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WISCONSIN TRANSPORTATION INFORMATION CENTER – LTAP at the University of Wisconsin–Madison

Warm mix technologies emerge as paving option on local roads



Testing the temperature of warm mix asphalt during paving.

Lower fuel consumption in production may reduce emissions by as much as 40 to 60 percent and there are fewer asphalt fumes at laydown, a particular benefit for construction crews.

USE OF WARM MIX technology is an emerging trend in asphalt road construction in Wisconsin and nationally. Warm mix asphalt (WMA) is produced and placed at temperatures 30 to 100 degrees lower than conventional hot mix (HMA). The properties of the mixture, made with special additives, also improve workability and compaction at lower temperatures.

Among recognized benefits of WMA is the fact that producing and placing the mix at lower temperatures makes it possible to haul longer distances. Lower fuel consumption in production may reduce emissions by as much as 60 percent and there are fewer asphalt fumes at laydown, a particular benefit for construction crews. Described as durable enough to withstand high traffic demands, warm mix technologies also have the potential to reduce problems with cracking on low-volume roads.

Placing warm mix asphalt materials is similar to laying conventional hot mix. Agencies with WMA experience say the newer technology achieves pavement density quicker than HMA produced with the same materials and, in most cases, they can open the newly placed mat to traffic sooner. The cost difference between the two technologies is narrowing with wider adoption of WMA and as more warm mix technologies come on the market.

Contractors in the state are offering WMA as an option and in the last two years, county highway departments in Wisconsin have started to use it on local projects.



Newly paved stretch of State Highway 100. The 2006 WisDOT project compared the performance of warm mix asphalt to traditional hot mix.

An evolving technology

Warm mix belongs to an evolution in asphalt technologies that began in Europe in the late 1990s. It came on the scene in the United States about nine years ago. Since then, public agencies and private contractors in the US have produced and placed millions of tons of WMA, choosing from nearly 30 available additives in four categories: chemical, organic, foaming and hybrids.

WMA is one of five "accelerating technologies" the Federal Highway Administration is promoting via its Every Day Counts (EDC) initiative as efficient and environmentally sound. See page 10 for more on EDC.

As reported on the EDC site www.fhwa.dot.gov/everydaycounts, national studies show WMA technologies produce promising results. A 2009 Transportation Research Board study indicates warm mix technologies

use as much as 30 percent less fuel and emit about a third less dust and carbon dioxide than the mainstream process.

At the University of Wisconsin in Madison, research by Hussain Bahia, Professor of Civil and Environmental Engineering who leads the Modified Asphalt Research Center (MARC) on campus as part of a national consortium, includes testing the main WMA foaming and chemical technologies. In the lab, his group found that the chemical additives performed best at improving the bond between asphalt and aggregate and allowed compaction at lower temperatures. Dr. Bahia says on-going research involves testing additive amounts. He is developing guidelines based on study results to outline design mixes that produce both quality materials and energy savings.

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Closer look at the Safety Edge



Vertical edge on STH 55 before any milling took place, a drop of about two inches.

There are potential advantages to making the low-cost improvement on narrow local roads with gravel shoulders that degrade over time, exposing the pavement edge and a dangerous drop off for traffic.



The look of the new Safety Edge on STH 55 prior to placing the shoulder.

SAFETY BENEFITS of the Safety Edge paving technology are well documented. National studies report that constructing a gradually sloping pavement edge on a roadway helps reduce the risk of a crash when drivers drift off the road and lose control of their vehicles.

The Wisconsin Department of Transportation is collaborating with the Federal Highway Administration during the 2011 road construction season to take a closer look at the constructability and maintenance of safety edge solutions. Chief Roadway Standards Engineer Jerry Zogg of WisDOT is leading a team working on the Safety Edge initiative with Bill Bremer, Safety Engineer with FHWA's Wisconsin Division. They plan seven pilot road projects across the state this summer to test installation of the Safety Edge.

The technology is one of five the FHWA is promoting as part of its Every Day Counts program. See story page 10.

Testing a new edge

Rather than construct a vertical pavement edge, the Safety Edge is a 30-degree angle built by using a "shoe" that attaches to the paving screed on existing paving equipment. Research indicates 30 degrees is the best slope for allowing drivers to re-enter the road safely.

Zogg says that WisDOT recognizes the role the Safety Edge can play in making crashes less frequent and severe. He sees potential advantages to making the low-cost improvement on local roads that are narrow with gravel shoulders that degrade over time, exposing the pavement edge and a dangerous drop off for traffic.

Hoping to shed light on building and maintaining the alternative, the Safety Edge team is taking

their questions on the road. "Our primary interest on these pilot projects is to learn more about incorporating Safety Edge in the paving process and get a clearer picture of how it works on different project types," Zogg explains.

"We also want to judge the best way to finish shoulders to give them stability and minimize erosion." Information from FHWA on the Safety Edge suggest that when shoulder gravel erodes or is scattered by tire wear, an angled edge helps reduce the risk of an edge drop off until maintenance programs can catch up.

The Safety Edge team will monitor installation of the paving detail on projects planned in each region of the state. Six of them feature hot mix asphalt and one involves reconstruction of a concrete pavement. Zogg explains they want to test the new edge on thin overlays, thick overlays, full reconstruction and in minor resurfacing or preventive maintenance scenarios.

A list of the 2011 Safety Edge pilot projects in Wisconsin appears on the next page.

The Wisconsin Transportation Information Center (TIC) plans to coordinate a demonstration showcase event at one of the project sites during the summer to give local road officials, contractors and others a chance to see a Safety Edge installation in action.

