a pavement that is both quiet and safe. In fact, Larson, Scofield, and Sorenson note that because texture has such an effect on both noise and friction, the two issues must be considered together to fully address highway users' concerns (Larson et al. 2004).

Paul Wiegand of the National Concrete Pavement Technology Center at Iowa State University summarized typical tire–pavement interface noise by conventional concrete pavement texture type, using test data on approximately 1,000 concrete pavement sections.

Wiegand indicates three zones of OBSI noise, as shown in Figure 1. Zone 1 is described as the innovative level (less than about 99 dBA) where research is needed to develop textures to meet the proposed levels. Zone 2 (99 to 105 dBA) is described as the zone that includes many conventionally textured concrete

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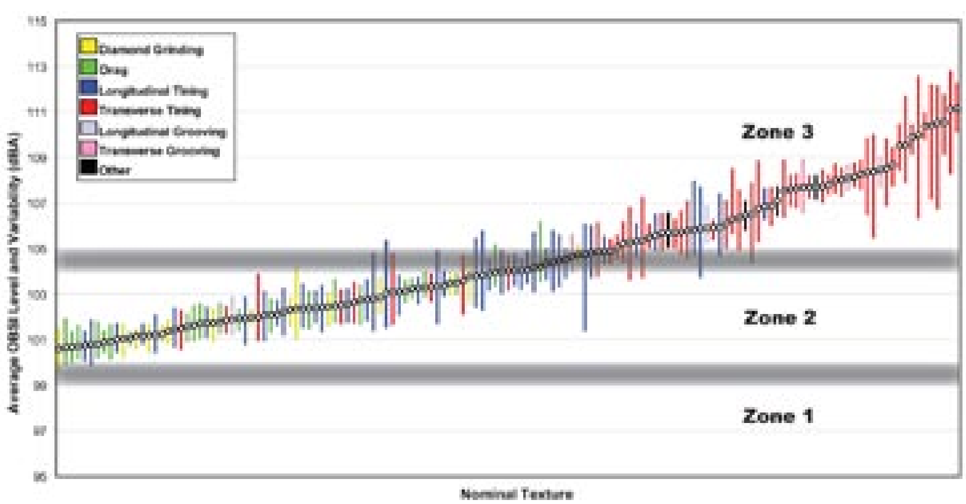


Figure 1. Pavement texture and three zones of on-board sound intensity (Wiegand 2006, p. 2).

SOURCES

Bernhard, Robert J., and Roger L. Wayson. 2005. "An Introduction to Tire–Pavement Noise." The Institute for Safe, Quiet, and Durable Highways, Purdue University, West Lafayette, IN.

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Shrouds, James M. 2005. "Guidance on Quiet Pavement Pilot Programs and Tire–Pavement Noise Research." Federal Highway Administration's Office of Natural and Human Environment, Washington, DC.

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Pavement Texture, continued from page 7

pavements that are cost effective and provide a balance between noise, friction, and smoothness. Zone 3 (more than 105 dBA) is described as the zone to avoid. It includes pavements that exhibit the highest noise levels. These pavements tend to have highly aggressive textures such as transverse grooving. While he notes that much research is yet needed, Wiegand concludes that many noise issues can be addressed through diamond grinding of existing pavements and a drag (burlap or turf) for longitudinal tine finish of new construction (Wiegand 2006).

In January 2005, FHWA issued a memo entitled "Guidance on Quiet Pavement Pilot Programs and Tire–Pavement Noise Research," which notes that current FHWA policy does not allow the use of pavement type or surface texture as a noise abatement measure. The memo encourages State participation in the Quiet Pavement Pilot Program (QPPP) or in quiet pavement research.

The QPPP provides for a monitoring period of at least 5–10 years during which the State would collect data on acoustic, textural, and frictional characteristics and document public reaction. The memo continues, "If policy change is to occur, results of the QPPP or additional research must demonstrate the safety and durability of each 'quiet pavement,' as well as its noise reduction capability. The safety and noise reduction of the pavement must last in perpetuity. In the short term, any policy change will be State specific, i.e., the change will only apply to a given State DOT(s) for a specified pavement type or texture. If warranted, changes in national policy may be considered in the future."

