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NCAT confirms that Crafco Pavement Joint Adhesive is the performance leader.
# Pavement Preservation Journal

## Summer 2013, Vol. 6, No. 2

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**On the cover:** ‘Mill-and-fill’ in Alaska. Photo courtesy of Jason Lamoreaux, Alaska DOT & PF. See article page 27.

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The challenge: rehabilitating the complete pavement structure of a 3.7 mile section of I-81 in Virginia. The solution: two project phases involving the use of as many as three different recycling methods. The result: REVOLUTIONIZING ROAD REHABILITATION!
**Time for Preservation Community to ‘Play With the Big Boys’**

With pavement preservation codified through the efforts of FP² Inc. in the *Moving Ahead for Progress in the 21st Century (MAP-21)* bill, and field work is progressing on our new research program at the National Center for Asphalt Technology, it’s time to consider how pavement preservation has matured, and with that, how support for FP²—the voice of pavement preservation—will be structured in the future.

As interest in pavement preservation skyrockets among state, municipal, township and county governments, the demands on national, supportive groups like FP² Inc. and the National Center for Pavement Preservation are increasing.

In action at another level are state-level preservation research and technology transfer entities, like the Texas Pavement Preservation Center in Austin (see page 34 in this issue), or the California Pavement Preservation Center at Chico. Similar efforts exist for recycling and reclaiming, which is a major component of the pavement preservation coalition, such as the Pavement Recycling and Reclaiming Center at Cal Poly Pomona, and the pooled-fund-supported Recycled Materials Resource Center at the University of Wisconsin-Madison.

A different kind of statewide tech transfer effort in pavement preservation includes the new Florida Pavement Preservation Council, and the Georgia-Carolina Pavement Preservation Council, which focus on outreach to cities, counties and townships, as well as state DOT districts. On a broader scale their efforts are replicated by the regional preservation partnerships, such as the Rocky Mountain West Pavement Preservation Partnership spotlighted on pages 27-29.

And the relatively new Pavement Preservation & Recycling Alliance (PPRA) is a partnership of FP²’s founding associations—the Asphalt Emulsion Manufacturers Association (AEMA), the Asphalt Recycling & Reclaiming Association (ARRA), and the International Slurry Surfacing Association (ISSA)—the goal of which is to advance sustainable, eco-efficient, and innovative pavement applications. Read about its upcoming, first-ever meeting and workshop this November on page 17.

**PRESERVATION NOT WHAT IT USED TO BE**

With the growth in pavement preservation—and in supporting entities—it seems to me that the entire industry needs to realize that pavement preservation is not what it used to be.

Instead of being a mysterious and perhaps threatening new concept that somehow siphons state funds from capital improvement projects, pavement preservation should and will be a standard practice by agencies as they manage their roadway systems.

Your FP² has been very effective in changing the language about pavement preservation and management of roadway systems. Pavement preservation is now mainstream and it’s time for the preservation community to act like a major player, instead of the runt of the litter.

Therefore to continue operating and being as effective as the demands require, I strongly feel it’s necessary to take another look at how FP² is funded, and identify the sources of future funding. This will be necessary if we are to “play with the big boys.”

We no longer are the practice that is funded only when there is enough money. Instead, we are the industry that fosters the systems and processes that allow an agency to effectively manage and optimize its pavement system for the benefit of taxpayers.

**IMPORTANT MEETING IN JUNE**

With this changed environment in mind, for FP² to have to go to industry for funding needed activities on a program-by-program basis is undermining its ability to plan and be proactive in meeting the ever-increasing agency needs that are vital to its mission.

The FP² board of directors’ spring meeting will be held at NCAT in Alabama in early June, during a meeting of funding partners for the Preservation Group project launched last year (see page 21). Dr. Buzz Powell and his team will tour Lee Road 159 where the pavement preservation treatments were placed in 2012, and the project will be discussed intensively. From this a full report to all FP² supporters will be developed.

But while there your board will discuss how FP² can respond to the leadership role that has been thrust on it by the growth in pavement preservation, and these discussions will lead to a significant fall strategic planning meeting on the future of FP². We hope you will work with us toward that goal.
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‘Thinning Up’ Concrete Overlays for Pavement Preservation

By Bill Davenport

Concrete overlays for asphalt and concrete pavements are thin, and getting thinner. Today, about 60 percent of concrete overlays are placed on asphalt pavements, compared to the early days when they were almost all on concrete.

“Concrete overlays have been around since the early 1900s,” said Gerald F. Voigt, P.E., president and CEO of the American Concrete Pavement Association. “There were an estimated 350 concrete overlays placed between 1910 and 1990, but it wasn’t until the 1990s that overlays became more prevalent.”

That is, in the late 1990s, the focus among ACPA’s agency partners went beyond overlays on concrete to include overlays on asphalt pavements. “Some of the early groundwork in concrete overlays of asphalt pavements dated to the early 1980s, with projects done on county roads in Iowa, as well as parking lots in various parts of the country,” Voight said. “We learned a lot from Iowa, including some useful information about thinner concrete overlays.”

“Iowa and certain other states started constructing concrete overlays about 30 years ago to meet the mid-range needs of agencies,” said Dale Harrington, P.E., senior project engineer at Snyder & Associates, representing the National Concrete Pavement Technology Center at Iowa State University [CP Tech Center]. “They turned out to be a long-term serviceability solution for county roads and state highways in Iowa, and for many years, this was our standard approach to overlays.”

Things began to change after a question was posed by ACPA staff asking “Why can’t the concrete pavement industry do a 2-in. mill-and-fill?” A short time later the first reported “ultrathin” concrete overlay was placed on asphalt at a landfill in Louisville in 1991. “This innovation is illustrative of the benefits that occur when industries compete,” Voight said.

Changing Dynamics

With more than 80 years of use, concrete overlays have evolved into a time-tested technology, and increased acceptance has led to increased use. “Today we are seeing concrete overlays account for about 10 to 15 percent of the square yards of concrete placed on an annual basis,” Voigt said.

There are many factors that led to the increased use of overlays, including the current competitive dynamics of paving media. "Asphalt costs more, and so concrete now provides a solution that offers a very competitive first cost," Voigt said. "Agencies will get comparable costs and performance to what they will get from an asphalt overlay."

With current technology, 4-, 5-, or 6-in. concrete overlays may be placed, but 6-in. overlays still are more common than 4-in. or 5-in. sections," Voigt said. "With current technology, we can be competitive with 3-in. asphalt overlays." Voigt also notes that while 4- to 6-in. concrete overlays are common, there are still applications where thicker overlays are used successfully.

