Asphalt

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HMA Testing and Quality for the Future

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The Magazine of the
Asphalt Institute
Summer 2005
Vol. 20, No. 2

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Asphalt President's Message

It's summertime! Most regions are now in full construction swing following a busy training and tradeshow season. If you've been paying attention, you'll know that a lot is changing. That is why we're devoting this edition of *Asphalt* to new asphalt technology.

If you serve the highway construction industry in any way, like me, you may have been asked this winter, "What's new?" People wanted to know how the soaring prices of crude oil would affect their liquid asphalt supply this summer and their prices. They wanted to know about AI's recently completed publication, ER-215 *Quantification of the Effects of PMA for Reducing Pavement Distress*, on the effectiveness of polymer modified asphalts—available now at www.asphaltinstitute.org in our online store. Practitioners were eager to learn about life cycle costs and how this information is used in the pavement-type selection process. The list goes on.

This issue highlights the answers to some of those questions by first bringing you an article co-authored by FHWA's John Bukowski and John D'Angelo. The article, *HMA Testing and Quality for the Future* focuses on using automation and new technology to speed results and improve quality control and acceptance testing. Don't miss it.

New technology surfaces in the form of thickness designs too. The Asphalt Institute spent the last couple of years updating its venerable thickness design software, sold for years in a DOS version (I'm betting there are some of you out there that still use it.) and now it is NEW and Updated and released as SW-1 *Asphalt Pavement Thickness Design Software*. If you are interested in thickness design, you'll want to take a look at AI's one-day seminars being offered later this year and dedicated exclusively to that topic. Keep an eye on our website for the dates and locations.

Peter T. Grass, *President*

Technology advances mean equipment changes, too. We take a look at the state of the practice for reclaimed asphalt pavement (RAP) handling equipment.

I overhead someone ask the other day "California is moving to Superpave?" Slowly but steadily, "Yes." We showcase one such project along the Alameda Corridor—the first large scale use of Superpave mixes in that state, on a port-serving connector with 60 percent truck traffic. This summer CALTRANS is also is the process of converting to PG graded binders, a collaborative process that has involved many segments of the industry for a long time. Training gets underway shortly and the Asphalt Institute will be part of that, offering on-site classes to help get the technicians comfortable with the required testing regimens. New Asphalt Technology at work!

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For the latest information from the Asphalt Institute, visit the Institute's website at www.asphaltinstitute.org

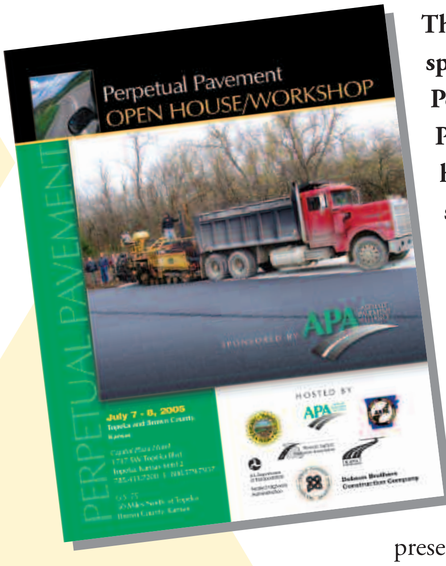
Asphalt Features

AI and PRI Asphalt Technologies have launched a new state binder specification database. Each individual specifications document summarizes the respective asphalt binder specifications for each of the 50 state highway agencies. A standard format is used to list specifications, methods and criteria, PG-plus tests and requirements, typical grades, exclusions and the agency's website where specifications can be found. Visit *asphaltinstitute.org* for details.

AI has developed a Proficiency Sample Program (PSP) for Roofing Asphalts, similar to the successful program administered by the AASHTO Materials Reference Laboratory (AMRL) for paving-grade asphalt binders. The PSP will help users understand the between-lab variability of some common tests for roofing asphalt binders described in ASTM D312, Standard Specification for Asphalt Used in Roofing. Visit *asphaltinstitute.org* for details.

The Asphalt Pavement Alliance (APA), the Safe, Quiet, Durable Highway Institute and the North Central Superpave Center will hold a conference on road noise at Purdue University November 1-3, 2005. The conference will feature presentations on the sources of road noise, demonstrations of noise levels and presentations of how asphalt pavement can reduce road noise. Visit *asphaltalliance.com* for details.

The Airport Pavement Workshop in Philadelphia, Pennsylvania, October 25-27, will provide up-to-date information for those designing, constructing and managing asphalt airport pavements. The Workshop includes a review of current specifications and advisory circulars, detailed descriptions of materials, and pavement design, construction, and preservation practices for airports. For more information, see page 21.



The APA is sponsoring a Perpetual Pavement open house/workshop in Topeka and in Brown County, Kansas, on July 7-8, 2005. The workshop will feature technical presentations and a site visit. There is no charge for attending the event, but pre-registration is required. Email or call the Kansas Asphalt Pavement Association at *jjkapa@aol.com* or 785-271-0132.

AI welcomes new members Asphalt Refining and Technology Company (ARTC), **LLC** of Douglasville, Georgia, and **Canadian National Railway** of Montreal, Quebec.

Ed Schroeder of Asphalt Refining & Technology Company, LLC receives his AI membership plaque from AI Membership Chairman Len Nawrocki (left) of Valero and AI President Pete Grass (right).

Michel Jean of Canadian National Railway (center) receives his AI membership plaque from AI 2005 Chairman Bill Haverland of ConocoPhillips (left) and Len Nawrocki (right).

Pictured are the representatives of the winning agencies. Back row Eric Harm, Illinois DOT; Gerald Nicely, Tennessee DOT; Larry O'Donnell and Luke Stango, co-chairmen of the APA; Jack Lettiere, AASHTO; Dan Collen, County of Santa Clara, California; and Tom Peterson, Colorado Asphalt Pavement Association, who accepted on behalf of the Colorado DOT. Front row: Sam Beverage, Kentucky Transportation Cabinet; David Kopp, Texas DOT; Andrew Johnson, South Carolina DOT; Aaron Behrman, Ohio DOT and Patrick Hughes, Minnesota DOT.

APA's 2004 Perpetual Pavement Awards were presented in a special ceremony at the National Center for Asphalt Technology (NCAT) at Auburn University in May 2005. Jack Lettiere, Jr., 2005 President of AASHTO, made the presentations. The winners were the Roads and Airports Department of Santa Clara County, California, and the Departments of Transportation of Colorado, Illinois, Kentucky, Minnesota, Ohio, South Carolina, Tennessee and Texas. The Perpetual Pavement award is given to owners of asphalt pavements that are at least 35 years old and have never had a structural failure. The road must demonstrate the qualities from long-life asphalt pavements: excellence in design, quality in construction, and value to the traveling public.