Other research underway includes the National Cooperative Research Program Project 1–44, which addresses the development of rational procedures for measuring tire–pavement noise and will demonstrate applicability of the procedures through testing of in-service pavements. This work is scheduled for completion in late 2007. In addition, the Concrete Pavement Road Map work at Iowa State University includes Track 4, Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements, which will result in a better general understanding of concrete pavement surface characteristics.

To supplement ongoing research, FHWA is offering a new workshop to increase agency knowledge of tire–pavement noise and noise abatement strategies. Developed by the Office of Pavement Technology and the Office of Natural and Human Environment in conjunction with the Transtec Group, "Tire–Pavement Noise 101" is designed to help pavement engineers and noise practitioners improve their understanding of pavement noise and learn ways to reduce it. "The workshop is intended to bring noise practitioners and pavement engineers together and fill in the knowledge gaps between the two parties," says Mark Swanlund of FHWA. More information is available at http://www.fhwa.dot.gov/environment/noise/tp_noise.htm.

## On the Road: A New Mobile Concrete Lab

FHWA's Mobile Concrete Laboratory (MCL) is a key component in the technology transfer program designed to bridge the gap between the development and implementation phases of new technologies. The MCL is a fully functional concrete laboratory uniquely housed in a 15-m (50-ft) trailer that is equipped with both conventional and innovative testing equipment for use with fresh and hardened concrete. Following a series of earlier versions that had been in use since the late 1980s, the MCL staff from FHWA's Office of Pavement Technology has recently taken delivery of a new MCL.

The MCL has proven to be a highly effective means for introducing FHWA's customers and partners in State highway agencies (SHAs), industry organizations, and academia to innovative concrete testing equipment. The MCL provides onsite testing demonstrations and training to complement field and laboratory training received by SHA personnel and others. MCL staff also oversee an equipment loan program for SHA personnel, and they showcase innovative testing equipment at regional and national conferences and SHA-sponsored events. The inaugural showcasing event for FHWA's newest MCL was at the spring convention of the American Concrete Institute held in April 2007 in Atlanta, Georgia.

For more information about FHWA's mobile lab and how SHAs can schedule demonstrations of testing equipment for fresh and hardened concrete, visit FHWA's Web site: http://www.fhwa.dot.gov/pavement/concrete/mcl.cfm or contact Gary Crawford, 202-366-1286 (gary.crawford@dot.gov) or Geoffrey Kurgan, 202-366-1335 (geoffrey.kurgan@dot.gov).

# COMPASS: Optimizing Concrete Paving Mixtures

Concrete mixture design is more challenging and complex than ever before. The demand for long-lasting, high-performing, quickly constructible pavements challenges highway agencies. To build highways that satisfy these high standards, designers are choosing from a wide array of ingredients—a variety of aggregate sources, cement types, chemical admixtures, supplementary cementitious materials, and recycled materials—while considering how ingredient interactions, environmental conditions, and construction practices will affect the end product. The industry needs a tool that can isolate and minimize the approach to the mixture design and proportioning process based on job-specific conditions.

In response to the industry's need, FHWA, in partnership with the National Institute of Standards and Technology, developed a Web-based application tool termed Concrete Optimization Software Tool (COST). Following successful trials with COST, the FHWA decided to develop a version that is more user-friendly.

The Concrete Mixture Performance Analysis System (COMPASS) is undergoing extensive testing before its release in early 2008. COMPASS is a Windows-based application system for obtaining optimized paving mixtures.

COMPASS has two key components, a knowledge base and a set of four computer modules. The knowledge base supplies information on concrete properties, testing methods, and material characteristics and compatibilities. The computer modules allow the user to define inputs such as importance of the project, type of pavement, climatic conditions, construction constraints, environmental exposures, and criteria, such as strength, cost, and permeability, that are specific to the project.

There are four computer modules: Performance Criteria and Materials Selection, Gradation, Proportioning, and Optimization. Each module has the ability to be used independently as a stand-alone tool, or the user can build upon each consecutive module's analysis.