Yet the quest for thinner concrete overlays continues, and Voigt is quick to add that solid research, technology transfer and implementation are a major part of this effort. Industry, academia and public sector work in a partnership.
toward common goals. “This is a need-based effort, as agencies are starting to apply concrete overlays in preservation solutions, not looking for major structural benefit, but to improve functional condition and extend pavement serviceability,” Voight said.

**ENGINEERING THINNER OVERLAYS**

Voigt attributes the evolution to thinner concrete overlays a result of better understanding of bonding between layers, shorter joint spacing, reliable design methodologies, and improved fiber additive technology.

“Concrete overlays have gotten thin enough through science and technology that they are really a resurfacing alternative, and not just a structural overlay consideration only,” Voigt said. “When we first talked about evolving concrete overlays to what we’re seeing now, that is, mostly concrete overlays on asphalt pavements, we talked about the need to create better bonds and shorter joint spacing. That made a big difference, as we pushed for shorter joint spacing to facilitate thinner slabs. This removed one of the key failure criteria, so the science has led us to doing shorter panels in the range of 5, 6 or 7 ft., depending on the configuration.” Voigt said. Even shorter panels were evaluated, but not found to be effective. “With the 5- to 7-ft. panels, you have only one load per slab, and a very effective pavement.”

The original design equations for concrete overlays came from U.S. Army Corps of Engineers’ research. Prior to that, most overlays were placed with some reasonable effort was made using engineering judgment.

Now ACPA has added concrete overlay designs to its newest generation of pavement design software, StreetPave 12. The software can be used for all six types (bonded on asphalt, unbonded on asphalt, bonded on concrete, unbonded on concrete, bonded on composite, and unbonded on composite). It also accounts for the benefits of fiber additives, which constitute another technological advancement that Voigt and Harrington said plays an important role in ‘thinning up’ overlays.

“Synthetic fibers, and more specifically, macro synthetic fibers, have made a difference for overlays, especially as they get thinner,” Voigt said. “They provide toughness, are a means of reducing plastic shrinkage cracking potential, and help control differential slab movement. They extend the fatigue factor of the concrete, because the fibers hold cracks, and they contribute to the preservation benefit we are looking for with thinner and thinner pavements.”

**TECHNOLOGY TRANSFER, IMPLEMENTATION**

In addition to the technological advancements made in PCC overlay materials, design and construction practices, technology transfer and implementation have played a...
significant role in developing thin concrete overlays.

The first edition of the *Guide to Concrete Overlays* was produced in 2007. Voigt and Harrington said the guide was the product of many experts, who came together from the public, private and academic sectors to share overlay experience and expertise. Within a short time, the complete printing was distributed, and so, a second edition and broader distribution was completed for 2008. A third edition of the publication is scheduled for production later in 2013, Harrington said.

“There is no doubt we are seeing significant interest and use of concrete overlays for structural and non-structural considerations,” Voigt said. “It is a direct result of actions put in place by ACPA, local ACPA chapters and state affiliates, with the fine work by the CP Tech Center.”

Working with the Federal Highway Administration, the CP Tech Center developed a multi-state concrete overlay technology assistance program across the country. “We took expert teams to states for pavement design and construction, and these teams visited 27 states in 3 ½ years,” Harrington said. “We saw strong interest in concrete overlays. We also learned that to provide desirable solutions for either asphalt or concrete, we needed a next generation of overlays that could preserve pavements for 15 to 25 years at competitive costs.”

Interested states can learn more about concrete overlays through this program, which demonstrated and documented the both the successes and lessons learned about concrete overlays, Harrington said. Included were 26 field site visits in 18 states. Six additional states hosted workshops or received technical assistance on projects from the CP Tech Center. An additional four states held overlay demonstration projects, and eight states either constructed or planned overlay projects.

Voigt and Harrington described a number of resources have also been useful in transferring and implementing concrete overlay technology. One example is ACPA’s *National Concrete Overlay Explorer*, which has been a useful tool in gaining acceptance and use of concrete overlays.

**FUTURE OF THIN CONCRETE OVERLAYS**

Although the current state of the technology is 4- to 6-in. concrete overlays, Voigt said the concrete pavement industry will continue working on the goal to advance the technology to create thinner preservation overlays, as well as to advance thicker structural overlays.

“We aim to meet agencies’ needs for resurfacing and pavement preservation solutions,” Voigt said. “For agencies, concrete overlays provide an alternative, and by having an alternative, they can instill competition in their area. Competition...
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always leads to improved unit costs, so agencies can do more with the same budget, and the taxpayer wins. It’s also helpful for the concrete and asphalt industries to compete. This is one reason we have the range of concrete overlay products we have today … and will have in the future.”

He sees the similar advantages for road users, and although they may not be aware of the evolution of thinner concrete overlays, they will benefit from them.

“For road users,” Voight said, “concrete overlays will continue to provide a nice, long-term solution that will meet or exceed the length of service of asphalt overlays, which means longer cycles between resurfacing, which means fewer user delays and interruptions in their use of roadways.”

“Your father or grandfather and mine invested in the original infrastructure in the 1950s, 1960s,” Harrington said. “The beauty of concrete overlays is that we are using the original investment as a base for pavements that will last for many more years.”

The limitations of thickness, or perhaps more accurately, the “thinness” of concrete pavement overlays has yet to be proven, but the American Concrete Pavement Association is confident that now is the time to consider concrete overlays for resurfacing and pavement preservation strategies. Through continued use and evaluation of concrete overlays, it is likely the industry, agencies and academia ultimately will determine just how “thin” is thin enough.

Davenport is vice president, communications, for the American Concrete Pavement Association.

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After Five Years, Colorado CPR Project Holds Strong

A five-year review completed in the summer of 2012 of a 2007 concrete pavement rehabilitation project in Colorado which involved grooving and grinding shows no further deterioration of the concrete pavement or ride quality.

Bordering the eastern and southern sides of the Cargill Meat Solutions plant in Fort Morgan, Colo., Barlow Road and Gateway Avenue serve as the only route for continual 24-hour heavy truck traffic to move cattle and product to and from the plant.

Because of the high level of wear developed over the years, a one-mile long, four-lane-wide, segment of this roadway was in need of repairs. Nearly all of the road panels experienced faulting in both travel directions at an average panel displacement of 3/8 to 1/2 in. As a result, the bumpy riding surface was in need of rehabilitation.

The heart of the problem existed within the design, which did not incorporate dowel bars at the transverse joints, and instead relied on base layers and aggregate interlock for load transfer. Unfortunately this design was no match for the extreme truck loading that this pavement received on a daily basis. The solution was base and sub-base stabilization, undersealing and alignment/lifting of concrete slabs, and diamond grinding with joint sealing.