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More than 124,000 industry professionals from around the world attended CONEXPO-CON/AGG 2005 during its five-day run March 15-19 at the Las Vegas Convention Center. The show featured the latest equipment, product innovations and technological advances of the construction, construction materials and power transmission industries. The show spanned more than 45 acres of exhibit space for the 2,400 exhibitors. International attendance topped 21,000 with people attending from more than 130 countries. The Asphalt Institute exhibited at the show and met with a variety of industry associates at the weeklong event.

Panel discussion during the Quiet Pavements symposium.

Highlights of AAPT's 80th Annual Meeting

By Mike Huner, P.E. • Asphalt Institute Field Engineer

The Association of Asphalt Paving Technologists (AAPT) was established January 17, 1924, in Chicago, Illinois. In the beginning, there were only 19 charter members. However, AAPT has since grown to exceed 1,000 members from all parts of the world. The initial purpose of the Association was for the advancement of asphalt paving technology. Today, its purpose is defined by four main objectives:

- To advance asphalt paving technology;
- To encourage communication among those charged with technical responsibility for the production and laying of asphalt pavements, with production of materials or with construction or construction equipment;
- To serve as a central point for exchange of ideas related to the technology of asphalt paving; and
- To conduct, encourage and collate research in the asphalt paving industry.

One of the primary means of achieving these objectives is through the publication of the AAPT Journal. With its compilation of reports on state-of-the-art technologies and practices, the Journal is regarded as one of the premier sources of literature for the asphalt paving industry. The annual publication began in 1928 and Volume 74 will be published this year. Another yearly AAPT event is the Annual Meeting. Typically held in March, this meeting serves as a forum for technical presentations, symposiums and workshops.

The 80th Annual Meeting of the AAPT was held March 6-9, 2005, in Long Beach, California. With more than 260 registered attendees from 17 countries around the world, this year's meeting represented the highest attendance in the past three years. With a common interest in research of materials and methods, the attendees spanned a broad spectrum of the industry, reaching materials suppliers, consultants, contractors, universities, government agencies and other researchers. Some of the highlights of the meeting were:

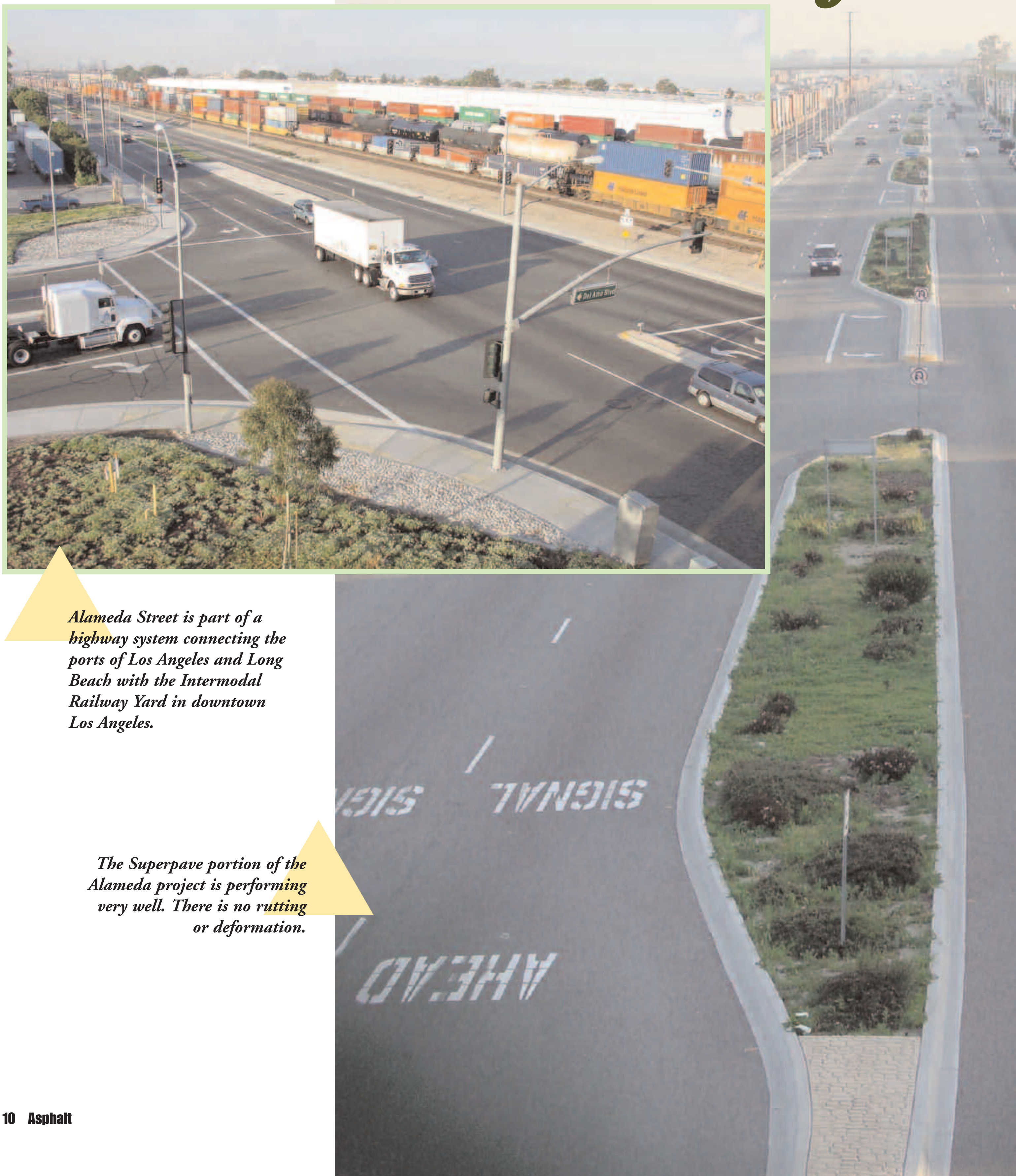
- A Government Engineers' Forum was held on Sunday, March 6. Discussion topics included a new Federal Highway Administration initiative for QC/QA, and integration of Superpave mix design with new mechanistic-empirical pavement design.
- The technical presentations included 23 papers. These were grouped into five categories:
  1. Workshop Session;
  2. Binder Characteristics and Evaluation;
  3. Mechanistic-Empirical Evaluation of Models;
  4. Field Verification of Fatigue and Permanent Deformation Models; and
  5. Performance Modeling.
- A symposium titled *Developments in Quiet HMA Pavements* was held.

Another highlight of the meeting for the Asphalt Institute (AI) came during the meeting's banquet. AAPT conferred awards of Honorary Membership on former AI Director of Research (and AI Roll of Honor Recipient) Vyt Puzinauskas and former AI Member Representative (and AI Distinguished Service Award Recipient) Larry Santucci. Honorary membership is the highest award conferred by AAPT on an individual. In their acceptance speeches, both Puzinauskas and Santucci noted the role of the Asphalt Institute in their careers.