**COMPASS Goals**

- Identify relevant performance criteria that are a function of job-specific inputs.
- Identify applicable mixture performance criteria and recommend test methods.
- Assess the impact that changes in materials or proportions, environmental conditions, and construction procedures have on constructability and performance.
- Provide guidance on aggregate blending.
- Recommend initial mixture proportions.
- Optimize mixture proportions based on multiple, job-specific criteria.

For more information, contact Peter Kopac, FHWA Highway Research Engineer (peter.kopac@dot.gov) or Mauricio Ruiz, Project Manager, The Transtec Group, Inc. (mauricio@thetranstecgroup.com).

# CPTP Expert Task Groups Meet

The Engineering and Executive ETGs gathered recently to discuss issues involving technology and management.

Topics at the Engineering ETG meeting in October 2006 included CPTP meetings with State DOT management, a Task 65 update, a report from the previous executive ETG meeting, a presentation on the European Scan of Long-Life Concrete Pavements, and general member concerns. Several action items were identified:

- Continue technology transfer activities.
- Ensure that CPTP products and findings are available with appropriate draft specification texts to facilitate consideration by agencies.
- Involve more contractor and consultant staff in Best Practices workshops.
- Organize the next CPTP conference (Optimizing Concrete and Processes for Accelerated Concrete Pavement Construction and Rehabilitation).

At the Executive ETG meeting in March 2007, topics included the Concrete Pavement Road Map; Canadian and European Scan of Long-Life Concrete Pavements; State Long-Life Concrete Pavement Practices and Directions; prestress–precast pavement activities; and FHWA's Alkali–Silica Reactivity Development and Deployment, Pavement Surface Characteristics, and Highways for Life programs. Action items included the following:

- The 2006 presentations to the AASHTO Standing Committee on Highways and to the Materials and Construction subcommittees should be followed with brief written updates.
- WASHTO and SASHTO management should be invited to sponsor proposed CPTP regional workshops.
- FHWA will review its policies on the procurement of proprietary products.

# Alkali–Silica Reactivity—Update on FHWA's Development and Deployment Program

**ASR Development and Deployment Program Tasks**

- Understanding the ASR mechanism process for prevention (applied research)
- Develop testing and evaluation protocols (deployment and applied research)
- Selection, implementation, and maintenance of field application and demonstration projects (deployment and applied research)
- Assisting States in inventorying existing structures for ASR (deployment and applied research)
- Development of an ASR data center and facilitation of adopting testing procedures (deployment and applied research)
- Technology transfer of findings (deployment)
- Organization and facilitation of the ASR Technical Working Group (deployment)

Updates on the ASR Development and Deployment Program are posted at http://www.fhwa.dot.gov/pavement/concrete/asr.cfm

The Alkali–Silica Reactivity (ASR) Development and Deployment Program is a result of SAFETEA-LU legislation that provided funding for projects and programs that further development and deployment of methods and techniques to prevent and mitigate ASR. The legislation also requires that assistance be provided to States for inventorying their structures for ASR. The program is fully integrated to consist of deployment and applied research tasks to include pavement, bridges, and other highway structures. It was developed with the following goals:

- Increase durability, performance, and reduced life-cycle costs through prevention and mitigation of ASR in concrete pavements, bridges, and other highway structures.
- More effectively deploy current technologies to prevent and mitigate ASR in the field.

The ASR Program has identified seven tasks (see left).

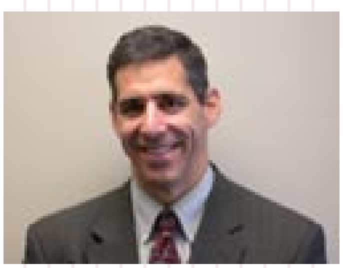
An ASR Development and Deployment Program Technical Working Group (ASR TWG) was established to provide feedback to FHWA program managers to help them meet the goals established for the ASR program. The group is composed of members from FHWA and other federal agencies, State DOTs, academia, and industry. The ASR TWG met in Washington, DC, for its kick-off meeting in April 2007. Opening remarks were given by King Gee, FHWA's Associate Administrator for Infrastructure.

