

RoadScience

By Tom Kuennen, Contributing Editor



▶
On I-35 near Kearney, Kan., stringless technology is resulting in a super-smooth pavement for the Kansas DOT

Photo courtesy of GOMACO Inc

Concrete 'Road Map'

Not Set in Stone

**Stakeholder Needs Take
Concrete 'Road Map'
in New Directions**

The CP Road Map, formally the *Long-Term Plan for Concrete Pavement Research and Technology* – first articulated to the industry at the Transportation Research Board meeting in January 2006 – is fine-tuning its direction and experiencing a few course corrections as research meets reality in a changing environment for concrete pavement studies.

The refreshed program is symbolized by a new logo which demonstrates how different pieces of a puzzle come together to form a solid pavement.

Under the aegis of the National Concrete Pavement Technology Center (National CP Tech Center) at Iowa State University – which provides operations support services to the CP Road Map program – the CP Road Map is in the fourth year of a 10-year strategic plan that outlines approximately \$250 million in needed concrete pavement research.

While the CP Road Map articulates a broad variety of research needs, local budgets and sheer necessity has curtailed the scope of ongoing research activity from coast to coast.

Now, seven active tracks (of 13 total) are active, dubbed *Priority Tracks in the CP Road Map* literature. These are:

- **Track 1:** *Performance-Based Concrete Pavement Mix Design System*
- **Track 2:** *Performance-Based Design Guide for New and Rehabilitated Concrete Pavements*
- **Track 3:** *High-Speed Nondestructive Testing and Intelligent Construction Systems*
- **Track 4:** *Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements*
- **Track 7:** *High-Speed Concrete Pavement Rehabilitation and Construction*
- **Track 11:** *Concrete Pavement Business Systems and Economics*, and
- **Track 13:** *Concrete Pavement Sustainability*.

In abeyance in 2010 are:

- **Track 5:** *Equipment Automation and Advancements*
- **Track 6:** *Innovative Concrete Pavement Joint Design, Materials and Construction*
- **Track 8:** *Long-Life Concrete Pavements*
- **Track 9:** *Concrete Pavement Accelerated and Long-Term Data Collection*
- **Track 10:** *Concrete Pavement Performance, and*
- **Track 12:** *Advanced Concrete Pavement Materials*.

Environmental Sustainability

Even as some tracks fell into abeyance, in 2007 a new priority track was instituted – *Concrete Pavement Sustainability*.

“A couple of years ago, our executive committee decided that we needed to focus on sustainable engineering products, and to develop an additional track for the Road Map that put real focus on environmental sustainability,” Cackler told *Better Roads*. “There is a lot of individual research that is cross-cutting among all our tracks, but we were able to extract those to specifically ensure that sustainable concrete pavement

Thin concrete overlay is placed in Story County, Iowa ▶

Photo courtesy of National CP Tech Center

practices were being addressed in its own track.”

The Road Map is a living document that should not be carved in stone, but should be altered to include new tracks like sustainability, Cackler said. “It’s an agile Road Map that can adjust to needs,” he said. “Right now, we are taking a similar approach that will address rehabilitation and maintenance, which is important because of the financial bind that agencies are in right now.” But the program will be enlarged in the future.

The sustainability topic is so “hot” right now that an International Conference on Sustainable Concrete Pavements: Practices, Challenges and Directions will be held Sept. 15–17 in Sacramento, Calif.

Organized by FHWA and the National Concrete Pavement Technology Center, and cosponsored by a variety of other organizations, including AASHTO, the conference will provide an international forum in which to discuss the sustainable attributes of concrete pavements via existing technologies, emerging research, approaches to measuring energy and environmental impact, user needs, and international practices and experience.

Briefing on Concrete Sustainability

In August 2009, the *Road Map* published a 48-page briefing document, *Building Sustainable Pavements with Concrete*. Written by the National Con-

crete Pavement Technology Center’s Dr. Peter Taylor, P.E., and Dr. Thomas Van Dam, P.E., Applied Pavement Technology, Urbana, Ill., the document may be downloaded at www.cproadmap.org/publications/sustainability_briefing.pdf.

“It’s just one of the products that have been developed,” Cackler said. “We are also developing a manual of practice that will give agencies guidance on specific technologies for building sustainable pavements. The briefing document is only the initial product from this track.”

The briefing is intended to communicate sustainability concepts and practices to the concrete pavement community, in order to effect positive economic, environmental, and social change, the authors said.

“Many intrinsic characteristics of concrete make it a relatively sustainable material for pavements,” Van Dam and Taylor write. “Many concrete-based solutions for new and existing pavements have elements that may improve the sustainability of a pavement system. Moreover, implementing sustainable pavement solutions helps owner agencies address their pavement performance and budget challenges, because cost-effectiveness and high performance are integral [to] sustainable solutions.”