Zogg says among other things, they want to evaluate the best method for achieving the final shape of the Safety Edge in the case of multiple lifts, or sequential



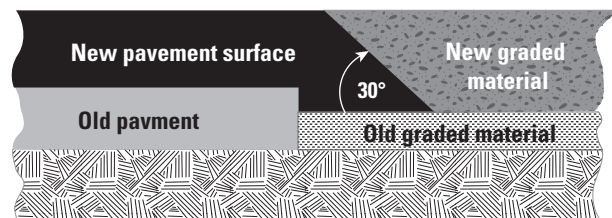
Trans Tech shoe attached to paving screed creates the Safety Edge.

layers of asphalt placed to get the intended depth. "We want to see if the new edge has an impact on pavement density or the smoothing surface of a hot mix road."

The Construction Materials Support Center at the University of Wisconsin-Madison is working with the Safety Edge team to develop a post-construction evaluation. They will survey engineers and contractors on the projects to document their recommendations on Safety Edge constructability.

The team also is identifying guidelines for the different project types. This includes developing specifications for HMA pavements and overlays, and concrete pavements and overlays.

They are providing information on equipment requirements to the Wisconsin Asphalt Paving Association (WAPA) to encourage contractors to acquire the neces-



Cutaway drawing shows how the sloped Safety Edge meets the graded shoulder material.

sary safety edge hardware. The TIC has a set of Trans Tech shoes that local agencies can borrow for use on their projects.

STH 55 experience

The WisDOT North Central Region successfully pilot-tested the first Safety Edge projects in Wisconsin in 2010 on STH 55 and STH 47 in Menominee County. FHWA selected the STH 55 project as one of a dozen national projects for an in-depth study of constructability issues. The contractor, Wisconsin-based Northeast Asphalt, tried two different Safety Edge maker technologies: a prototype end gate shoe by Carlson Paving Products and a shoe by Trans Tech that has been used on numerous projects in the United States in the past six or seven years. FHWA donated the Trans Tech shoes from the STH 55 to TIC so the Center can loan them to local governments.

At what cost?

Bremer says theoretical calculations done by the Texas Transportation Institute estimate installing the



Paver advances on the STH 55 project, producing the Safety Edge as it goes.



Crews place and grade the gravel shoulder on the STH 55 project, making it level with the new pavement surface and enclosing the Safety Edge.

2011 Safety Edge Pilot Projects in Wisconsin

HMA Projects

Northwest	US Hwy ST Hwy 13
Northeast	ST Hwy 42
North Central	ST Hwy 73
Southeast	ST Hwy 144
Southwest	ST Hwy 69

Concrete Project

Southwest	ST Hwy 23
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A 30-degree edge slope makes it easier for drivers who drift off the road to recover control.

Safety Edge may add between \$500 and \$2,000 per mile to a project. His experience with STH 55 and other on-the-road research suggests the amount of asphaltic material to construct the angled edge is almost negligible on a hot mix project, less than one percent in most cases.

The FHWA reports that the Safety Edge attachment should not affect the rate of production during laydown.

Option on local roads

Improving road safety by creating a durable pavement edge that reduces the danger of shoulder erosion, the Safety Edge is a paving option with application on local roads. TIC's demonstration showcase this summer will give public officials responsible for those roads a first-hand look at this technology. Watch *Crossroads* and the TIC website for more on the time and place for events. ■

The TIC has a set of Safety Edge shoes that local agencies can borrow for use on their projects.

Contacts

Bill Bremer
FHWA Wisconsin Division
608-829-7519
william.bremer@dot.gov

Jerry Zogg
WisDOT
608-266-3350
Jerry.Zogg@dot.wi.gov

Resource

www.fhwa.dot.gov/everydaycounts/technology/safetyedge/
Safety Edge information on FHWA's Every Day Counts site features links to quick facts, case studies and other resources.

Pedestrian safety improvements a joint effort



Village of Waterford's walk-to-school projects get everyone involved.

Common to all these projects is that they depend on a coalition of groups working together and local leadership to make things happen.

Contacts

Renee Callaway
Safe Routes to School
Coordinator
Wisconsin Department
of Transportation
608-266-3973
renee.callaway@dot.wi.gov

Virginia Loehr
La Crosse County Health
Department
608-785-9833
loehr.virginia@co.lacrosse.wi.us

Vikki Zuehlke
Village of Waterford
262-534-3980
wwaterford.clerk@tds.net

CRASH STATISTICS reported by the Wisconsin Department of Transportation indicate that since 1990, there has been a 44 percent decrease in injuries to pedestrians. Pedestrian deaths have declined steadily over the past 20 years.

Despite these lower numbers, the fact remains that in 2009, a pedestrian was injured or killed every 7.2 hours in Wisconsin. That statistic suggests the need for continued efforts that combine engineering, education, enforcement and emergency response to improve pedestrian safety.

Safer walk to school

Children account for as many as half of all pedestrian injuries when they do occur, often in neighborhoods or school zones where excessive speed or driver inattention is a factor. Local governments that receive funds through the Safe Routes to School (SRTS) grants program administered by WisDOT offer good examples of how any community in Wisconsin can make local streets and intersections safer for all pedestrians.

Although the next round of SRTS grants is more than a year away, Safe Routes programs completed or underway in locations around the state demonstrate strategies local agencies are following to improve the safety of walking and bicycling routes to and from area schools. Common to all these projects is that they depend on a coalition of groups working together and local leadership to make things happen.

Awareness prompts change

Two La Crosse County communities with ongoing pedestrian safety initiatives secured grants in the 2010-2011 cycle to augment their efforts. The Village of West Salem has an enrollment of approximately 1700 students traveling to and from a campus with elementary, middle and high school facilities.

State Highway 16 runs northwest of the campus, a road that about half the student body crosses en route to school and home.

Momentum for improving traffic controls and signage in the area came from a local bicycle/pedestrian committee led by community members and representatives from the schools. The group contacted Virginia Loehr, SRTS Coordinator with the County Health Department, for her help preparing a Safe Route's proposal. West Salem received \$93,725 last fall toward infrastructure improvements and \$24,850 to support non-infrastructure activities. The infrastructure improvements they outlined include:

- Place Yield to Pedestrian stanchions in busy crosswalks.
- Install School Crossing set to flash on a timer in three locations.
- Install flashing STOP sign at busy 4-way controlled intersection.
- Install ADA-compliant curb ramps at various locations.