Each panel was lifted and leveled with the adjacent panel at the transverse joint by drilling a pattern of 5/8-in. holes on 4-ft. spacing through the pavement. Next, an expanding structural polymer from Uretek USA was injected to lift and stabilize the surface. Diamond grinding was performed to smooth transverse joints and remove panel warping. The final stepped included sealing approximately 35,000 linear feet of joints.

The nondestructive methods used on this project eliminated the need to tear out the existing pavement, which saved time and money. By closing only one lane at a time, the roadway was able to safely remain open full time to local traffic, with all lanes available for use between project work shifts.

The result was a largely greatly improved, smooth and safe ride that is expected to extend the life of the pavement by 20 years. With a total project value of $643,000, the taxpayer cost was estimated at 50 percent of the cost to remove and replace.

Concrete pavement restoration work in Fort Morgan, Colo., in 2007

NEW 2013 BOARD FOR IGGA

IGGA—a non-profit organization dedicated to serving as the leading promotional and technical resource for acceptance and proper use of diamond grinding and grooving, as well as pavement preservation/restoration—elected new board members and officers for 2013.

New president is Tom Bonness, Jr. of C.P.R., Inc. Following more than 25 years’ experience in the concrete paving industry, Bonness has specialized in concrete pavement repair, full and partial depth repair and dowel bar retrofit techniques. Bonness began as a skilled laborer, and now is the president of C.P.R., Inc., a concrete contracting company based in Elkhorn, Wis. He also is managing member of C.P.R. Leasing, LLC and the president of T3 Concrete Testing, Inc.

Other new officers include vice president, Jake Steinberg of Construction Materials, Minneapolis; secretary, Terry Kraemer of Diamond Surface, Inc., Rogers, Minn.; treasurer, Scott L. Eilken of Quality Saw & Seal, Bridgeview, Ill.; past president, Alex Ugalde of Hilti North America, Tulsa; director, Jerry Voigt, American Concrete Pavement Association, Rosemont, Ill.; and international director Charley Grady of Crafo, Chandler, Ariz.
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epresenting over 140 of the world’s leading companies in the pavement preservation and rehabilitation industries, over 300 delegates gathered in February for 10th combined annual meeting of the Asphalt Emulsion Manufacturers Association (AEMA 40th annual meeting), the Asphalt Recycling & Reclaiming Association (ARRA 37th annual meeting), and the International Slurry Surfacing Association (ISSA 51st annual convention).

Themed Building a Stronger Industry for the Future: Preservation & Rehabilitation 2013, the meeting highlighted advancements in technology and the application of asphalt emulsions and other additives, asphalt recycling and reclaiming, slurry and micro surfacing, chip seal and crack treatments.

In Indian Wells, Calif., the delegates heard more than 40 speakers over the three-day period. The meeting was a concentrated assembly of industry promotion and technological advancement, as industry leaders and innovators joined together in a unique opportunity to discuss subjects of common interest and to share news of accomplishments in their related fields.

Meeting activities also included the respective elections of new officers and directors of each association, as well as awards presentations, and numerous committee, technical committee, and task force sessions.

FASTER AGAIN HELMS ARRA

ARRA re-elected Patrick Faster, Gallagher Asphalt Corp., president for the 2013-2014 term. Faster has been in the highway construction business for over 25 years and is national sales director for Gallagher, where he oversees its recycling division.

Other 2013-2014 officers elected were vice president, Andrew Fox, of InVia Pavement Technologies, Tulsa, and secretary/treasurer, Ryan Essex, The Miller Group, Inc., Gormley, Ont. ARRA’s immediate past president is Bill Garrity, Garrity Asphalt Reclaiming Inc., Bloomfield, Ct. Directors elected for the term include: Darren Coughlin, Coughlin Co., St. George, Utah; Dale Cronauer, Blount Construction Co., Inc., Marietta, Ga.; John Irvine, Roadtec, Chattanooga; Tom Kiernan, Lafarge Corp., Lockport, Ill.; and Terry Sharp, Caterpillar Paving Products, Maple Grove, Minn.

The ARRA Charles R. Valentine Award for Excellence in Cold In-Place Recycling for 2013 was presented to Mike Neil, director of construction support services, and Tara Liske, surfacing materials engineer, Engineering and Operations, Manitoba Infrastructure and Transportation.

ARRA’s Award for Excellence in Full Depth Reclamation for 2013 was presented to Paul Ingham, director of operations, City of Markham, Ont.

AEMA ELECTS MCCULLOUGH

At its annual meeting held in Indian Wells, the AEMA membership elected Mark McCollough president for the 2013-2014 term. He’s director of business development with Asphalt Materials Inc., where he manages a micro surfacing and chip seal company in Michigan, and an asphalt recycling division based in Ohio. McCollough also works with the Heritage Research Group laboratory to develop asphalt innovations into future businesses.

He’s on the board of FP², Inc. and also is active in ARRA and AEMA.

Other 2013-2014 officers elected were vice president, Archie Reynolds, Norjohn, Ltd., Burlington, Ont., and secretary/treasurer Mark Ishee, Ergon Asphalt & Emulsions, Inc., Jackson, Miss. AEMA’s immediate past president is Bucky Brooks, Asphalt Materials Inc., Oregon, Ohio.

Directors elected for the term include Diane Franseen, H.G. Meigs, LLC, Portage, Wis., Hans Ho, Telfer Oil Co., Martinez, Calif., Dan Koeninger, Terry Asphalt Materials, Inc., Hamilton, Ohio, Craig Moore, Cleveland Asphalt Products, Shepherd, Tex., and Mark Smith, Vance Brothers, Inc., Kansas City, Mo. Jean Claude Roffe, Colas, SA, France, will serve as international member representative, and James Andrews, BASF Corp., Charlotte, N.C., will serve as AEMA’s supplier member representative. Mike Hemsley, Paragon Technical Services, Richland, Miss., was appointed chairman of AEMA’s International Technical Committee.
DENEUVILLERS HEADS ISSA

At Indian Wells, ISSA named Christine Deneuvillers president for the 2013-2014 year. She is technical manager, in charge of the Campus for Science and Techniques Laboratories, Colas S.A., a leading private road research laboratory, located near Paris.

The laboratories have a workforce of 50 research specialists and engineers dedicated to road technologies and innovations. She began her career in resins in 1988 and then moved on to road construction at the end of 1994 as the head of an asphalt binders and emulsions team at the Colas Central Laboratory. She was tapped to become laboratories manager in 2007 and was appointed technical manager in 2010.

ISSA also named Rusty Price, Intermountain Slurry Seal, Salt Lake City, vice president; Carter Dabney, Slurry Pavers, Inc., secretary; and Eric Reimschiissel of American Pavement Preservation, treasurer. Doug Ford, Pavement Coatings Co., is immediate past president.