The briefing articulates seven “common-sense principles” regarding sustainable concrete pavements and their implementation. They are:

>>>



Full Page with bleed

● **Get Smart.** The concrete community should not be content with the status quo; instead it should become educated about how to make concrete pavements an integral part of sustainable infrastructure, including the embrace of the concept of pavement life cycle.

● **Design to Serve the Community.** Context-sensitive design entails meeting the needs of not only the user, but also the adjacent communities and the environment. For example, road builders strive for the smoothest, most-efficient surface, yet a locality may want a rough surface to “calm” traffic. Designers need to get the local needs straight.

● **Choose What You Use.** Look beyond simply meeting long-established concrete pavement specifications, the automatic application of which year after year creates a barrier to the acceptance of rapidly evolving sustainable practices, such as enhanced use of recycled concrete aggregate (RCA).

● **Less is More.** Another common-sense principle of sustainable design is “less is more.” Other factors being equal, a design that uses less virgin material is generally more sustainable.

● **Minimize Negative Impact.** The industry is urged to incorporate construction and operational designs that directly contribute to the sustainability of concrete pavement, including noise from construction and from traffic; safety during wet weather and night driving; delays during new construction and during rehabilitation; pollution, particulates and waste generated by construction and traffic; water use and treatment of run-off such as sawing slurry; energy efficiency of construction, traffic operations, and urban lighting; and mitigation of the urban heat island effect, in which higher temperatures exist over built-up urban areas. “Sustainable practices can be as basic as maximizing the efficiency of haul trucks,” they write.

● **Take Care of What You Have.** The concrete industry should embrace active pavement preservation principles – such as diamond grinding – to prolong concrete pavement life and delay disruptive reconstruction through multiple cycles, and

● **Innovate.** “Adopting a sustainable approach to pavements requires agencies and industry to develop new ways of thinking and doing,” Van Dam and Taylor write. “We can no longer base decisions on economic impacts alone, especially first costs. We must consider environmental and social impacts as well, spanning the entire pavement life cycle. Developing win-win-win solutions challenges our abilities to create and innovate.”

Performance-Based Mix Designs

Environmental sustainability notwithstanding, the CP Road Map’s No. 1 priority has been the shift to performance-based mix designs, and that’s the topic of Track 1: *Performance-Based Concrete Pavement Mix Design System*.

As the industry shifts from one-size-fits-all “prescriptive” concrete mix designs to those that are optimized for performance, stakeholders need guidance as to how that can come about. For example, this year a pooled fund study is underway that will study mix proportioning and set times, and includes Iowa, Kansas, Michigan, Missouri, New York, Oklahoma, Texas and Wisconsin. It joins a variety of other projects in this track.

And in May 2010, in support of Road Map Track 1, *Performance-Based Concrete Pavement Mix Design Systems*, the CP Road Map released *Moving Advancements into Practice (MAP) Brief 1-1: Job-Specific Optimization of Paving Concrete with COMPASS*.

This brief familiarizes end-users with FHWA’s Concrete Mixture Performance Analysis System (COMPASS), a Windows-based application that uses a proven statistical mix optimization approach, and includes many practical features and analysis techniques to help users optimize concrete mixtures.

With COMPASS, a user can optimize the performance of a concrete mixture in a particular environment by properly selecting material constituents, such as types of aggregates, cementitious materials, and admixtures, that will benefit properties identified as important to a particular environment, project type, and degree of importance of the project.

TRANSGUARD® 4000 REUSABLE CONCRETE CURING COVERS



Reef Industries, Inc. manufactures Transguard® Concrete Curing Covers for controlled curing of concrete slabs, bridges and roads. Proper moisture control during concrete curing will reduce cracking, dusting and scaling for both field and pre-cast applications. Transguard® 4000 concrete curing covers are a natural colored polypropylene fabric with a white polyethylene backing. They are ultraviolet light stabilized to provide protection against degradation and to offer long service life. The lightweight, reusable wet cure covers are more flexible than other curing materials, resulting in easy installations, saving time, labor and money. Complies with AASHTO specification M-171 and ASTM C-171 for reflection and moisture retention.

RI REEF INDUSTRIES, INC.
TOLLFREE 1.800.231.6074
www.reefindustries.com

Write 171 on Reader Service Card



▲ **Exposed aggregate surface**, seen here on European concrete pavement, may suppress noise while enhancing friction.

Photo courtesy of National CP Tech Center

This MAP brief followed an earlier document on mix optimization which described different concrete mixes in different states, including testing. The document recommended protocols for

testing such mixes.

"We have been working with track leadership regarding how can they model mixes for optimization, including COMPASS," Harrington told *Better Roads*. "We have been working to publicize that through the Road Map."