Among non-infrastructure programs the committee backed was sponsorship of a Walking School Bus once a week. A health-related aspect of SRTS, the "bus" involves one or two adults walking a route to school and picking up a procession of students along the way heading in the same direction. West Salem plans to install special signs along the Walking School Bus route to alert both drivers and sidewalk users. The elementary school also has a dedicated SRTS liaison who monitors safety issues and stays in touch with Loehr about other needs.

Awareness of safety issues is where many of these improvements start. That was the case in West Salem, says Loehr. The next step is finding a way to implement those improvements. "Support from all sides and a willingness to listen are making this work."

Signage on a quiet street

Loehr also helped the La Crosse County Town of Campbell develop its Safe Routes proposal. The town is on French Island, a narrow stretch of land that lies between the Mississippi and Black rivers north of the City of La Crosse.

There are no sidewalks and few school zone signs along the quiet straight road that leads to the town's elementary school. Parents and school staff members raised the question of adding improvements at crosswalks that intersect with busier streets and the principal got in touch with Loehr.

She helped organize a committee that included town officials, the chief of police, parents, teachers and school administrators. They drove and walked the route taking notes on problems and solutions, and explored how to align their efforts with pedestrian safety initiatives already in place through the city and county. A consulting firm will help with design of the project.



A Town of Campbell safe routes committee proposed installing more school zone signs and traffic controls along this route to school.

Based on their proposal, the town received \$58,142 through SRTS to assist with these infrastructure improvements:

- Install two sets of Rectangular Rapid Flashing Pedestrian Activated Beacons at two crossing areas along routes to school.
- Install School Crossing signs with AHEAD plaques in advance of the Beacons.
- Install School Zone Speed Limit signs in three locations approaching the school.
- Paint highly visible crosswalks throughout the community.
- Paint shared-lane markings and stripe travel lanes that alert drivers, bicyclists and pedestrians about where they belong on the road.

The town plans to use an additional \$15,000 in non-infrastructure SRTS funding for safety education and enforcement. As in West Salem, a SRTS liaison at the school helps promote the safety message and identify other needs.

Lasting plan for safety

Work that went into studying problem traffic areas and identifying solutions to improve pedestrian safety helped the Village of Waterford secure a grant through the SRTS program in 2008. But it did more than that, says Village Clerk Vikki Zuehlke. The Racine County community continues to use the plan as a template for many initiatives. It is the basis of Waterford's application for Main Street status to support creating a more walkable downtown. Village administrators also hand it to every residential developer with the request that their projects include adequate pedestrian paths.

The taskforce Zuehlke recruited to develop the plan—representatives from parent-teacher organizations, the public works department and law enforcement, local businesses, a bicycle federation, the health department, bus services and other stakeholders—continues to collaborate on safety issues, a commitment she describes as a powerful benefit of the SRTS process.

Waterford based its Safe Routes approach on improvements and activities under five categories:

Engineering Install new signs and beacons around seven schools

Education Disseminate information about safety and enforcement to parents and students

Enforcement Increase police presence during drop-off and pick-up times

Encouragement Expand support for walk- and bike-to-school promotions

Evaluation Measure effectiveness of all efforts for future planning

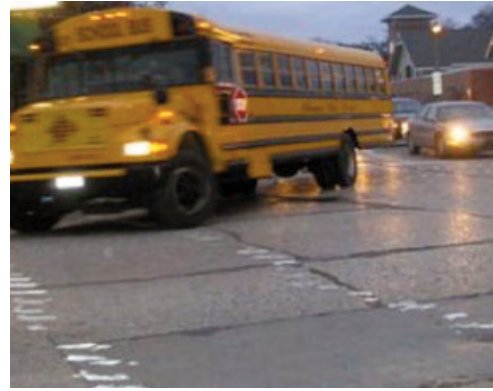
The taskforce based its recommendations for the engineering solutions on an analysis of the type and location of traffic controls that fit the safety needs of each school. Improvements include new in-road pedestrian signs to slow traffic, florescent green school pedestrian signs to identify school zones and, on a busy roadway near one school, flashing beacon signs.

Zuehlke says getting people with so many different perspectives in on the discussion made the planning process more meaningful for everyone. "Groups represented on the taskforce essentially made an investment in the solutions they came up with and that's helped make issues of pedestrian safety much more visible," she adds.

Complying with the MUTCD

Excerpt on "School Speed Limits" from the TIC publication *Signing for Local Roads* (download at <http://tic.engr.wisc.edu/>) reflects the latest rules from the *Wisconsin Supplement to the Manual on Traffic Control Devices*.

Wisconsin Statutes (Section 349.12) set the school speed limits at 15 mph unless modified by the road maintaining authority. Research shows better compliance with limits and less difference in the speeds of road users when the limit is set at 10 mph below the speed limit of the road. Statute allows this approach and WisDOT recommends it. The school speed limit sign, where used, should be a single panel or assembly of signs with the following messages: School sign (S4-3), Speed limit sign (R2-1) and When Children Are Present sign (S4-2). Use an End School Zone sign (S5-2) after a school zone. And because fines are double in school zones per Wisconsin Statute 346.60, install a FINES HIGHER sign (R2-6P) at school zones. The Wisconsin Supplement proposes using the FINES HIGHER sign in lieu of BEGIN HIGHER FINES ZONE or FINES DOUBLE signs.



Busy intersections on school routes are a major focus of local pedestrian and bicycle safety efforts.

Feedback on initial efforts is positive. Schools are adopting and expanding the walking programs, and the presence of increased enforcement is slowing traffic in school zones.