Additional directors are technical director Bob Jerman, MWV Specialty Chemicals; and directors Scott Bergkamp, Bergkamp Inc., Rex Eberly, Strawser Construction Inc., Rich Francis, Southwest Slurry Seal Inc., Doug Hogue, VSS Macropaver, Howie Snyder, Vance Brothers, Inc., Larry Tomkins, Ergon Asphalt & Emulsions, and Dave Welborn, MWV Specialty Chemicals.

ISSA presented its President’s Award for Excellence for 2013 to ISSA member Valley Slurry Seal, of West Sacramento, Calif., for its work with the County of Santa Barbara, Calif., on its 2012 county-wide preventive maintenance program of scrub seal and micro surfacing.

SLURRY WORKSHOP IN JANUARY

“The ISSA Slurry Systems Workshop is a 3-1/2 day hands-on training program, and more than 3,000 individuals have participated in this training since its inception well over a decade ago,” Deneuvillers said. “We are already preparing the 29th Slurry Systems Workshop at the Caribe Royale in Orlando, scheduled for Jan. 21-24, 2014. The committee chairman is Rex Eberly, who has done a fantastic job for several years. This will be a very good opportunity to talk, to network, and create essential partnerships and communications between industry and agency.”

She notes the ongoing effort to design and finalize the ISSA/FHWA web-training Phase I, structured in three sections: micro surfacing, slurry seals and chip seals. “I would like take this opportunity to acknowledge the efficiency and hard work of ISSA’s specific matters experts, Tim Harrawood, Brian Horner, Chuck Ingram and Larry Tomkins, and also many other volunteers,” she said. “Without their dedication, we would never have had such a pertinent web-training site.”

Visit ISSA’s site at www.slurry.org to find out how to participate in the 120-minute interactive training modules.

“And for those who haven’t planned it yet, remember that the AEMA-ARRA-ISSA annual meeting 2015 will be in Paris,” Deneuvillers said. “Start your planning now, as it will be a great convention.”

Copies of most presentations from the ARRA-AEMA-ISSA joint meeting will be posted to the associations’ websites at www.aema.org, www.arra.org, and www.slurry.org.
At NCAT Preservation Study, Performance Clues Emerge

At the ongoing NCAT pavement preservation study – even though preservation treatments were placed just late last year – clues are beginning to emerge that may lead to validation of pavement life extension via preservation treatments.

In the fall of 2012, for the first time, preservation techniques began to be studied at the Pavement Test Track at the National Center for Asphalt Technology (NCAT) near Auburn, Ala. The new NCAT Pavement Preservation Effectiveness Study is bringing the prestige of NCAT’s research facility to pavement preservation practice.

In addition to use of the NCAT Pavement Test Track to study pavement preservation treatments, preservation treatments were placed off-track on a half-mile local county road that supports traffic to an aggregate quarry and an asphalt mixing plant with a high percentage of truck traffic. There, as part of the NCAT Pavement Preservation Effectiveness Study, Lee Road 159 is serving as the host roadway for the off-track component of the 2012 multi-sponsor Preservation Group (PG) experiment (Fig. 1).

“We’re starting to see clues on Lee Road 159 that may be indicative of the life-extending benefit curves we aim to define as a function of pretreatment condition, and low severity cracking is becoming more prevalent on track test sections designated for inclusion in the PG experiment,” said Buzz Powell, P.E., Ph.D., NCAT assistant director and Test Track manager. “And we are headed in the right direction with our plans for the future of the preservation study.”
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sections on both the track and Lee Road 159.”

Fig. 2 was taken while standing in section L4, an untreated control section that had more cracking at the time the treatments were installed last summer. Inspection was conducted while the pavement was in a saturated/surface dry (SSD) condition between rain events.

“As you can see,” Powell said, “there is a tremendous amount of interconnected cracking in section L4 that completely stops at the L5 sign. It appears the crack sealing in section L5 has inhibited the development of much of the interconnected cracking observed in section L4 while both sections were in a similar SSD condition. It is an exciting illustration of the life-extending benefit we aim to define for all the treatments and treatment combinations included in the PG study on Lee Road 159.”

A meeting on the project will be held at the test sites in June. More information on the project is available at www.pavetrack.com.
Integrated System Keeps Fort Collins ‘Asset Smart’

Fort Collins’ system of integrated asset management is helping that city control costs and program maintenance by combining its varied infrastructure inventories into a single platform.

The result will be an integrated pavement, bridge and utility management tool that—among many other things—will overlay sewer condition, water line condition, pavement condition and bridge condition to permit city management to program maintenance and capital projects, and assist it in determining where best to spend the city’s funds.

“The great value of the system is that it gives us a clear understanding of the condition of the entire network, be it bridges, pavements, or eventually, utilities,” said Rick Richter, capital projects manager, Engineering Department, City of Fort Collins.

The fourth largest city in Colorado, Fort Collins has about 580 miles of streets in its inventory. Fort Collins began data collection on its pavement condition in 1989 but started looking for a more advanced PMS in the late 1990s.

“We wanted to get software in which we could input our own condition data and develop our own deterioration curves, rather than using some canned process,” Richter said. “We wanted something Windows-based that would not require a computer programmer to operate. And we wanted GIS. Geographic information systems were in their infancy in 1997 in Fort Collins, but we felt that would become important in the future.”

The system selected was the dTIMS infrastructure asset management system from Deighton Associates, Ltd., and the city was able to migrate its eight years of pavement condition data into the new system.

The new program gave Fort Collins some new capabilities in forecasting pavement maintenance and preservation activities, although at the time roads were the only asset on the system.

“We had a greater ability to determine the process used to predict deterioration of roadways,” Richter said. “Being able to enter our data so the curves and predictions were accurate was a big benefit. The ability to project budgets and perform cost benefit analyses of what treatment to use, when, and how effective it would be, and then project what the pavement condition will be based on various budgets, also was a benefit.

We could see what would be needed to maintain a condition, versus what would happen under a constrained budget, and produce both scenarios in

By Tom Kuennen

Deighton’s Total Infrastructure Management System (dTIMS) software allows users to compare the projected changes to network condition into the future.
graphs and charts. It was a huge leap for us.”

“When you have a streets asset worth $440 million you certainly want to know how to manage that asset,” said Larry Schneider, superintendent, Fort Collins Streets Department. “You want to know which treatments to use at the right time. When we are planning the next year’s program, we want to know what treatments we will use and on which streets.”

Fort Collins staff worked with Deighton to link its existing geographic information system with its dTIMS system, and that has helped coordinate road and bridge improvements with scheduled utility work.