Next year's meeting is in Savannah, Georgia, March 27-29, 2006, at the Hyatt Regency Hotel.

Alameda Project

by Ed Misajet
and John Davis



Alameda Street is part of a highway system connecting the ports of Los Angeles and Long Beach with the Intermodal Railway Yard in downtown Los Angeles.

The Superpave portion of the Alameda project is performing very well. There is no rutting or deformation.

Exceeds Expectations

The Alameda Corridor is a 26-mile super-cargo highway connecting the ports of Los Angeles and Long Beach and the Intermodal Railway Yard in downtown Los Angeles. It accommodates 50 to 75 percent heavy trucks. When it was completed five years ago, it handled 26,000 vehicles per day, but 49,000 are expected by 2010.

Highway engineers designed a portion of Alameda Street using Superpave to withstand Supertrucks, large container carriers with heavy cargo loads, along with the relentless Los Angeles sun and huge ESAL loadings. The roadway was designed to address three potential asphalt problems—rutting, fatigue cracking and low temperature cracking. Caltrans (California Department of Transportation) and Los Angeles County design engineers chose Superpave mix for the pavement within their portion of the project because they believed it would meet the performance challenge.

Hot Sun and Heavy Trucks

Caltrans and L.A. County design engineers considered climate and traffic conditions. The hot Los Angeles sun plus the heavy trucks could cause severe rutting if the pavement mix was not right. Caltrans wanted a roadway that would be easy to construct and easy to maintain. L.A. County required that Superpave meet its Type A mix specifications, which addresses traffic loading, subgrade requirements and highly crushed aggregate particles.

The Los Angeles County portion of the project spanned a 6.3-mile section of Alameda Street and was divided into three sections, two of which were approved for Superpave mix. “We had to satisfy both Caltrans’ and L.A. County’s mix requirements,” said K. Brian Rickey, P.E., Los Angeles County Materials Engineer and former Resident Engineer for the Alameda project.

“The Alameda project was the first major use of Superpave in L.A. County, and maybe in the state,” said Rickey. “Because it was part of the ports access demonstration projects, we were able to use Superpave on the project. We did our homework before deciding Superpave was the right choice to withstand the extreme temperatures and the heavy traffic.”

According to Rickey, the county used a Caltrans 3/4-inch mix on one-third of the project and Superpave on the other two-thirds. “That ultimately provided us a good comparison between a traditional mix and a Superpave mix.”

Superpave Mix Design

Project design engineers specified 20 inches of Superpave mix on four inches of aggregate for the Superpave section. The four inches of aggregate acted as a platform for the asphalt. The 20 inches of Superpave was placed from the aggregate base to the top of the roadway.

“We used one Superpave mix all the way to the top,” said Rickey. “Because the material was so coarse, we asked the hot mix producer to put more fines in the surface course mix, but within the Superpave gradation specifications.”

Superpave Construction

Rickey explained that constructing the Superpave section did not require special procedures. “It was pretty normal. Out here in California, we don’t have the big temperature swings that other states have, so we didn’t have to accommodate the cold weather. We didn’t have a project that mandated the use of tarps over the hot mix, so we used windrows and that made placing the mix easier.”

Rickey said that the construction portion of the project was easy compared to the administration, coordination and inspection challenges. “Heavy truck traffic, along with big asphalt tonnage, and coordinating the requirements of numerous agencies was a constant challenge.” L.A. County administered several contracts totaling nearly $100 million over a six year period. “Our team worked with the City of Carson, the City of Los Angeles, Caltrans, the Alameda Corridor Transportation Authority, the Union Pacific Railroad and others. I was the single point of contact for all of them. I wasn’t able to be the main guy on the roadway, but I did pull plenty of evenings myself inspecting the asphalt.”

Compaction

On some projects around the United States compaction of Superpave mixes has been a significant problem. But on the Alameda project, compaction of the Superpave mix was a fairly standard operation. “In general the compaction was pretty consistent with traditional mixes,” said Rickey. “One difference is that we used a rubber-tire roller.”

Rickey said the initial placement of the Superpave test strips gave the paving crews an opportunity to understand what the mix was doing. "The crews were able to determine the actual time necessary to let the mix cool before beginning the breakdown rolling. Once the paving crews understood how to compact the material, it took less rolling effort than it would have for a traditional mix. Doing the test strips helped us a lot."

Night Work Only

All the paving operations on the Alameda projects were done at night, which posed some challenging logistical problems for the construction team. "Placing a 24-inch thick structural roadway in a commercial zone with heavy traffic where you have big trucks coming in and out of driveways plus accommodating nighttime traffic from a big refinery, took a lot of traffic management," said Rickey.

"We had to make arrangements for access for those businesses to get in and out every night. We provided temporary access ramps, then, when we were ready to pave, we ripped out the ramps and began paving."

Maintenance

Rickey noted that maintenance so far on the Alameda Street project has been very limited. The Superpave portion of the roadway is performing without rutting or deformation of any kind. "I took a drive through the project not long ago and I was amazed that even at the stop bars where the heavy trucks stop and then accelerate, I didn't see ripples in the striping.

"L. A. County has a five-year slurry program, but there has been no discussion to my knowledge of including the Superpave section in that program. The only maintenance so far is picking up trash, watering the trees and such—no pavement maintenance."

Performance

The connector road from the Del Amo Grade Separation to the Superpave section of the Alameda was paved with a traditional AR4000 mix and that connector road has noticeable rutting in it. But as the connector enters the Superpave portion, Rickey says the road is beautiful. "It has absolutely no rutting or deformation." He is thoroughly impressed with the performance of the Superpave portion of Alameda Street and is happy to say "Based upon a side-by-side comparison, it is performing very well."

"From an overall performance standpoint, I think everybody involved is happy with it."