Partners in safety

Most local governments include pedestrian and bicycle safety considerations in their budgets—like sign replacement programs, crosswalks, crossing guards and focused enforcement. With resources so scarce, this is an area where collaborating now with a variety of local organizations and individuals that care about the issue can produce effective partnerships and strengthen future SRTS applications. Local officials who share the search for ideas about dealing with trouble spots and how to implement changes often find an opportunity to build cooperation and facilitate action on important safety initiatives. ■

The Waterford taskforce continues to collaborate on safety issues, a commitment Zuehlke describes as a powerful benefit of the SRTS process.

Resources

www.dot.wisconsin.gov/localgov/aid/saferoutes.htm

Information on the federally funded, state-administered Safe Routes to School program that promotes safer options for pedestrians and bicyclists.

www.dot.wisconsin.gov/safety/motorist/crashfacts/docs/pedestrianfacts.pdf

Wisconsin pedestrian traffic safety facts.

http://safety.fhwa.dot.gov/ped_bike/ Pedestrian and bicycle safety with links to safety plans, research and tools for evaluating safety problems.

www.nhtsa.gov/Pedestrians Pedestrian safety page on National Highway Safety Administration site with information on education, enforcement and outreach.

www.safekids.org/our-work/programs/walk-this-way/ Pedestrian safety program information from Safe Kids initiative, a network of organizations working with health and safety experts, educators, corporations, foundations, governments and volunteers to prevent unintentional childhood injury.

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Warm Mix paving technologies emerge as an option

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“Although WMA requires us to rethink aspects of our approach to asphalt road construction, there are a lot of misconceptions that it’s dramatically different. It’s not.”

Resources

www.fhwa.dot.gov/everydaycounts

The FHWA Every Day Counts initiative features WMA facts, case studies and resource links.

www.warmmixasphalt.com/

The Warm Mix Asphalt Technical Working Group site includes national experts from public and private sector organizations. Information about technologies, links to mix-design reports and WMA news.

<http://lwmrc.wisc.edu/>

Modified Asphalt Research Center website has information on projects, collaborations and links to publications.

New specifications

The Wisconsin Department of Transportation began testing WMA four years ago to learn about its properties and performance. Thomas Brokaw, Materials Laboratory Supervisor in the WisDOT Division of Transportation Systems Development, describes the pilot projects as important to understanding what many experts see as the next step to improving asphalt technologies.

“Although WMA requires us to rethink aspects of our approach to asphalt road construction, there are a lot of misconceptions that it’s dramatically different. It’s not,” comments Brokaw. “And there is little we have to change in the standard specifications except from the quality management standpoint.”

WisDOT is developing WMA specifications for the 2012 edition of the *State of Wisconsin Standard Specifications for Highway and Structure Construction*. They will reference an approved list of warm mix processes and additives. The goal of the specifications committee is to publish early enough for the upcoming roadwork season. They also plan to update the state’s *Construction and Materials Manual* with WMA guidelines.

WMA in Wisconsin

WisDOT first tested WMA on State Hwy 100 (Ryan Road) in 2006. The Milwaukee-area project involved laying two WMA sections and a control section using HMA. One WMA section featured an organic

additive marketed as Sasobit and the other a chemical-based product called Evotherm. The department worked in cooperation with its regional office and Wisconsin-based contractor Payne & Dolan, Inc. Payne & Dolan had experience producing and placing WMA for commercial clients but this was their first public project.

Brokaw says risk of failure was low. The goal was to gain knowledge of the process and help familiarize regional personnel with WMA technologies and testing.

The paving process went well. Brokaw recalls positive comments from the contractor about workability and less odor and heat behind the paver. Four years later, there is no difference in pavement performance between the control and WMA areas. Brokaw says that concerns about rutting proved baseless, and so far WMA sections match or exceed expectations.

Costs were higher at the time of the Hwy 100 test, he notes, due to the price of the additives and the investment in plant modifications to produce asphalt at lower temperatures. “We expect WMA will become cost neutral once it’s established, thanks to energy savings at the plant, fewer passes of the rollers and more additive options coming on the market,” Brokaw says.

Contractor experience important

John Bartoszek, Corporate Manager of Technical Services and Engineering for Payne & Dolan, got a close-up of European warm mix technologies when he joined an FHWA-sponsored trip several years ago to explore which ones were applicable in the U.S. He saw benefits, including how the technology improved compaction and helped extend the paving season—a plus in this region.

Work on the Hwy 100 project was a chance for a side-by-side test of old and new technologies, Bartoszek says, but it also demonstrated for everyone involved that compaction at lower temperatures was feasible.

Mathy Construction of Onalaska is another Wisconsin-based contractor active in developing and producing warm mix technologies. Gerald Reinke, Technical Director for Mathy Technology and Engineering Services, says the firm started researching WMA in 2004 and paved test tracks in 2005. A year later, they began using the technologies on road projects.

Reinke says WMA allows contractors to use more RAP (recycled asphalt pavement), which can reduce costs. Because there is less aging of the asphalt (due to heating) as it mixes, the pavement surface shows less cracking and fatigue. Mathy takes core samples of its WMA pavements at different stages after construction to measure performance. Reinke says his findings indicate WMA typically increases pavement life by two years, a number that may increase with ongoing research.

As for the promise of a longer paving season with WMA technologies that are workable at lower temperatures, Reinke points out that true warm mix has placement temperature limits similar to hot mix. However, it is possible in certain situations to design a mix with WMA additives and produce it at close-to-hot-mix temperatures for placement in air temperatures below 40 or 45 degrees. The material arrives hotter and the warm mix additive extends the workable temperature range so crews have time to place and compact the asphalt.

WisDOT’s Brokaw predicts the department will consider making WMA technologies a future requirement for late-season state paving projects. “As we see how it performs at lower air temperatures, it’s one of the areas where the benefits of WMA could aid us the most.”

County road projects

La Crosse County Highway Department contracted with Mathy for warm mix to use on a county highway project last summer. Keith Back, Assistant Highway Commissioner, says trying WMA



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was part of the department's contribution to a countywide sustainability effort. Properties associated with WMA suggested it would help reduce the impact of roadwork on the environment.