“We developed our GIS parallel with the pavement system, but eventually we had to bring them together,” Richter said. “That gave us a tool that really made a difference. Once we integrated the GIS tool it enabled us to develop GIS maps for construction projects. For example, I can look at all the construction projects and ask if they affect a bridge. If the answer is ‘yes’, we can pull up the bridge condition, its last inspection report, and determine that before we do something to the road, we have to do something to the bridge. It makes that whole process a lot simpler.”

**PAVEMENTS, BRIDGES AND UTILITIES**

It’s common for states to develop integrated asset management systems and have staff assigned to perform pavement and bridge management, but less so for municipalities, said Dan Roberts, Deighton’s U.S. operations manager, based in Denver. “Most of the states have a pavement management engineer supported by a team,” Roberts said. “But at the municipal level, the guy who does pavement management typically will wear a number of different hats. A comprehensive pavement management system is a valuable addition, saving money and helping them work more efficiently.”

To this end, Fort Collins maintains its pavement management system, and has just launched a bridge management system which also runs on dTIMS, so both asset classes are managed on the same platform, within the same system. “They’ve moved pavement management out of their engineering group and into their Street Department,” Roberts said. “I have found that most operations groups don’t like to be dictated-to by engineering. By moving pavement management into streets they have been quicker to adopt the recommendations of the dTIMS program.”

Utilities—including potable, storm and sanitary water infrastructure, and soon, electrical distribution—are in the process of being integrated into Fort Collins’ asset management system.

“The benefit of using a system like dTIMS is that it is totally configurable,” Roberts said. “Any kind of pavement treatment, performance curve, and decision tree can be configured by the user.”

“As asphalt technology changed, and PG-rated liquid asphalts came into use, we saw our reflective cracks reduce substantially,” Richter said. “So as the performance of the pavements changed, we were able to go in to dTIMS and adjust our performance curves to reflect the improved performance of the pavements.”

**BIG SURPRISE WITH BRIDGES**

The inclusion of bridges with pavements into the asset management system was an extremely important development for Fort Collins.

“When I took over our capital projects and bridge group we brought bridges into the system so we could do the same type of analysis and tracking that we did with pavements,” Richter said. “We had a list of large box culverts and traditional bridges, and we entered all that data into a dTIMS database. When we popped the information onto a map we saw there were many roads and streets crossing irrigation canals or drainage ditches that had no documented bridge or culvert. Turns out there were a hundred bridges that were not in our inventory!”

These were structures that, for example, were constructed by subdivision developers and never made it into city documents. “These days we live in a data-driven society, and our city council members want to see data graphically, and they want it yesterday,” said Jin Wang, P.E., civil engineer, Engineering Department, City of Fort Collins. “That’s one reason we integrated bridges into the system; the more prepared we are in setting up the presentation of asset condition, the faster we can deliver the information to the decision makers.”

The goal is to get bridge preservation funded by the city council the same way pavement preservation is funded. “You want to apply preventive maintenance on a bridge on the newer bridges,” Wang said. “The deterioration of a bridge element can be catastrophic, but...
and the council wants to know at what point a bridge will fail. We can’t know that but we can tell them the condition. The city council is very used to the presentation of pavement conditions so we want to make a similar presentation for bridges. They also want to see where a bridge is located, and the integration of dTIMS and our GIS is very helpful for that.”

INTEGRATING UTILITIES

Utilities like storm and waste water which are in the dTIMS system are just now being integrated into the GIS, Richter said. “The city’s eventual goal is have everything on the same platform,” he said. “Then the maps will overlay the sewer condition, water line condition, pavement condition and bridge condition, and then let us determine where best to spend our funds. It also will keep us from paving a street and having it torn up six months later for sewer work. It will be a money saver for the city in the long term.”

“Our utilities in this system are potable water, waste water, storm water and electric light and power,” said Chris Parton, P.E., asset manager, Fort Collins Utilities. “The city owns the distribution lines and we purchase electricity from the Platte River Electric Power Authority, where we are one of four members. They generate power and transmit it to our substation, and from there we distribute it to our customers.” The city also owns water pipelines and waste water is processed by two treatment plants which are city owned and operated.

Currently, the inventory of assets exists in a variety of databases, including Microsoft and Oracle products. Parton is working on these three water utilities in order to determine what it will take to get the systems to an acceptable level of risk for each of the systems in which major capital expenditures will not be a surprise.

Ultimately, Fort Collins will benefit from cross-asset optimization and coordination, which will permit the city to establish multiple-year work programs for each of the assets, and allow them to be viewed next to each other, so conflicts can be avoided.

That can include cutting a utility trench in a newly paved street for a water line; if a water line must go in next year, and the program shows the street should be paved the following year, then the paving can be moved up a year and both paving and utility work can be done as one project.

“We will be using the program to generate a street maintenance plan five years out,” Schneider said. “We then can go to all the other departments, all the utilities both inside and outside Fort Collins, and say ‘What will you be doing the next five years?’ We can lay our plan out and they can say ‘We’ve got a water line that’s going to go here’, or ‘We’ve got a gas line that is going to be coming down this road’. That will change what we do in the coming five years.”

Kuennen is editor of Pavement Preservation Journal. Article contributed by Deighton Associates, Ltd.
Alaska’s new web-based pavement preservation treatment database provides an online treatment strategy selection program to support Alaska’s asphalt pavement preservation program.

The recently enacted MAP-21 surface transportation legislation strongly emphasizes the concepts of asset management and preservation. The law contains language that is helpful to pavement preservation (PP) and is expected to bring great benefits to owner agencies, the preservation industry, and road users. The promulgation of this law almost coincided with the completion of a PP study for Alaska in fall 2012.

In its continuing efforts to enhance its preventive maintenance program, the Alaska Department of Transportation & Public Facilities (ADOT&PF) has collaborated with the California Pavement Preservation Center and the Alaska University Transportation Center to complete a PP research project titled “Developing Guidelines for Pavement Preservation Treatments and Building a Pavement Preservation Program Platform for Alaska.”

The main product of this effort was the development of a web-based PP treatment database with an online treatment strategy selection program to support Alaska’s asphalt PP program.

**TRACKING FIELD TRIALS**

For many agencies, it has always been a challenge to keep track of field trials and performance of new PP methods. Field trials seldom are properly documented or shared with other entities and agencies. To enhance management of PP innovations and promote effective techniques, the research team developed a treatment database which will keep track of the performance of innovative projects and promote the use of effective PP techniques.

This tool, located at http://ceresearch.ecst.csuchico.edu/cp2c/AlaskaPPDB/, has long-term value in helping ADOT&PF and local agencies obtain PP performance information, such as multiple year condition survey results, expected life, and life-cycle cost from the project data.