But it's very much a team effort, Harrington said. "Our track leadership involves many different agencies, and also private sector industry," he said. "With the exception of what we do at the national center, the CP Road Map encourages, but does not have influence over the research."

"What's more fair to say is that through the communications of the CP Road Map, the committee structure and the executive committee," Harrington added, "researchers get an understanding of where the priorities are, where there is need, and then due to their funding abilities, go out and execute the research, in this case COMPASS."

Mechanistic Design

In the wake of the new *Mechanistic-Empirical Design Guide for New and Rehabilitated Pavement Structures*, via

Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements, the CP Road Map is working to ease the transition to the mechanistic guide on behalf of agencies that specify concrete pavements.

The track's mission is to enhance the next generation of mechanistic approaches to pavement design, and improve their integration with materials, construction, and environmental inputs. A major element of the track is helping agencies and contractors successfully make the change from strictly empirical design approaches to mechanistic approaches.

"The need has been recognized," Cackler said. "Millions of dollars are being expended as states work on the implementation of the guide. We've done a couple of things: We are working with both FHWA and the National Center for Asphalt Technology on the design guide implementation team on a series of regional forums. But our real emphasis is on the area of concrete overlays."

Concrete overlays are a priority area because of the need for a very durable,

CULVERT REHAB: Dig and replace has been replaced.

Go 'no dig' to rehab your failing culverts with the Snap-Tite® HDPE patented joint and installation system.

Pre-cut sections of machined pipe are 'snapped' together and pushed through the length of deteriorated existing pipe, delivering better flow and a watertight seal at all joints. Rehab with Snap-Tite® is faster, safer – and more economical.



Pre-cut sections of machined pipe are 'snapped' together and pushed through the length of deteriorated existing pipe, delivering better flow and a watertight seal at all joints. Rehab with Snap-Tite® is faster, safer – and more economical.

Make the Connection!

For more information visit
www.culvert-rehab.com
or call us at
1-800-CULVERT



Snap-Tite® installation is easier – without specialized equipment, excavation or road closures.



FREE UTILITY FLASHLIGHT



Compact 6" design, ideal for glove box, toolbox or around the home or office. Get yours by visiting www.culvert-rehab.com and click on **FREE flashlight offer!**

While on-line, check out new Snap-Tite animations and installation video, and download the new Snap-Tite® Design Guide!

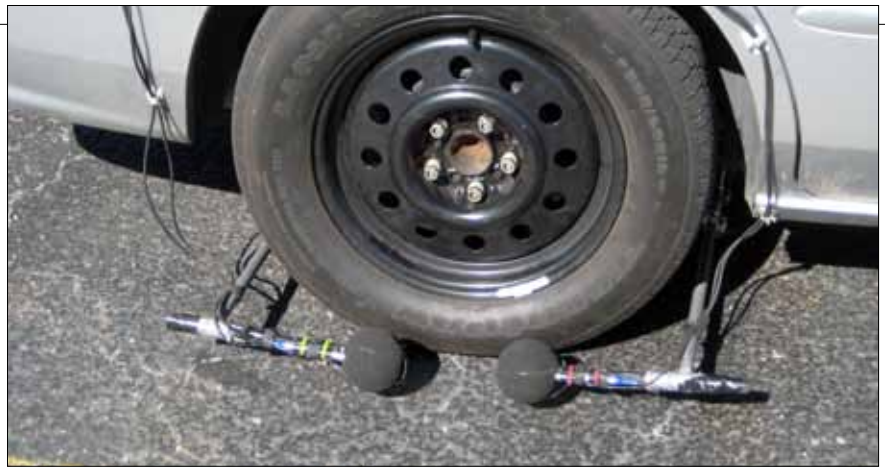
but low-cost, solution to rehabilitation, Cackler said. "The design procedures are not well-defined for concrete overlays, and by the end of the year the Road Map should have a product out on the best software available and design examples for concrete overlays."

Intelligent Paving

For Track 3, *High-Speed Nondestructive Testing and Intelligent Construction Systems*, the Road Map is planning to provide assistance and technology deployment on these high-tech essentials, especially in the area of automated paving and GPS guidance systems.

The goal of this track is to develop nondestructive testing methods that use continuous and real-time sampling to monitor performance-related mix properties, reduce the number of human inspectors, and improve construction operations.

"There are broad applications in a number of areas," Cackler said. "We're extending that technology to stringless paving, incorporating technologies on paving equipment that will assess surface characteristics, and real-time



▲ **As part of research carried out** under CP Road Map program, noise generated at the pavement/tire interface is recorded using dual microphones

Photo courtesy of National CP Tech Center

smoothness information. As you get away from stringline control, and get to stakeless technology, we will be able to build smoother concrete pavements by eliminating that whole process."