Patrol Supervisor Joe Clements who oversaw the project says placing the asphalt material gave his crews the opportunity to compare it to hot mix jobs. The verdict overall was positive. A Mathy engineer who tested compaction during paving recommended that the county crew adjust the rolling pattern to get optimum compaction.

Back and Clements see benefits in WMA workability and its initial performance. "The material and the process laid out a real good mat," Clements says. "The key is compaction and the warm mix of aggregates, including recycled asphalt, knitted together closely, was not porous."

Workers also noticed fewer fumes from the WMA during paving and liked how it stiffened right away. Traffic was back on the road 90 minutes after paving, quicker than the two-to-three hour restriction that is typical on their HMA projects. Five months later, the WMA-paved road remains visibly darker than is typical with HMA—an advantage in a snowy climate, says Clements, as the black pavement absorbs more heat from the sun and clears quicker after a storm. He wants to judge how it resists cracking after three to five years.

The Grant County Highway Department purchased WMA for road projects in its southwestern Wisconsin region in 2009 and 2010. Grant County Highway Commissioner David Lambert says they wanted to see if the warm mix performs better on the low-volume county roads that constitute the majority of roads in the county's road system.

"We've had problems with cracking of our asphalt in the past," notes Lambert. "Our hope is the slightly softer asphalt with the warm mix helps with this, especially on roads where rutting is not a concern."

Although two years is too soon to report final results on the county's first WMA project, Lambert says they are monitoring pavement performance on the completed projects closely. One immediate benefit Lambert cites is getting traffic on the road quicker because crews can start final rolling sooner. This efficiency also cuts back on overtime for machine and operator. Lambert says the fact WMA lacks the typically strong smell of hot asphalt during placement is a bonus, too, for the men working on the paver and people living near the job.

Evaluating mix properties

The low-temperature production of WMA requires new standards for evaluating mix designs. FHWA's Matthew Corrigan studies the performance of pavement materials and the properties that stand up to traffic loads over time.

Corrigan is an Asphalt Pavement Engineer with the FHWA and participates in a WMA technical working group (TWG) providing guidance on WMA mix design, testing, evaluation and production. One result is a proposed appendix to the recently completed AASHTO *R 35 Superpave Volumetric Design for Hot Mix Asphalt (HMA)* that describes WMA-specific mix design procedures.

Adopting WMA it is not as simple as turning down the temperature and throwing in an additive, Corrigan says. "It is important to recognize the operational and production changes that are needed to take advantage of all WMA benefits, like improved density and lower emissions, and also provide equal or better performance over traditional HMA pavements."

Dr. Bahia agrees and notes that producing the material at reduced temperatures changes and slows the aging (and curing) process of the asphalt on a warm mix project. "Adjusting or fine-tuning formulations is necessary to achieve the desired results with this as with other materials," he adds. "But it also means rethinking how we build asphalt roads in Wisconsin as the use of warm mix grows."



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Warm mix asphalt produces fewer fumes and less heat behind the paver during laydown.

According to Corrigan, factors like plant efficiency and WMA-specific testing protocols will help distinguish the most effective WMA technologies. The goal of the TWG and other organizations is to create standards for evaluating mix properties and performance at construction and as the pavement ages.

Understand the standard

As warm mix technologies improve and state and local agencies choose them for asphalt road construction, Corrigan says they will become standard.

Knowledgeable contractors are out ahead on WMA and often serve as good resources for local road officials. Brokaw notes that with more contractors in Wisconsin adding the new technology to their toolkit and gaining expertise on effective mixes, local governments have an opportunity to consider using WMA on future paving projects.

Local officials can educate themselves on warm mix technology through resources listed here and by working with WISDOT, other agencies and suppliers. Understanding the properties and benefits of warm mix technologies will prepare them to evaluate bids that include WMA, monitor warm mix projects during placement and judge the technology's pavement performance over time. ■

Work on the Hwy 100 project was a chance for a side-by-side test of old and new technologies, but it also demonstrated for everyone involved that compaction at lower temperatures was feasible.

Contacts

Keith Back

La Crosse County Highway Department
608-786-3810
back.keith@co.la-crosse.wi.us

Hussain Bahia, PhD.

UW-Madison
608-265-4481
bahia@engr.wisc.edu

John Bartoszek

Payne & Dolan, Inc.
920-757-7535
JBartoszek@crmanagement.com

Thomas Brokaw

Wisconsin Department of Transportation
608-246-7934
Thomas.Brokaw@dot.wi.gov

Matthew Corrigan

Federal Highway Administration
202-366-1549
Matthew.Corrigan@dot.gov

Joe Clements

La Crosse County Highway Department
608-786-3840

David Lambert

Grant County Highway Department
608-723-2595
dlambert@co.grant.wi.gov

Gerald Reinke

Mathy Construction Co.
608-783-6411
greinke@mathy.com

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Choosing cold mix

Cold mix asphalt is workable through a range of air temperatures, and there is minimal cracking once the mixture cures.

COLD MIX ASPHALT has a place in paving technology that goes back to the earliest days of the automobile. Local governments in Wisconsin sometimes choose cold mix to overlay pavements on roads with low traffic volume.

Produced at a central plant or on site, cold mix asphalt is a mixture of asphalt cutback or emulsion, and aggregate. The cold mix remains pliable as it cures, a process that makes it easy to place and compact.

Niche material

The advantages of cold mix are significant, says Hussain Bahia, a Civil and Environmental Engineering Professor at the University of Wisconsin who also directs the Modified Asphalt Research Center (MARC) on the Madison campus. "The cold mix process has minimal impact on the environment and is efficient to produce locally," Dr. Bahia observes. "Nonetheless, it remains a niche material in the United States, a fact that prompted me to explore the technology further." Among research projects he oversees is one documenting best practices in mix design for cold mix asphalt.

One factor in its favor is that the material costs less to produce than hot mix asphalt (HMA). Although the liquid asphalt in the mix is expensive, savings occur in production since cold mix is not heated.