More specifically, the purpose of the database is to:

- Centralize and archive important preservation project information in a database residing on a secured server
- Monitor PP innovation projects/treatments including interactive web mapping to display project locations (through Google Map embedded in the application)
- Enhance collaboration and technical information transfer by using an online system to share information on PP activities amongst Alaskan entities, and
- Develop a pavement treatment selection program based on the information in the database, such as pavement condition, traffic, environmental conditions, life-cycle cost or cost-effectiveness.

The database can be accessed by three user levels: general users, advanced users, and database administrator. To promote knowledge sharing amongst agencies and industry, anyone...
can access the ADOT&PF-administered website, create an account and log in as a general user to view projects’ details. Advanced users can view project information as well as add new projects and edit their own existing projects. An administrator manages user accounts and the knowledge in the database including adding or editing treatment types.

**TREATMENTS IN THE DATABASE**

Treatment types currently used or expected to be used for asphalt roadways in Alaska are included in the database. Currently used treatments consist of crack sealing, single layer chip seals, double layer chip seals, thin asphalt overlays, and mill-and-fill operations. Potential preservation treatments include slurry seals, micro surfacing, thin-bonded wearing course, and saw-cut joints.

A user can input project information such as location, climate region, traffic volume, existing pavement condition, treatment type, construction information, photos and relevant reports. The embedded Google Map displays the project location and a corresponding marker. A user can click on the marker to see the project details.

The database helps users monitor the performance of PP treatments by storing post-treatment inspection and condition survey information. Multiple post-treatment surveys can be entered into the database for every project, and can include information on distresses such as fatigue cracking, rutting due to structural failure, rutting due to studded tires, and condition measurements including International Roughness Index (IRI) and Pavement Serviceability Rating (PSR).

Rutting and IRI are collected annually for the pavement management system using an automated, laser-based road surface profiler. The PSR is calculated using rutting and IRI data. These surveys and annual condition data will help determine performance models or deterioration rates of pavements that have been treated and are expected to be valuable in predicting service life of treatments under the diverse traffic and environmental conditions in Alaska.

**INTEGRATED STRATEGY SELECTION**

A powerful function of the database is the integrated treatment selection module that will help users choose suitable treatment solutions based on project information and existing pavement distress conditions.

Factors considered in the process of selecting an appropriate treatment for a given pavement include: pavement age and condition, traffic level, expected future plans, available funding and agency policy. Modeled after work done at Caltrans and described in its MTAG, two strategy selection matrices were developed for Alaska: a non-crack-related matrix, and a crack-related matrix.
The treatment options include not only preventive preservation treatments, but also major rehabilitation and reconstruction strategies for Alaska.

An assessment of the existing pavement condition can involve project information from records or database, and/or visual site inspection; testing the existing pavement, as conditions require; and defining the performance requirements for the treatment using factors such as pavement condition, ride quality and treatment life.

At this stage of the selection process, the main goal is to determine what treatments might work. Feasible treatments can be identified after quantifying pavement condition, analyzing test results and reviewing available data.

When comparing the different treatments options, consideration should be given to the following factors: treatment cost, treatment life, the ability of the treatment to extend the existing pavement’s life, traffic level, construction limitations, weather, curing times or local issues that affect a specific treatment.

A Life Cycle Cost Assessment (LCCA) is performed to compare and rank candidate feasible treatment options. Equivalent Annual cost (EAC) can be calculated and used to compare feasible alternatives with different service lives. The treatment that meets the performance requirements with the lowest EAC may be selected. These steps have been automated and integrated in the database in the form of a computer program to assist in the strategy selection process.

**FUTURE ENHANCEMENTS**

Future enhancements of this dynamic and flexible system could include populating the database with more PP project and condition survey information, with the aim of developing performance curves for preservation treatments; refining the two Alaska strategy selection matrices to reflect real situations, especially treatment costs and expected lives; and improving integration of this treatment selection and preservation database into the pavement management process.

Communicating the value of pavement preservation to a broader audience and implementing research results such as those described in this article, will be key topics of the next meeting of the Rocky Mountain West Pavement Preservation Partnership (RMWPPP). As an active member of this partnership, ADOT&PF is pleased to announce that the next RMWPPP meeting will be held in Anchorage, Oct. 8 and 9, 2013. Meeting details will be posted at http://www.tsp2.org/pavement/rmwppp/.

Saboundjian is statewide materials pavement engineer, and Parsons is research engineer, Research, Development & Technology Transfer, Alaska Department of Transportation & Public Facilities, Anchorage

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The South Carolina Aeronautics Commission recently completed a project to evaluate the condition and capacity of pavements at 23 airfields in South Carolina. The project, carried out by Applied Research Associates (ARA) with support from Infrasense, Inc., sought to evaluate both the weight bearing strength and the Pavement Classification Number (PCN) on all runways, taxiways, aprons, and ramps for each of the airfields investigated aircraft.

PCNs are used in conjunction with aircraft classification numbers (ACN) to identify the strength of airport pavement facilities. This information is critical for airport operations in determining the type of aircraft that can land, and prescribing taxiing patterns. Overloading of airport pavements can significantly reduce their life and performance, and leads to relatively costly rehabilitation maintenance efforts.

The PCN is expressed as a five character code which incorporates load capacity, pavement type, substructure strength, maximum tire pressure capacity, and method of evaluation. The technical evaluation
used in this work involves the use of falling weight deflectometer (FWD) testing – in combination with a number of cores or borings – to determine both the pavement structure strength and layer thicknesses and properties.

However, more recently, ground penetrating radar (GPR) has been utilized to supplement coring, to mitigate disruption to normal airport operations and provide more comprehensive pavement structure information.

The PCN on these 23 airports was evaluated using FWD data at 200-ft. test point intervals, combined with GPR pavement thickness data collected continuously on each airfield element. Cores were taken at selected locations for verification of the GPR data and for characterization of pavement material types.

The GPR testing was also used to determine pavement layer structure information for FWD back-calculation, and to identify deeper subsurface features including voids or foreign objects, such as abandoned fuel tanks or tree stumps in embankments.

All major pavement elements, including runways, taxiways, and aprons were continuously scanned with GPR. The GPR system consisted of a vehicle-mounted GSSI SIR-20 radar control and data acquisition unit, an electronic distance-measuring device (DMI) attached to the vehicle wheel, a Trimble AG 114 GPS unit with Omnistar differential correction, a 400 MHz ground coupled antenna, and a 1GHz horn antenna. The purpose of the two antenna approach was to achieve a combination of adequate depth of penetration and high resolution for accurately determining the pavement and base course layer thicknesses, identifying areas of high moisture content and detecting any subsurface utilities or embedded objects (i.e. fuel tanks, tree stumps).

The equipment is set up so that survey speeds can be carried out at 15 to 20 mph. The GPR survey of the runways and taxiways consisted of a series of either two or four parallel features were identified and mapped using geo-referenced data files.