Optimized Surfaces

For Track 4, *Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements*, the Road Map has been looking closely at pavement texture regarding noise, friction, splash and spray.

"Over the last four years, there has been a national effort to characterize the different kinds of concrete pavement surfaces, whether they be drag-textured, burlap, tined or diamond-ground," Cackler told *Better Roads*. "We've even looked at some of the European exposed-aggregate surfaces. We're trying to associate the texture and its characteristics with the acoustical qualities of that texture. The goal is to find out what makes quiet



Kill the Wheel

Discover Go iPave



ACCURATE MEASUREMENTS. ONLINE. ANYTIME.

✓ Driveways ✓ Roads ✓ Parking Lots ✓ Curbs

FREE TRIAL www.goipave.com/promo Enter Code: BR8

Go iPAVE

800.280.5153
www.goipave.com

Full Page with bleed

pavements quiet, and noisy pavements noisy, yet optimize that information for frictional qualities. That work is ending this year and we are working on deploying that knowledge and specification guide late this year or early 2011."

All pavement textures associated with concrete can be very quiet or noisy, he added. "It all depends on the technique, which is based on process control," Cackler said. "We now can work with contractors and agencies to make sure they understand that there is no reason to have concrete pavement that is not very quiet as well as very smooth."

In October 2009, in support of Track 4 of the CP Road Map, *Concrete Pavement Surface Characteristics*, the Road Map released *MAP Brief 4-1, Diamond Grinding to Reduce Tire-Pavement Noise in Concrete Pavements*. It, and other CP Road Map publications, may be downloaded at www.cproadmap.org/publications/.

High-Speed Rehab, Construction

Some of the activity regarding overlays also carries over to Track 7: *High-Speed Concrete Pavement Rehabilitation and Construction*. "If you have a pavement in need of rehabilitation, perhaps placing a concrete overlay on it may be the appropriate thing to do," Cackler said. To this end, a Concrete Overlay Field Application program has been active, with field visits in 2009 to Delaware, Pennsylvania, Washington State, Nevada, West Virginia, Texas and New Mexico, and, in 2010, to Georgia and Minnesota. Visits to North Dakota, Virginia, Illinois and Indiana were planned for July 2010.

"We want to increase awareness of the tools for concrete pavement rehabilitation, and have worked with FHWA on training materials," Cackler said. "We want to share with public agencies their best option for addressing pavements in distress."

Regarding high-speed construction, the Road Map is looking at in-situ processing of materials. "There is an expanded use of in-situ material process on construction sites, and there is a real trend toward reuse of material that will save tremendous amounts of time," Cackler said. The recyclability aspect also feeds into the sustainability theme.

In the meantime, the Road Map released *MAP Brief 7-1: Use of Nonwoven*

Geotextiles as Interlayers in Concrete Pavement Systems. MAP Brief 7-1 describes the potential use in the United States of nonwoven geotextile materials as interlayers in concrete pavement systems, particularly unbonded overlays. Starting with experience gained in Germany, MAP Brief 7-1 discusses the availability and cost of nonwoven geotextiles in the United States, specifications, recent field tests, recommended construction practices and research issues.

Business Systems and Economics

For Track 11: *Concrete Pavement Business Systems and Economics*, the executive committee of the Road Map is trying to identify, from the business side, any barriers to how an agency specifies or bids paving products.

"There has been a lot of growing interest into alternate bidding, and life cycle assessments, and this particular track is dedicated to identifying any barriers to concrete, or education or communication needs, that would enhance concrete use," Cackler told *Better Roads*. "A lot of activity in that area has taken

place at the state DOT level, and we are now evaluating what communications pieces might be needed to deploy in this area."

Thus, research is underway to evaluate the impact of alternative bidding for asphalt-concrete solutions, and to evaluate the effectiveness of incentives. Also, "webinars," blogs, and other web-based methods are being utilized as outreach mechanisms, especially as agency travel to conventional conferences and workshops is curtailed in light of budget cuts. The team also has made significant progress in developing effective accelerated technology transfer and rapid education programs for the future concrete paving workforce. ❖



PLUS Digital Extra

If this story is valuable to you, go to our DIGITAL EDITION (at www.BetterRoads.com) - page 33a - to look into the history and operational details of the *Concrete Pavement Road Map of Research*.

Prepare for takeoff.



Hi-Way®

With more than 70 years of manufacturing under our belt,
our line of Hi-Way deicing spreaders and road maintenance
equipment is being refreshed with a whole new look.

Same great quality. Whole new strategy.

Fasten your seat belt.

Hi-Way products are manufactured by:

Highway Equipment Company

800-363-1771 • www.highwayequipment.com

© 2010 Highway Equipment Company. All rights reserved.