Advantages

Cold mix is a good option for local roads, says John Delmore, Regional Manager with Scott Construction. The Lake Delton-based Wisconsin firm has extensive experience with cold mix asphalt having produced and placed cold mix for hundreds of municipalities in the state.

Cold mix asphalt is workable over a range of air temperatures, he notes, and there is minimal cracking once the mixture cures. Curing times vary depending on weather conditions.

Delmore observes that cold mix performance, like other asphalt technologies, depends on the condition of the existing road. "A good base helps any road surface hold up to traffic," Delmore says. "And many of the rural roads we pave with cold mix manage some pretty heavy loads."

Eric Otte of the consulting firm JE Arthur and Associates of Fond du Lac is working with Delmore to analyze several of Scott Construction's cold mix projects. From initial observations, Otte says the limited amount of pavement cracking was his main impression. Even pavements he studied that date back 25 years appear to be holding up well with minimal maintenance. He notes the flexibility that keeps a cold mix pavement from cracking could be a drawback where there is a combination of heavy loads on a newly paved road in hot weather.

Cold mix gains strength as it cures, a process where the moisture in the mix evaporates over time after paving. One aspect of Dr. Bahia's work is to identify mixes that set quicker, updating an old technology for an age of busier roadways road officials need to re-open with minimal delay.

Cold mix on local roads

Jack Dittmar became familiar with the technology as an engineer with Waupaca County for 10 years and continues to use cold mix on roads he manages today as Monroe County Highway Commissioner. More than half the 90 miles of highways in the county paved since Dittmar took over 12 years ago are cold mix roads. Monroe County uses hot mix on highways and at intersections with higher truck traffic.

Dittmar says a key advantage with cold mix is its flexibility. Seams knit together after laydown and cracks that form over time repair themselves. "My feeling is cold mix surface will last longer on low-volume town roads than hot mix because of this flexibility," he says. "We see that in pavements that are holding up well 10 years or more after initial laydown."

The main disadvantage for his operation is the weather sensitive nature of cold mix. Rain and high humidity can delay a paving project so scheduling during a dry stretch of weather is imperative. Maintenance involves a seal coat five to eight years after paving with cold mix to slow surface deterioration.

Dittmar says a key advantage with the cold mix material is its flexibility. Seams knit together after laydown and cracks that form over time repair themselves.

Contacts

Hussain Bahia, PhD.
UW-Madison
608-265-4481
bahia@engr.wisc.edu

Randy Brandes
Town of Rockland
Manitowoc County
920-375-0940
rocklandcollins@tds.net

John Delmore
Scott Construction, Inc.
920-819-7912
jdelmore@scottconstruct.com

Jack Dittmar
Monroe County Highway
Department
608-269-8740
Jack.Dittmar@co.monroe.wi.us

Don Kittell
Town of Glenmore
Brown County
920-360-6873

Eric Otte
JE Arthur and Associates, Inc.
920-922-5703
EricOtte@jeaaa.com

Resource

<http://uwmarc.wisc.edu/>
Modified Asphalt Research Center website with information on projects, collaborations and links to publications.



SCOTT CONSTRUCTION

Cold mix paving on a town road in Sheboygan County.

On cost, Dittmar estimates saving \$800,000 during the last dozen years using cold mix asphalt on Monroe County highways. He requests bids at both hot and cold mix prices and, over the years, has seen the range of savings on cold mix go from \$5 per ton a decade ago to almost \$15 per ton savings today. County crews paving with cold-mix work from stockpiled materials or mix it a batch at a time with a portable plant.

Town roads too

The Town of Rockland in Manitowoc County and Brown County's Town of Glenmore also use cold mix asphalt on most road projects. Rockland County Town Chair Randy Brandes says cold mix paving accounts for 95 percent of his local roads. He says they do not see the longitudinal cracks at the centerline that can cause early deterioration. When cracks occur, the road surface "kneads" back together, regaining its strength. And it lasts, Brandes notes, citing a road resurfaced 19 years ago that remains in excellent shape with only one seal coat treatment in that time.

Don Kittell, Town Chair in Glenmore, says cost is the main issue for his community. They generally place cold mix asphalt or do chip seal over gravel on the 60 miles of roads and lanes under the town's jurisdiction. Farm equipment and heavy trucks put lots of weight on local roads, but Kittell says with a good base and timely maintenance, they perform well. He also notes the advantage with cold mix is its ability to mend itself, delaying the need for maintenance.

In the mix

Asphalt paving covers thousands of miles in Wisconsin, many of those miles the responsibility of local governments. Understanding more about advances in mix technology and materials production will help agencies evaluate all their options. Given cold mix asphalt's reputation as a flexible, portable, low-energy technology for paving low-volume roads, it belongs in the mix. ■

New online source for local roads issues

PUBLIC AGENCIES responsible for local roads have a new online source for timely information and commentary on the transportation issues that concern them. The **Local Roads Compendium** <http://localroads.wisc.edu/> is a clearinghouse of articles, reports, manuals, training materials and other resources covering a range of local roads topics.

The Wisconsin Transportation Information Center (TIC), the Wisconsin Transportation Center (Wistrans) and the Wisconsin Department of Transportation's Local Roads and Streets Council developed the site as a way to gather valuable information from a variety of sources in one place. The Compendium also invites users to submit content and give feedback.

Navigate topics and news

The Compendium consolidates available resource materials on 29 roads-related topics and content updates in an easy-to-navigate format. Searching for information on a specific topic, site visitors will find links to publications, design tools, policies and ordinances, experts and videos. The site allows visitors to rate and offer comments on the relevance and value of each selection.

A page on the site dedicated to questions and comments gives local road officials visiting the site a chance to exchange questions and concerns about local roads management in Wisconsin. The "news" page is an outlet for site administrators and users to report on transportation-related activities or issues going in the state. A training and events page lists activities in Wisconsin and the surrounding area.