The task to develop ASR testing and evaluation protocols is underway. The protocols will provide guidance on rapid testing and evaluation methods to prevent ASR in new concrete, mitigation of ASR in existing concrete, and the determination of future deterioration of ASR-affected structures. This task is scheduled for completion in early 2008. Work has also begun on the development of standard operating procedures for the field application and demonstration projects portion of the program.

To learn more about the ASR program or to host a field evaluation or demonstration project in your State, contact Gina Ahlstrom at FHWA, 202-366-4612; gina.ahlstrom@dot.gov.

To learn more about the applied research portion of the program, contact Paul Virmani at FHWA, 202-493-3052; paul.virmani@dot.gov.

# Peter Stephanos Takes Key FHWA Assignment



Peter Stephanos, Director, Office of Pavement Technology (peter.stephanos@dot.gov)

FHWA Administrator Richard Capka announced the selection of Peter Stephanos for the Senior Executive Service position of Director of the Office of Pavement Technology in the Office of Infrastructure, effective March 4, 2007.

Stephanos brings to FHWA 20 years of quality experience in the highway pavement area at the State level. Most recently, as the Director of Materials and Technology for the Maryland State Highway Administration, he was responsible for the design and acceptance of materials used on highway projects. Additionally, he managed four material laboratory testing facilities, geotechnical drilling operations, pavement and bridge testing operations, and engineering design. In the past, he delivered geotechnical engineering services for 7 years with MACTEC, a leader in the engineering, environmental, and remedial construction industries. He earned a bachelor's degree in civil engineering and a master's degree in both civil engineering and geotechnical engineering from the University of Maryland. Stephanos will be a key member of the FHWA team, providing national leadership in pavement technology.

# New CPTP TechBriefs Show the Way

Four new CPTP TechBriefs have been released during 2007. They provide guidance on best practices related to dowel bar placement, joint sawing, whitetopping, and long-life concrete pavements.

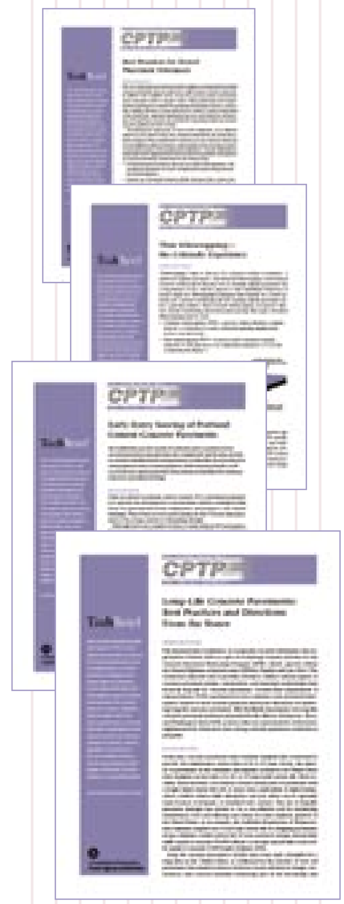
Best Practices for Dowel Placement Tolerances—The use of appropriately sized dowel bars is highly recommended for jointed concrete pavements that are subjected to high volumes of heavy truck traffic. Dowel bars provide positive load transfer across joints to greatly reduce critical deflections and stresses, thereby reducing the potential for pumping and faulting at joints, as well as slab cracking. However, proper placement of the bars is critical to their proper functioning. Recognizing this, most highway agencies in the United States have adopted requirements for dowel placement accuracy. Today, dowel alignment can be measured efficiently and accurately using MIT Scan-2, a state-of-the-art, nondestructive testing device for measuring and recording the position and alignment of dowel bars. The device is easy to use, and the alignment can be checked within a few hours of concrete placement. A comprehensive study is underway (NCHRP Project 10-69, Guidelines for Dowel Alignment in Concrete Pavements) to develop improved guidelines for dowel placement tolerances needed to ensure good pavement performance. In the interim, the information in this TechBrief may be used to develop practical interim specifications.
(FHWA-IF-07-021, 2007)