Product Showcase Asphalt

Asphalt Testing Equipment

APPLIED TEST SYSTEM'S new Pressure Aging Vessel simplifies the process and documents the data for ASTM D6521 procedures. Status screens prompt the user for action. The final screen includes present pressure, maximum and minimum temperatures, time out-of-target-range, and total time for complete 20-hour process. The complete process can be run directly from the front panel or from your PC, with optional ATS remote monitor/control package. *For information, call David Howard at (724) 283-1212.*

ANTON PAAR'S new SmartPave Asphalt Rheometer has auto configuration and automated temperature calibration to document your entire measurement and calibration. It conforms to all AASHTO and ASTM requirements, including the new temperature calibration manager. The rapid Peltier heating and cooling system can double your throughput. *For information, contact Anton Paar USA Inc. at (800) 722-7556 or visit www.anton-paar.com.*

DESPATCH INDUSTRIES' high performance Rolling Thin-Film oven is especially designed for testing the effect of heat and air on a moving film of asphalt in accordance with ASTM D2872 and AASHTO T240. Inside chamber dimensions are 16 inches wide, 17.5 inches deep and 13.5 inches high; maximum temperature 400°F/204°C, 240V/60hz with digital temperature controls and removable bottle carousel. *For information, call Despatch Industries at (952) 469-8278 or visit www.despatch.com.*

BARNSTEAD INTERNATIONAL'S Pyro-Clean glassware cleaning system uses only heat at 800 to 900°F to remove organic materials like tars, resins, polymers, char or virtually any organic residue, leaving your glassware sparkling clean. Glassware comes clean without using acids, caustics or any other chemical or solvent cleaners. *For information, call Barnstead International at (563) 556-2241 or visit www.barnstead.com.*

INSTROTEK'S CoreDry produces repeatable dry weights for consistent test results in 15 minutes or less. Samples stay cool and safe during the drying process, which preserves sample composition so you have dry weights in minutes, without degrading or changing the sample characteristics. The CoreDry uses high vacuum technology and an electronic desiccation system to extract water from the sample, evaporate it and condense it in a cooling trap. *For information, call InstroTek at (919) 875-8371 or email marbelaez@instrotek.com.*

Asphalt Product Showcase

This showcase features some of the latest innovations in asphalt sampling and testing technology.

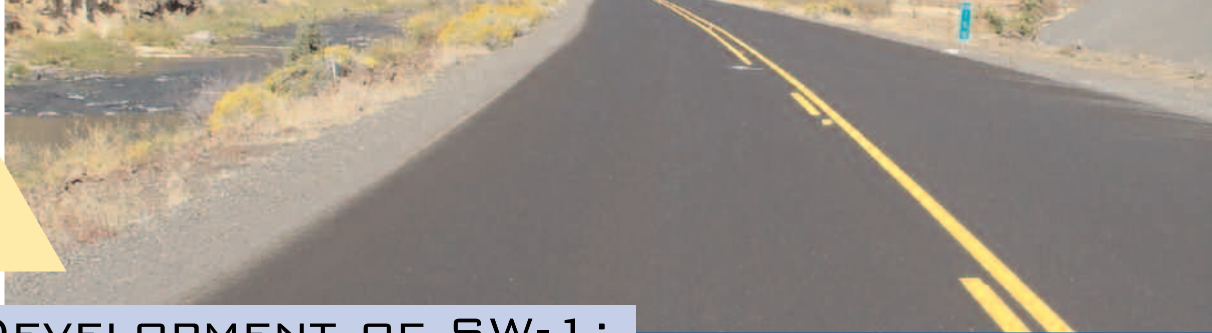
R/H SPECIALTY & MACHINE, INC.'S FD-4A™ force-measuring adapter is engineered for accurate measurement of the force in tensile testing asphalt specimens in a ductility machine. It is capable of canceling out the specimen weight while registering the force exerted on the test material. Built-in electronics communicate tensile loads to a digital readout/controller unit. Calibration apparatus and data acquisition software are included. *For information, call (812) 232-0781 or email rhsm@thnet.com.*

PAVEMENT TECHNOLOGY, INC'S Laboratory Automatic Gradation Unit (AGU) is a particle-size analyzer that conducts a complete sieve analysis automatically and transmits the accumulated data to a computer. The AGU features an Automated Loading System that allows a user to stage up to seven samples (40-45lbs) for gradation analysis or material separation. The AGU has a carousel that is used to collect graded samples and aggregate for material separation. The carousel can accommodate eight five-gallon buckets. *For information, call (770) 388-0909 or email wadec@pavementtechnology.com.*

PINE INSTRUMENT COMPANY'S Rotary Asphalt Wheel Tester continuously rotates the specimen between three Hamburg style wheels. Each rotation of the specimen provides three load cycles, speeding up testing time. There is no need to mount multiple specimens to perform the test—a single specimen is all that is required. Wheel velocity is constant, unidirectional, and easily adjusted from the control panel. *For information, call (724) 458-6391 or visit www.pine-inst.com.*

FLIR SYSTEM'S ThermaCam E65 Infrared Camera ensures consistent materials application temperature for the asphalt industry. The lightweight, easy-to-use E65 is the most accurate hand-held infrared camera on the market today. The E65 includes LCD screen, storage of up to 200 thermal images with text notations, seamless PC image downloading with QuickView software. *For information, call (800) 464-6372 or visit www.flirthermography.com.*

BROOKFIELD ENGINEERING has added new bi-directional communication to its most popular instrument, the DV-II+ Viscometer. The new DV-II+Pro model offers simplicity of operation for single point viscosity measurement or can be configured to run automated tests for multiple point data collection without the involvement of the operator or computer. The DV-II+Pro is totally compatible with Brookfield Viscometers and accessories currently in use. *For information, call (508) 946-6200 or email sales@brookfield-engineering.com.*



SW-1 is used for highway pavement design.

The Development of SW-1: New Asphalt Institute

by John Duval, P.E.
Asphalt Institute Field Engineer

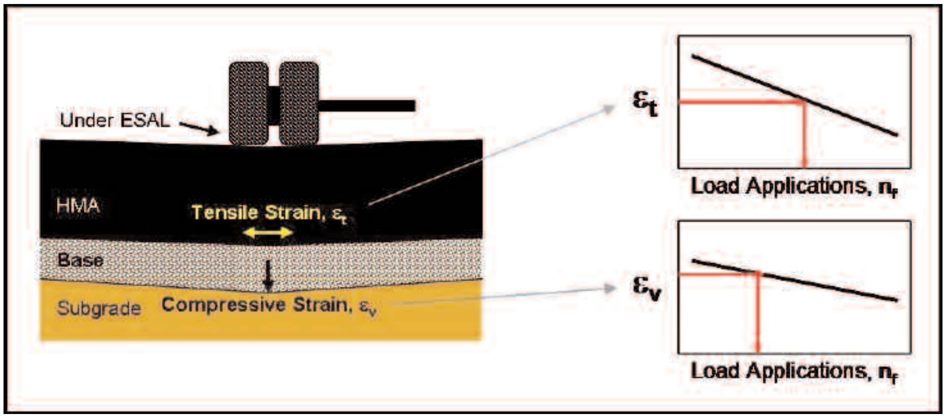
In 2001, the Asphalt Institute began to explore the idea of updating its computerized pavement design tools for highways, heavy wheel loads and airports. The DOS-based programs, HWY, HWLOAD, AIRPORT and the structural analysis tool DAMA, had long been respected among design professionals for ease and simplicity of use. But the programs were overdue for conversion to the Microsoft Windows® operating system to allow more accessibility to the current generation of pavement designers.