**PAIRING GPR WITH FWD**

The FWD is a non-destructive testing device that is used for determining pavement structure load carrying capacity.

A key element in the successful analysis of FWD data is the knowledge of the pavement layer thicknesses. With most FWD evaluations, pavement layer thickness is estimated based on construction plans and occasional cores. However, pavement thickness can vary significantly from these assumed values, and small errors in the assumed asphalt thickness can result in large errors in back-calculated moduli of the asphalt and base layers.

Ground penetrating radar provides a means for obtaining accurate layer thickness data at FWD test locations, and GPR has become a "mainstream" technology for pavement thickness evaluation. For South Carolina, a field data collection program was designed to acquire the data while minimizing disruption to normal airport operations. This program included GPR data collection, FWD data collection and coring.

The GPR equipment used on this project consisted of a vehicle-mounted GSSI SIR-20 radar control and data acquisition unit, an electronic distance-measuring device (DMI) attached to the vehicle wheel, a Trimble AG 114 GPS unit with Omnistar differential correction, a 400 MHz ground coupled antenna, and a 1GHz horn antenna. The purpose of the two antenna approach was to achieve a combination of adequate depth of penetration and high resolution for accurately determining the pavement and base course layer thicknesses, identifying areas of high moisture content and detecting any subsurface utilities or embedded objects (i.e. fuel tanks, tree stumps).

The equipment is set up so that survey speeds can be carried out at 15 to 20 mph. The GPR survey of the runways and taxiways consisted of a series of either two or four parallel
passes (offset from the CL) covering the length of each facility. The apron areas were surveyed with a series of parallel passes spaced at consistent 25- or 50-ft. intervals, depending on the specifications, to obtain complete coverage. Real-time GPS guidance was used to maintain parallel survey lines of equal spacing.

During the survey, markers were placed in the GPR data at reference locations (i.e. boundary and hold lines) to supplement the GPS coordinates to ensure accurate spatial positioning and synchronization to FWD test locations.

DATA ANALYSIS AND RESULTS

GPR data were analyzed to calculate pavement and base layer thicknesses, identify areas of high moisture and detect embedded utilities and objects. Using Infrasense’s proprietary software, the GPR data file is observed visually on the screen in B-scan display, and the analyst “picks” the relevant pavement and base layers as they are observed. Coring data then were used for calibrating and confirming the GPR thickness results.

The processed GPR data was reported in tabular spreadsheet form. Runway and taxiway facilities were also presented graphically as depth scatter plots. Additionally, the pavement thickness was also plotted as area contour maps for all apron facilities (see Fig. 2). Note that wide variation in pavement structure encountered in this apron.

An additional analysis was carried out to identify anomalous activity (down to 7 ft. beneath the surface), indicative of high moisture content, voids and embedded utilities or objects. Utilities were identified as sharp hyperbolas that appear consistently across a number of adjacent passes. Areas of high moisture content were distinguished as having relatively high amplitude reflections and also appearing consistently across multiple adjacent passes. Voids (likely tree stumps and other anomalous native elements) were recognized as areas of irregular, sharp reflections. These...
prescribed events were picked and processed to produce Google Earth *.kml files.

GPR provided a comprehensive subsurface view over a larger pavement area than the point-specific coring and FWD testing. Whereas the coring operation revealed the base layer material, GPR results were used to measure the thickness of the base layer to which the PCN methodology is highly sensitive.

Nearly half of the 23 airports evaluated in South Carolina were quickly constructed during World War II, with base materials that often contained substandard components that have deteriorated over the years. The GPR data were able to quantify these conditions and provide the client a subsurface view of the source of many distress issues that will need to be accounted for in future rehabilitation plans.

In Texas, Fog Seals Should Last 18 Months

By Yetkin Yildirim, P.E.

The mission of the Texas Pavement Preservation Center (TPPC) is to promote the use of pavement preservation strategies. To this effect, TPPC expands upon the use of fog seals in its current newsletter by detailing their advantages and disadvantages in maintaining roadways.

Fog seals consist mainly of a diluted asphalt binder that is applied directly to the pavement surface. The main types of binders used in fog seals are cutbacks, emulsions, and polymer-modified emulsions. Fog seal materials used in Texas generally have a wide range of properties, but most are water-based emulsion materials.

A fog seal is applied directly to a pavement surface in spray form. When used properly on porous surfaces, fog seals can seal the pavement, lengthen the pavement surface life, provide some pavement edge-shoulder delineation, and prevent raveling. They also can be used during seal coat applications as a flush coat, which holds aggregate in place and protects windshields from flying rocks.

The preventive maintenance of existing roadways, as opposed to the construction of new ones, has gained momentum in the United States. Fog seals have been a cost-effective means of preventive maintenance in Texas and other states for many years.

WHEN TO USE A FOG SEAL

Fog seals function properly only when they achieve penetration. Because of this, fog seals should be used on aged and raveled hot-mix surfaces and chip-sealed surfaces. Fog seals have three main functions: to prevent raveling, to preserve and protect road conditions, and to seal and treat cracking and surface defects.

Therefore, fog seals should be used only on structurally sound pavements with minor defects. Fog seals decrease...
skid resistance in pavement, so surfaces that already have poor skid resistance should be avoided. Because fog seals are effective only when they achieve penetration, the surface must be porous enough to absorb most of the asphalt emulsion.

Fog seals also can be used as rejuvenating seals in aging pavements with brittle binders. Rejuvenating emulsions have oils that soften the existing binder, thus reducing its viscosity. This can be beneficial in situations where the surface has an open texture and the existing binder is brittle from age.

The TPPC newsletter details the materials and material preparation used for most fog seals. Fog seals must be applied carefully to appropriate surfaces. Problems arise when: the emulsion is not diluted properly, the spray bar is improperly positioned, or the emulsion is not at the ideal temperature and viscosity. Fog seals should be applied to surfaces that do not exhibit signs of significant distress or damage and are in proper weather conditions.

Among the major limitations of fog seals is their short service life. While their low cost is attractive, they should not be used for pavements requiring a long-lasting solution. Fog seals also are limited by weather and traffic. To repeat, fog seals lower surface friction, so surfaces with low skid resistance should not be treated with them.

The service life of fog seals varies. Several factors influence this, including: the type of seal, the original pavement conditions, the road’s geometry, and the amount of traffic. Generally, a fog seal’s service life is from one to three years, although some research estimates that it can be from one to two years.

**TXDOT RESEARCH AND DEVELOPMENT**

The newsletter (link below) outlines a study performed by the Texas Transportation Institute (TTI) and TxDOT which was designed to determine the effectiveness of fog seals and rejuvenators in preventive maintenance, thereby evaluating their economic effectiveness.