The mix of Compendium content already includes articles from past issues of **Crossroads** cataloged under specific resource topics and links to *Wisconsin Transportation Bulletins*, both published by TIC. Other sources to date include technology transfer

centers across the country; state DOTs and local road officials in Wisconsin.

User participation important

To build the Compendium into a robust online resource for public officials who manage and maintain local roads, the developers hope the site facilitates discussions among those officials. Researchers doing work on roads issues are another audience the site targets.

Visitors to the site can view all topic resources without being a member, but signing up gives users full access to the Compendium and the chance to participate in forums and exchanges. Members can submit content recommendations, including news articles (subject to review by content manager), create forums and post comments, contact other users and publish a brief profile on the site.

Active participation of local road officials and researchers will create a community of professionals who have knowledge and experience to share—through online give-and-take about challenging issues, best practices and the development of training materials. ■

To build a robust online resource, the Compendium developers hope the site facilitates discussions among public officials who manage and maintain local roads.

Resources

<http://localroads.wisc.edu/>
Homepage for Local Roads Compendium with links to resources, a feedback forum, news pages, and activities.

<http://tic. engr. wisc. edu/>
Wisconsin Transportation Information Center website.

www.wistrans.org/
Wisconsin Transportation Center website.

www.dot.wisconsin.gov/localgov/
Programs for Local Governments page at Wisconsin Department of Transportation website.

FHWA launches Every Day Counts

EVERY DAY COUNTS (EDC) is an “innovation initiative” from the Federal Highway Administration designed to advance transportation solutions that improve road safety, shorten project delivery and protect the environment.

The program, launched in 2010, focuses on accelerating the use of innovative technologies and strategies the FHWA considers effective and ready for wider use.

Shared resources

A goal of EDC is for federal transportation officials to work with their counterparts in state DOTs and local agencies, and with industry partners on implementing the innovations. The collaboration began with 10 regional innovation summits co-hosted last year by FHWA and AASHTO (American Association of State Highway and Transportation Officials). Breakout sessions during the summits introduced participants, including representatives from Wisconsin, to the EDC initiatives.

The Every Day Counts website www.fhwa.dot.gov/everydaycounts is a key communication outlet where participants can address questions and discuss issues related to the targeted technologies. The site contains a range of information about the EDC technologies and strategies.

Technologies in spotlight

The initiative promotes adoption of five technologies the FHWA terms “effective, proven and market ready.” They are warm mix asphalt, safety edge, prefabricated bridge elements, geosynthetic reinforced soil and adaptive signal controls.

WisDOT is leading Wisconsin’s EDC response, working with the FHWA Wisconsin Division and other partners to study and implement these technologies. Rory Rhinesmith, WisDOT Division Operations Director, is directing the effort, in association with George Poirier, Administrator of the FHWA’s Wisconsin office.

Poirier says the EDC’s success depends on such collaboration.

“We need participation and input from all agencies and groups with a stake in improving how we manage transportation projects at the state and national levels and adopting these new technologies.”

In addition to state and federal officials, the WisDOT technology teams include representatives from the Wisconsin Department of Natural Resources, the Wisconsin

County Highway Association (WCHA), the Wisconsin Transportation Builders Association and the American Council of Engineering Consultants.

The EDC website has links to FAQs, case studies and current resources for each technology.

The WCHA, one of the groups involved with implementation of the five technologies, is represented on most of the technology teams. Executive Director Dan Fedderly sees the EDC initiative as an important program.

“There is merit in adopting many of these approaches on local road projects,” he notes, citing the bridge-repair technologies that county highway crews can use on bridges under 20 feet, smaller spans that do not qualify for funding to keep them repaired. “The prefab elements and geo soil are methods we should look at for doing effective, low-cost repairs or replacements.”

Project delivery strategies

EDC also has a project delivery toolkit with better approaches to ten opportunity areas that accelerate progress on highway projects. These range from improving the environmental review process to more effective utility coordination.

“The public has seen what can be done in emergency situations when federal, state and local agencies work together,” says Poirier. “We need to be creative and challenge ourselves to get things done quicker and do a better job.”

Wisconsin plans to concentrate on five of the project delivery strategies, developing implementation steps to incorporate them into state projects and providing a model for local governments. Selected initiatives are:

Expanding the use of programmatic agreements Standardize procedures to avoid or minimize barriers that slow approvals.

Planning and environmental linkages Seamless integration of all planning documents into the environmental review process.

Accelerating technologies

Warm Mix Asphalt

Produced and placed at lower temperatures than hot mix, WMA can reduce emissions and extend the road construction season. See story page 1.

Safety Edge

Paving with a 30-degree sloped edge to promote safer re-entry for drivers who veer off the road. See story page 2.

Prefabricated Bridge Elements

Bridge structural components arrive at project location ready to erect.

Geosynthetic Reinforced Soil

Layers of compacted granular fill material and geotextile reinforcement supports bridge structure; reduce construction time and cost.

Adaptive Signal Controls

Adjusts timing of traffic signals based on changes in traffic volume and patterns.



Images of accelerating technologies from the Every Day Counts website, where visitors will find information and resources on all initiatives in the FHWA project.

Legal sufficiency enhancements

Identify legal issues early in document development related to the environmental review process.

Clarifying preliminary design scope

Identify design work allowed prior to environmental review and develop a consistent process.

Flexibilities in utility relocation

Research existing policies to identify ways to improve coordination between utilities and state DOTs.

Streamlining project delivery is a high priority for his members, Fedderly says. "It's something we've been working on for years, looking for ways to get more resources on the road and reduce administrative bottlenecks," he explains. "These strategies hold some of the greatest benefits for local governments."

Links on the EDC website connect these strategies to helpful documents and resources that define the approaches.

New sense of urgency

In introducing Every Day Counts, FHWA Administrator Victor Mendez cited the challenges all transportation agencies face to maintain safe roads in an efficient, cost-effective way. He called on state and local agencies to act with "a new sense of urgency" by adopting the proven technologies outlined in the initiative.