Originally, the development team was charged with simply converting the individual programs to Windows. Soon it became apparent that there was an opportunity to repackage the programs into a unified pavement design tool that could provide users with a much broader range of applications. The development team converted and integrated the procedures into a single, powerful and easy-to-use pavement design tool. *SW-1, Thickness Design Software*, as it is now known, was unveiled as the Asphalt Institute's primary thickness design tool in December 2004.

This article outlines some of the technical merits of the SW-1 system, including its foundation on mechanistic-empirical design principles, its broad range of capabilities and the power of the companion User's Guide.

Mechanistic-Empirical Design at its Core

The Asphalt Institute methods for pavement design are based on mechanistic-empirical (M-E) methods. As shown in the figure below, M-E design procedures consist of two parts: 1) calculating key stresses, strains and deflections in a loaded pavement structure, and 2) relating them to actual pavement performance.



AI's new SW-1, Thickness Design Software, is based on mechanistic-empirical design principles.

The developers of SW-1 harnessed the power of the M-E calculation engine to create specialized solutions for the most common applications, such as highways, roads, streets, parking lots, overlays, commercial and general aviation airports, ports and heavy industrial yards. For those users craving a bit more power, SW-1 offers the capability to perform Advanced Structural Analysis using the core M-E analysis engine.

Some of the advantages of the M-E-based design methods are the ability to easily characterize highway and street traffic using the common Equivalent Single Axle Load (ESAL). Airport and heavy wheel loads are characterized using single wheel loads or specific aircraft gear configurations. In the SW-1 design methods, the user is allowed to vary the climate by selecting the mean annual air temperature (MAAT). Users can characterize subgrade strength through the use of resilient modulus (M_r), California Bearing Ratio (CBR) and R-Value. SW-1 provides elegant M-E design solutions based on common engineering design inputs. The result is a powerful, yet practical, pavement design tool that everyone can use.

Broad Capabilities in an Integrated Design

SW-1 offers engineers a single point of reference for asphalt thickness design and analysis. Whether the project entails the design of a multilane interstate highway, a commercial airport, a container handling yard or an automobile parking lot, SW-1 provides a solution. The broad combination of capabilities in SW-1 allows an engineer to design an airport runway pavement one day and use the

SW-1 can be used to design heavy wheel load facilities.

Thickness Design Software

same familiar tool to design a city street pavement the next.

Users can switch quickly between design projects on SW-1's main screen. Known as the Project Definition tab, this is where users define a new project, open an existing project or save a new file upon starting the program. With a few simple clicks of the mouse, users can set up a project, e.g. a new highway pavement or an overlay for an airport runway. Once the project is defined, SW-1 prompts the user to input the required data on a sequence of screens. Once the input data is entered, the final step is to click on the Results tab.

User's Guide

Successful software programs are usually accompanied by complete documentation. SW-1 is no exception. The development team wrote the 108-page User's Guide to serve as a companion to the program during installation and operation. The first three chapters of the User's Guide describe step-by-step instructions for installing and conducting basic operations of the software, such as creating and organizing data files and project records, defining projects, viewing results and printing reports.

Chapter 4 discusses how climate is characterized using the MAAT. Chapter 5 provides details on entering subgrade information using M_r, CBR, or R-Value. Chapters 6-11 cover each of the primary pavement design methods: General Aviation Airports, Air Carrier Airports, Highways/Roads/Streets, Overlay Design, Planned Staged Construction and Heavy Wheel Load Applications. Each of these six chapters includes a discussion of the method and at least one example to further assist users in applying the software to their own projects.

The final chapter, Chapter 12, includes a discussion and an example of how to conduct Advanced Structural Analysis using the SW-1 core M-E calculation engine DAMA. Users will find that each example comes pre-loaded in the SW-1 software, making the User's Guide a powerful tool for getting the most out of the program. Download a FREE 30-day trial version of *SW-1, Thickness Design Software,* today at *www.asphaltinstitute.org.*

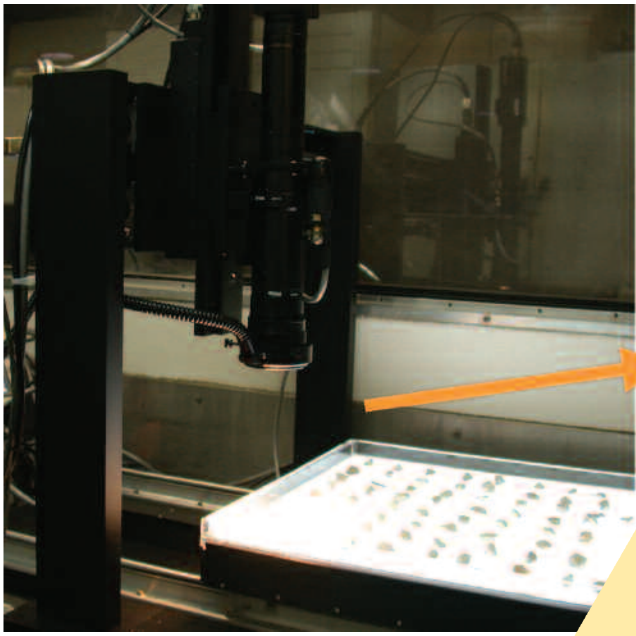
HMA Testing and Quality for the Future

By John D'Angelo and John Bukowski
Office of Pavement Technology, FHWA

Over the past 15 years, there have been significant changes in hot mix asphalt (HMA) quality control, testing and acceptance practices. In the past, it was common for the highway agency to do all the quality control testing and use that same data for acceptance. The standard for quality control was asphalt content and gradation.

Density was typically evaluated by comparing the roadway to a lab-compacted specimen, possibly made long before the project even started. If the ingredients were proportioned correctly, the pavement should perform well.

Today what we measure and who does the measuring has changed. The contractor does the quality control testing. Binder content and gradation are typically still part of the quality control program but they are not the controlling factors in determining the quality of the mix. Quality control today is typically based on the volumetric properties of the mix and density is based on in-place air voids determined from the maximum specific gravity. Additionally, some highway agencies now use the contractor's tests to determine pay values.