Thin Whitetopping – the Colorado Experience—"Whitetopping" refers to the use of a concrete overlay to resurface a distressed asphalt pavement. Of recent origin are whitetopping techniques that depend on a bond between the concrete resurfacing and the existing asphalt pavement surface (typically milled). These bonded overlays incorporate thinner concrete resurfacing and shorter joint spacing. This TechBrief provides details of the Colorado CDOT's successful experience with thin whitetoppings (TWTs), which dates back to 1990. Also provided are CDOT's guidelines for TWT, which are based on lessons learned from extensive field trials, as well as research findings.
(FHWA-IF-07-025, 2007)

Early-Entry Sawing of Portland Cement Concrete Pavements—This Technical Brief discusses the creation of contraction joints in portland cement concrete (PCC) pavements using early-entry saws. It explains the need for joints, provides an overview of traditional joint sawing practices, and describes the early-entry joint sawing approach and associated equipment. Although a relatively new development, early-entry sawing technology holds the potential for increased productivity, reduced costs, and reduced manpower requirements, making it a viable alternative to conventional joint sawing operations. A number of States allow the use of early-entry sawing equipment, and several have developed separate specifications governing its use. The TechBrief includes a brief summary of studies on the use of early-entry sawing, along with general guidelines for employing early-entry sawcutting technology.
(FHWA-IF-07-031, 2007)

Long-Life Concrete Pavements: Best Practices and Directions From the States—In the past, the majority of pavements in the interstate and primary systems in the United States were designed for an initial service life of 20 to 25 years. More recently, there has been a movement toward construction of pavements with a longer initial service life—40 or more years, particularly in high-volume, urban corridors where traffic disruptions and user delays due to lane closures can be especially acute. Long-life concrete pavements have been quite attainable for a long time in the United States, as evidenced by the number of very old pavements that remain in service; however, recent advances in design, construction, and concrete materials technology give us the knowledge and technology needed to consistently achieve what is clearly attainable. Several State DOTs participated in the International Conference on Long-Life Concrete Pavements, held in Chicago, Illinois, in 2006, and presented information related to their current practices and future directions for achieving long-life concrete pavements. This TechBrief summarizes practices presented by the Illinois, Minnesota, Texas, and Washington State DOTs, practices that are representative of directions implemented by States that have strong concrete pavement construction programs.
(FHWA-IF-07-030, 2007)

CPTP TechBriefs and related publications can be downloaded at http://www.fhwa.dot.gov/pavement/pub_listing.dfm



## Optimizing Concrete Mixtures / Accelerating Concrete Construction

# FHWA Sponsors International Best Practices Conference

Concrete specialists are gathering in Atlanta this fall to exchange the latest information on issues of importance in constructing and maintaining long-life concrete pavements. Highlights of the conference will be case studies from U.S. highway agencies, industry, and international practices. The program will offer peer-reviewed papers as well as invited presentations over 2½ days within two subject areas:

***November 7 to 9, 2007***
***Atlanta, Georgia—Westin Atlanta Airport Hotel***

**Optimizing Concrete Mixtures**

- Concrete workability, durability, and strength
- Using locally available material resources
- Providing for conventional as well as accelerated construction
- Mitigating materials-related distresses
- Assessing economic tradeoffs

**Accelerated Construction and Rehabilitation**

- Evaluating potential strategies and contracting issues
- Mitigating congestion and user costs
- Using shorter versus full closures
- Contractor and equipment concerns
- Concrete requirements, production rates, and testing needs
- Agency and contractor training needs

The conference is part of CPTP's technology transfer activities.

Updated information related to the conference and online registration are available at **http://www.fhwa.dot.gov/pavement/concrete/2007CPTPconf.cfm.**

For information on the availability of the conference proceedings (CD and print), contact Shiraz Tayabji: stayabji@CTLGroup.com.

**Conference Co-sponsors**—American Association of State Highway and Transportation Officials, American Concrete Pavement Association, Cement Association of Canada, Concrete Reinforcing Steel Institute, Georgia Department of Transportation, International Society for Concrete Pavements, Portland Cement Association, Southeast Chapter–ACPA, Transportation Research Board

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