Working with the FHWA and other transportation partners, WisDOT is setting the example by implementing technologies highlighted through EDC into its projects. The department plans to assist local governments with updated specifications, demonstrations and other resources.

Rhinesmith says WisDOT is setting an example by incorporating selected approaches championed through EDC in its projects.

"Many of these technologies are good examples of how construction techniques and materials keep improving," he notes. "Where we can use them to develop and complete road and bridge projects across the state effectively, we will." The department also plans to assist local governments with updated specifications, demonstrations and other resources. ■

Resource

www.fhwa.dot.gov/everydaycounts FHWA site devoted to Every Day Counts initiative with links to resources and discussions.

RESOURCES

Websites

The FHWA Every Day Counts site focuses on innovative technologies and practices to improve safety on roadways, protect the environment and shorten project delivery time.

www.fhwa.dot.gov/everydaycounts/

Warm Mix Asphalt page on the Every Day Counts site features facts, case studies and links to related resources about this accelerating technology.

www.fhwa.dot.gov/everydaycounts/technology/asphalt/

Section of FHWA website focuses on Warm Mix Asphalt; includes descriptions of the various warm mix additives and provides links to warm mix research.

www.fhwa.dot.gov/pavement/asphalt/wma.cfm

Warm Mix Asphalt Technical Working Group site, hosted by national Asphalt Pavement Association, includes information on warm mix and links to other information about WMA.

www.warmmixasphalt.com/

Bookstore at AASHTO site carries *Superpave Volumetric Design for Hot Mix Asphalt (HMA)* with special mix design methods for WMA appendix drafted by the WMA Technical Working Group.

<https://bookstore.transportation.org/home.aspx>

The *Every Day Counts* website has facts, case studies and links to other resources on the Safety Edge, one of five EDC accelerating technologies.

www.fhwa.dot.gov/everydaycounts/technology/safetiedge/

FHWA Safety Edge web page.

http://safety.fhwa.dot.gov/roadway_dept/pavement/safedge/



Print copies of listed publications available free from TIC. Download or request items at **Publications** on TIC website. Video, CDs, and DVDs loaned free at county UW-Extension offices. Also see **Video Catalog** on TIC website.

TIC website

<http://tic.engr.wisc.edu>

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Steve Pudloski, Director
pudloski@epd.engr.wisc.edu

Ben Jordan, Staff Engineer
jordan@epd.engr.wisc.edu

Katie Pawley, Program Associate
pawley@epd.engr.wisc.edu

Mary Maher, Writer/Editor
WRITING & CREATIVE CONCEPTS

Susan Kummer, Graphic Designer
ARTIFAX, PUBLICATIONS BY DESIGN

FEEDBACK

CONTACT US VIA EMAIL, PHONE, FAX OR MAIL ►

NAME _____ TITLE/AGENCY _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

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EMAIL tic@epd.engr.wisc.edu

TEL 800.442.4615

FAX 608.263.3160

Wisconsin Transportation

Information Center

432 N. Lake Street Rm 811
Madison, WI 53706

<http://tic.engr.wisc.edu>

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- 2 Closer look at Safety Edge
- 3 Pedestrian safety improvements
- 8 Choosing cold mix
- 9 Local roads issues online
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- 11 Resources
- 12 Calendar



“As we see how it performs at lower air temperatures, it’s one of the areas where the benefits of WMA could aid us the most.”

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432 N. Lake Street Room 811
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Details, locations & registration forms sent to Crossroads recipients prior to each workshop. More information & online registration at <http://tic.engr.wisc.edu/workshops/listing.lasso>

Work Zone and Flagger

Safety Learn how to apply effective work zone traffic controls and improve the safety of motorists, pedestrians, bicyclists and workers. Strategies for meeting federal and state requirements, and minimizing individual and agency liability. FEE: \$60

MAR 29 WAUKESHA	APR 6 HAYWARD
MAR 30 BARNEVELD	APR 7 TOMAHAWK
MAR 31 TOMAH	APR 8 GREEN BAY
APR 5 EAU CLAIRE	

Using WISLR to Manage Your

Roads Learn to use the web-based application to better manage pavement maintenance, submit pavement ratings to WisDOT, and create charts, graphs and maps of pavement

condition and other characteristics. Review process for creating a five-year budget plan. FEE: \$60

APR 12 GREEN BAY	APR 26 HAYWARD
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APR 25 TOMAHAWK	APR 28 TOMAH

On-Site Workshops

Save time and travel costs by bringing instruction to your shop or office. Schedule training that is convenient and tailored to your specific needs. On-site workshops let you train more people for the same cost or less, including staff from other municipal departments, nearby communities, or businesses you contract with. Contact TIC to book the program and date you want. On-site workshops include:

- Basic Surveying for Local Highway Departments
- Basic Work Zone Traffic Control
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UW-Madison Seminars

Local government officials are eligible for a limited number of scholarships for these EPD courses held in Madison. Go to <http://epd.engr.wisc.edu> or call 800-462-0876.

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- 21-22 Fundamentals of Public Works Construction Inspection #L942
- 23-24 Improving Public Works Construction Inspection Skills #L943
- 28-29 Municipal Engineering Fundamentals for Non-Engineers #L923

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- 4-6 Traffic Engineering Fundamentals #L941
- 12-13 Storm Sewer System Design Hydraulics #L917
- 14-15 Hydraulics of Detention Basin Design #L918
- 26-28 Effective Roadway Lighting #L915
- 26-27 Developing Owner’s Project Requirements #M401
- 26-27 Using WinSLAMM to Meet TMDL, LID, & MS4 Stormwater Requirements #M407

MAY 2011

- 23-24 Introductory Principles of Engineering Project Management #L567
- 25-26 Successful Execution and Control of Engineering Projects #L568
- 27 Computer Tools for Engineering Project Management #L569

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- 6-7 Comprehensive Practices for Effective Construction Project Management #L570
- 8 Principles & Practices of Construction Project Scheduling #L571
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