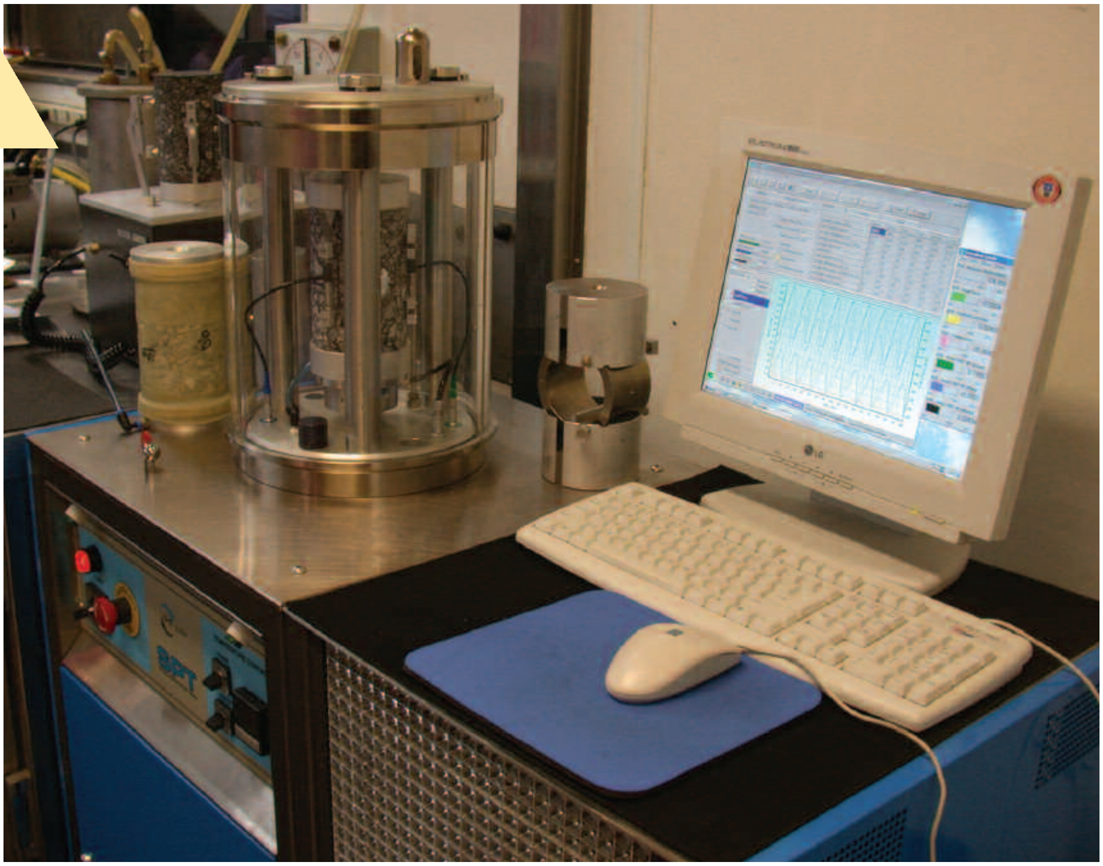
The aggregate imaging system measures the shape, angularity and texture of aggregates.

From Art to Science

The testing of HMA is changing from an art to a science. New tests that provide more accurate and performance-related mix properties are being developed for use in the quality control process. For example, the shape, angularity and texture properties of coarse and fine aggregates can be quickly and easily measured by a new aggregate imaging system (AIMS) developed by Dr. Eyad Masad and the Federal Highway Administration (FHWA). The AIMS can be used in the quality control of aggregates during their production, and the measured characteristics can be related to pavement performance.

The AIMS evaluates the shape and texture characteristics of coarse and fine aggregates by analyzing the images of the aggregate particles captured by video camera (black, white and gray format). The black and white images are analyzed for form and angularity; gray images are analyzed for texture. The AIMS evaluation reduces the variability of test results and speeds up the testing process. Potentially, it may replace the coarse aggregate angularity, fine aggregate angularity and flat and elongated particles tests.

The results from the AIMS are being used to determine a more direct relationship between aggregate properties and HMA pavement performance. A study is currently underway to determine the relationship between AIMS test results and the Superpave repeated load, permanent deformation performance test.



The Superpave Performance Tester is used to measure the stiffness or strength of HMA.

The Superpave Performance Tester was developed as a small, compact unit that fits into a field lab or trailer. The software used to operate the equipment was developed with ease of operation in mind and automatically goes through numerous self-checks to assure that the test is properly set up.

Traditional Process Control

Process control is the contractor's quality control system for monitoring the HMA manufacturing operation. The traditional approach to process or quality control is to evaluate a series of independent tests. This approach includes such steps as determining if the proper binder is in the contractor's tank and the right aggregates are in the stockpiles. It includes cold feed checks to make sure the proper amount of each stockpile is being added to the feed belt. This is where an AIMS evaluation can be used to check if the aggregates in the stockpile match the materials used in the original mix design.

Traditionally, the owner agency was expected to perform testing for acceptance analysis while separate quality control testing was performed by the contractor. But reductions in owner agency staff have made it increasingly difficult to perform adequate and timely testing. For high production operations, the concept of a few samples to represent large amounts of material also places high risks on the owner agency or the contractor. To address these concerns, new approaches to testing and increased reliance on automation are likely.

New Technology

Automated testing, data management and computer-controlled manufacturing potentially allow for reduced testing when these technologies can be applied to hot mix production and placement. Ultimately it is envisioned that real-time gathering of production information may reduce the time gap between production and data availability and improve the reliability of that data.

Applying the Technology

In 2004, a project was initiated by the Alabama DOT, working with the National Center for Asphalt Technology (NCAT), to evaluate a number of specific devices for automated sampling and testing of component materials. In-line viscometers were used to check the binder being fed into the plant. Sensors were used to measure the moisture in the aggregate. Automated belt samplers were used to obtain a sample of the virgin aggregates from the conveyor before it entered the dryer. An automated sample dryer and gradation device, integrated with the belt sampler, provided rapid feedback about the consistency of the aggregate and its conformity to the job mix formula. In the future, each of the automated technologies can be integrated as a system with programmable controls, data acquisition and report generation.

New Paving Technology

Computer-equipped rollers—or intelligent compaction—is one emerging technology that will allow greater control and oversight of the compaction process, resulting in better, more uniform density. Vibratory rollers with a measurement/control system can automatically control

PHOTO COURTESY OF NCAT

An in-line viscometer can be used to check the stiffness of the asphalt binder being pumped at the HMA mixing plant.

compaction parameters in response to materials stiffness measured during the compaction process.

The rollers can also be equipped with a documentation system that allows continuous recordation, through an accurate positioning system of roller location and corresponding density-related output. The information can include number of roller passes and roller-generated materials stiffness measurements. This output can enhance the ability of the roller operator and/or project inspection personnel to make real-time corrections in the compaction process. This output is available for inspector review, allows for a plan-view plot of stiffness throughout a designated section of roadway and provides a link to a pavement management system database.

Ultimately this technology will provide new tools for measurement of in-place pavement properties. Through the use of computers, modeling, and innovative software, intelligent asphalt compaction equipment offers the potential to improve operations, result in more uniform pavement density, reduce inspection requirements, and provide a long-term quality record that can be related to pavement performance.

PHOTO COURTESY OF NCAT

Belt-mounted moisture sensors can be used to monitor the moisture content of aggregate entering the plant.

Automated Testing

The quality assurance system of the future will include new processes and innovative testing equipment. This will not mean, however, that increased or excessive testing will be done. It will mean that we use all the tests to give us a better overall picture of what is being produced and how it relates to performance.