Even though fog seals have been used routinely in Texas for years, the value of these treatments has not been well documented. This study concludes that in order for a fog seal to be effective, it must delay further rehabilitation for approximately 18 months.

A more recent study by TTI and TxDOT took core samples from many pavement structures and analyzed them extensively. It also indicated through surveys of TxDOT personnel that fog seals may be useful in stopping the further raveling of recent seal coats. The study, which did not address directly the use of fog seals and rejuvenators in delineating shoulders and travel lanes, did indicate via project photos that this was an effective use of these treatments.

The study shows that the main reason behind the use of fog seals is their effect to reduce oxidation. Each fog seal material shows different characteristics. Therefore, it is very important to choose the right fog seal material based on the specific project.

The newsletter contains further information on the application of fog seals. The full text from the TPPC newsletter can be found at http://www.utexas.edu/research/tppc.

Yildirim is director, Texas Pavement Preservation Center.
The emission of volatile organic compounds (VOCs) by many construction, industry and transportation sources is a widespread problem. In the presence of sunlight, these VOCs react with nitrogen oxides, forming ozone. At the ground level, this pollution can cause respiratory problems, especially in children, seniors, and asthmatics.

Highway construction itself emits large amounts of VOCs, due in part to MC-30, a cutback asphalt that contains up to 50 percent kerosene by volume and functions as a prime coat. MC-30 emits its VOCs primarily during the curing process, a period after the material is applied to the roadway project when the kerosene is allowed to evaporate.

MC-30 emissions can impact not only humans but also vegetation; according to the Environmental Protection Agency (EPA), the resulting ozone can reduce agricultural crop and commercial forest yields, increase susceptibility to diseases, and give rise to pests and harsh weather.

MC-30 also can impact those who work directly with the material. Valero’s material data safety sheet for MC-30 warns that, in the short term, the fumes can cause nausea, headache, dizziness, and eye irritation. In the long term, the spec sheet cautions that the kerosene can potentially cause dermatitis, lung damage, and even cancer.

Additionally the sheet states that, because of MC-30’s polycyclic aromatic compounds, it can potentially cause anemia and disorders of the liver, bone marrow, and lymphoid tissues. Irregular heart rhythm, coma, respiratory arrest, and sudden death are also cited as consequences of contact with MC-30.

MC-30’s flammability also can be a concern, as it has a low flash point between 120 and 140 deg F, making it susceptible to ignition. This is especially acute during the hot summer months, which happen to be the period during which MC-30 is most often applied.
MC-30s use began in the postwar highway construction boom; due to its low cost and effectiveness, its popularity soared. However, concerns arose in 1970 when Congress passed the Clean Air Act (CAA), which established the National Ambient Air Quality Standards (NAAQS) and empowered the EPA to regulate emissions. To ensure public safety, the law strove to achieve NAAQS in every state by 1975 and advised states to set up State Implementation Programs (SIPs) in order to meet the standards. However, most of the states did not meet this deadline, and the CAA was amended in 1977 and 1990 in order to set new deadlines.

Today, each state has a SIP in place that guides its usage of MC-30 and other VOC-emitting substances. However, MC-30 use persists, even though alternatives that are safer for the environment and perform better than MC-30 exist and are gaining traction in the prime coat market.

Opinions expressed are those of the authors. Mancha is affiliated with The University of Texas at Austin, and Suzek with Terra Pave International.
In Nevada, Cold In-Place Recycling Preserves I-80

By Dan Brown

CIR—or cold-in-place recycling—refers to the practice of milling an asphalt pavement, then processing the material in a mobile recycling machine that crushes, sizes, rejuvenates and repaves the pavement, all in one pass.

“Our performance of CIR has been excellent,” said Darin Tedford, assistant chief materials engineer with Nevada DOT. “We have done more than 50 projects with CIR, and we’ve had minimal issues with construction and minimal failures.” He said the main benefit of CIR is to eliminate thermal or fatigue cracking of the asphalt.

“We try not to spend our small bank account on reconstructing any.

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low-volume road,” Tedford said. “So to get rid of cracking we basically use CIR instead of doing reconstruction. We’ll just CIR 2.5 to 3.0 inches and then overlay it with 2 or 3 in. of hot mix, depending on the design.”

Recently NDOT performed the CIR process on a 15-mile stretch of I-80 near Wendover. Tedford said the cost to remove and reconstruct an interstate highway such as I-80 would be $2 million per mile, but added his estimate for CIR, including an overlay, would be $400,000 per mile.

At that location I-80 had experienced both transverse and longitudinal cracking, but there was no evidence of base fatigue, said Darren Coughlin, owner of Coughlin Company, the CIR subcontractor. The prime contractor was Fisher Sand & Gravel Co.

TOP FRICTION COURSE MILLED

To generate reclaimed asphalt pavement (RAP) for use in the overlay, in advance of the CIR operation, Coughlin used a Roadtec RX-900 milling machine to remove the top 1 in. of friction course. The friction course had high asphalt content and smaller aggregates, and NDOT determined the material would be better used in the hot mix than in the cold recycled material.

The existing roadway was a 10-in.-thick full depth asphalt pavement, and Coughlin recycled it across the full width of 38 ft. on each side of the interstate. Leading the CIR train was a Roadtec RX-900 milling machine working in the downcutting mode, 3.5 in. deep, and cutting 12.5 ft. wide. Following was a Roadtec RT-500 recycling machine. With its on-board screen deck, crusher, weigh bridge and computerized metering of additives, the RT-500 provided control over the cold recycled product.

From the milling machine, the recycled material flows to a double-deck screen, which passes all material of 1.25 inches and smaller. Oversize material is screened off and sent to an on-board crusher to be sized and returned to the screen deck. Material passing the screen deck moves to the 48-in. diameter twin shaft pugmill mixer. For the I-80 project, the RT-500 mixed in 1.5 percent of CMS-2S emulsion plus 1.5 percent quicklime as an anti-stripping agent.

The RT 500 can meter in up to three additives. Weight data flows continuously from the belt scale, which is located between the screen and the pugmill, to the emulsion metering system. That assures real-time accuracy of additive metering at all times.

For the I-80 project the cold-recycled material was laid back down in a windrow. Fisher Sand & Gravel picked up the windrow, paved the material back down at 3.5 in., and compacted it. Two 12-ton double steel drum rollers and one 25-ton pneumatic roller handled the compaction chores.

A 4-inch overlay of hot mix asphalt completed the project. Coughlin estimates that the CIR pavement plus overlay will last 20 years.

Dan Brown is a freelance writer and principal of TechniCom, Des Plaines, Ill. Edited from article contributed by Roadtec, Inc.
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