Under the future system, devices such as the AIMS will be used at the plant to check the aggregate as it is delivered to verify specifications compliance, and to check that the aggregate is similar to the material used during the original design. After the initial tests, the automated system takes over with continuous monitoring of production. When the monitoring indicates aggregate changes, additional testing may be done.

The system of the future may allow the testing frequency to be dramatically reduced. Unlike current practice where samples are taken every 500 or 1,000 tons, the automated systems may allow samples to be taken every other day—just to verify that the process is working.

Mix Acceptance

The idea that we can make one or two tests

PHOTO COURTESY OF NCAT

An automated belt sampling device can be used to sample the aggregate before it enters the dryer.

An automated sample dryer and gradation device can be integrated with a belt sampler to provide data on aggregate consistency.

on a material and decide if it has the desired quality is outdated. HMA production has to be looked at as a manufacturing process. There are many steps that have to be checked in that process to assure quality with some type of performance measure at the end. The new tests and plant automation processes that are becoming available will look at HMA in a new way.

For example, this is where the Superpave Performance Tester could come into the picture. The process might go like this: the production process control and quality control are established; the system has been calibrated and running smoothly. At this point the performance properties of the mix, as determined by the Superpave Performance Tester, are used to accept the mix for payment. This testing would be done at the start-up of the project and at extended intervals during production. If the process control indicates a problem has occurred, a sample can be taken and tested later.

HMA testing in the future will use quick accurate tests on the initial components. Plant automation will assure that the production process runs smoothly and limited quality control testing will verify the process. Finally performance tests will be evaluated to accept the material. Then we will have an advanced quality assurance system that tells us more about the material we are placing on the roadway and how it performs.

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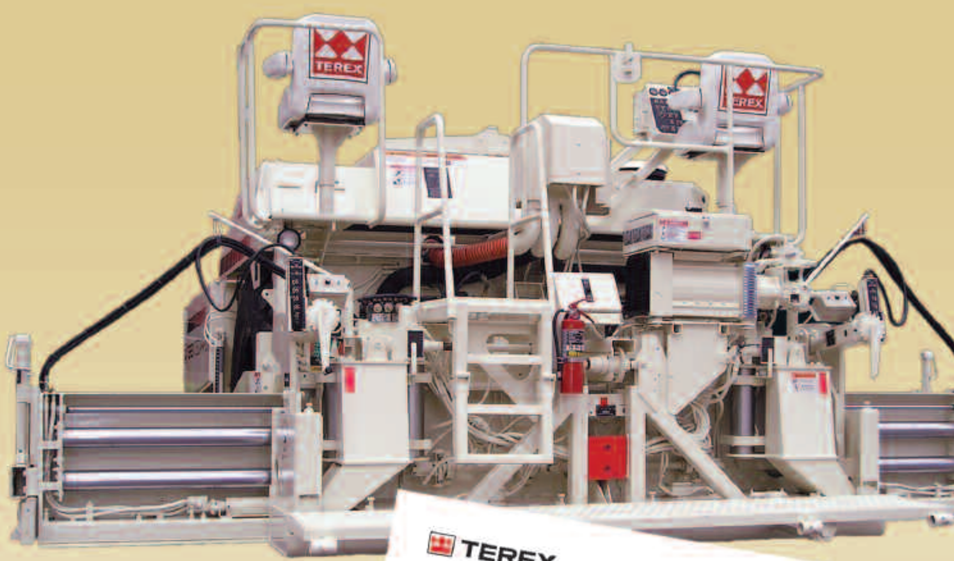

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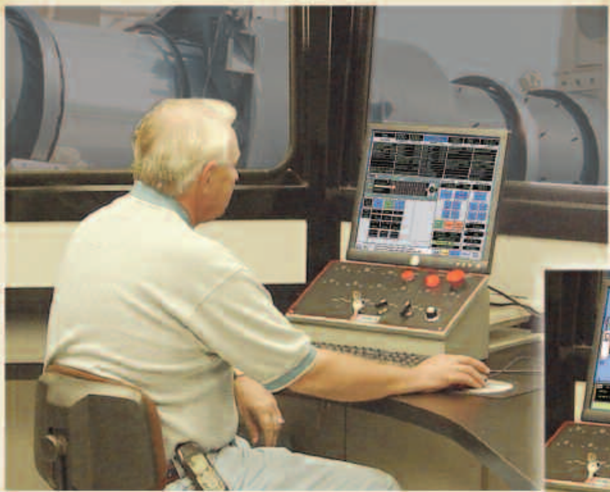

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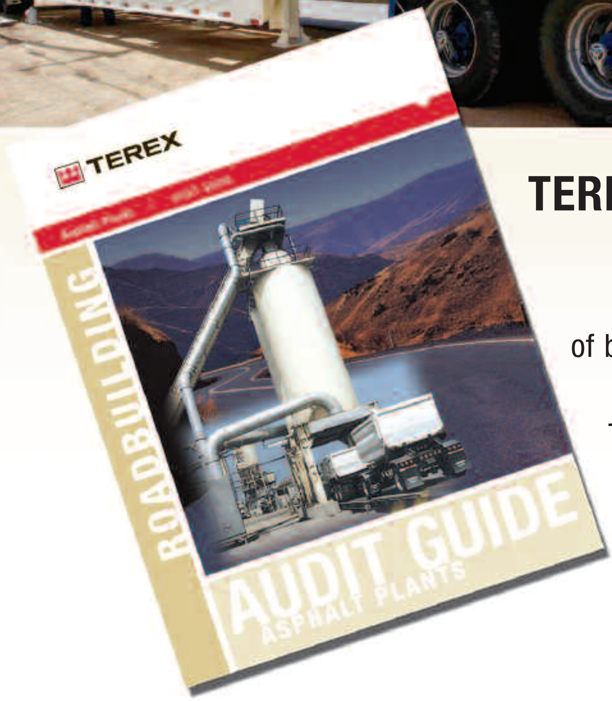

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QUIET PAVEMENT —

Coming to a Highway Near You

By Wayne Jones, P.E.,
Asphalt Institute Field Engineer

The squeaky wheel gets the grease! This adage has been true since 5000 B.C. when man first used wooden wheels to haul heavy loads. The latest variation of this old saying goes something like this: a noisy pavement gets the attention of the pavement engineer. Recent actions by public agencies have proven that community outcries for quieter pavements have been heard.

Background

By definition, noise is any unwanted or excessive sound. Noise, especially transportation noise, has become one of the most pervasive forms of pollution in today's environment. It affects our lives at home, at work and at play.

Urban noise is an indication of economic activity and commerce, and up to a point, an improving quality of life. But in extreme situations, it can lead to anxiety, stress and other health problems. When that happens, noise needs to be controlled or abated.

European Experience

The quest for quiet pavements originated in Europe where the preservation of historic vistas prevents the use of noise barrier walls. Most of the efforts in European countries have been on the elimination of the noise at the source.

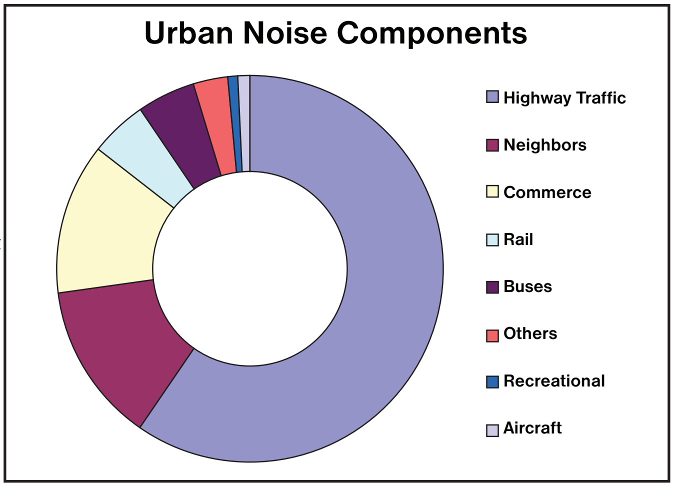

Figure 1

Currently there are two different approaches to achieve quieter hot mix asphalt (HMA) pavements in Europe. One method uses thin overlays with negatively textured, gap-graded mixes such as stone matrix mixtures. The second method calls for single or double layers of open-graded porous surface mixes that absorb both water and air and do not allow them to become trapped between the tire and the pavement.

Research at the Transportation Research Lab in the United Kingdom (UK) found no loss of skid resistance when specifying HMA surfaces and a 3 to 6 dBA reduction in noise generated when compared to other types of pavement. Such a reduction in noise is roughly the equivalent of increasing the distance from two to four times between the source and the listener. Based on these findings, the UK has launched a ten-year program to overlay the majority of their high-speed motorways with HMA to promote noise reduction.

Arizona Experience

Arizona paved a 1500-foot stretch of freeway in the Phoenix area with an open graded friction course (OGFC) to improve skid resistance and visibility during heavy rains. When motorists noticed the distinct reduction in noise provided by the new pavement surface, they began asking "Why can't we have a similar overlay near our neighborhood?" The local media picked up on the public's interest and ran feature stories about the quiet pavement surface. From this public outcry, came AZDOT's commitment to overlay all of the freeways in the Phoenix area with OGFC. The overlay program proved to be so successful at reducing noise levels around the city that the Phoenix Metropolitan Planning Organization agreed to loan AZDOT $34 million to accelerate the overlay program.

Research in California has shown that a quiet pavement overlay can maintain good acoustic qualities for the majority of its life. If the pavement remains quiet, then an agency will not have to renew the surface based on acoustic performance. When the surface needs to be rehabilitated, the new overlay can incorporate the latest quiet pavement technology.

Based on the Arizona experience and research in California, the Federal Highway Administration has announced the “Quiet Pavements Pilot Program” that allows credit for quiet pavement technology. Under the program, a state can take up to a 5-decibel credit for the use of quiet pavement surfaces. They must agree to re-apply a quiet HMA surface when monitoring shows that the old pavement is noisy.

Elsewhere Around the Country

During recent public hearings on pavement selection in Ohio, citizens from one community complained about a particularly noisy stretch of newly reconstructed Portland cement concrete (PCC) pavement. As a result, Ohio has begun to research quiet pavement technology and now considers noise a secondary factor in the pavement selection process.

The National Center for Asphalt Technology (NCAT) has begun to monitor and catalog pavement noise levels from around the country using a close-proximity (CPX) noise measuring trailer. By using the CPX procedures, tests can be done at highway speeds. To date they have measured over 320 pavement surfaces. They have found that HMA pavements with the smallest top-sized aggregates tend to produce the lowest noise level. Figure No. 2 shows the results for all pavement types in NCAT’s database.

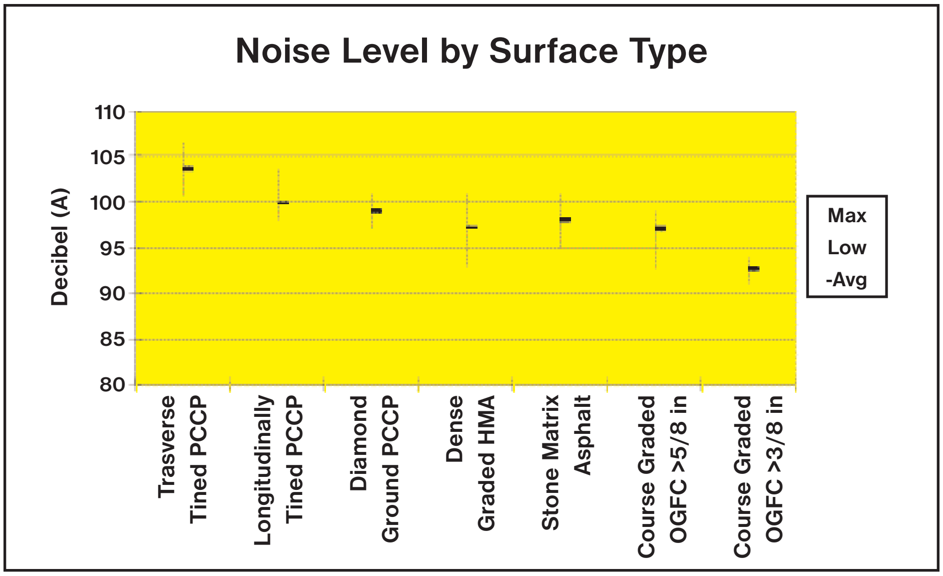

Figure 2

QuietPavement.com

To learn more about tire/pavement noise, log on to www.quietpavement.com, a new website sponsored by the Asphalt Pavement Alliance. The site has links to information about the history of road noise, case studies, and a tool that lets you compare the decibel levels of common neighborhood noises such as people carrying on a conversation, a dog barking, a blender and a jackhammer. One of the links is to streaming video files taken by NCAT’s CPX trailer while doing actual noise measurements on Phoenix freeways. The file shows the dramatic difference between the original PCC pavement and the new OGFC surfaces. Also on the site is an interactive section where you can build your own community and test the noise readings produced by selecting different pavement types.

For more about quiet pavement technology, visit quietpavement.com.

RAP can be introduced into the mix via an integrated, in-line feeding system.

Recycling Benefits for HMA Producers

Today's hot mix asphalt (HMA) producers are constantly trying different methods to improve asphalt quality and increase profits while satisfying state specifications. One means of accomplishing this goal is by incorporating reclaimed asphalt pavement (RAP) into the asphalt mix.

RAP is typically produced by milling an existing asphalt pavement or by crushing chunks of an old pavement that has been removed. Through the years, completed projects containing RAP have been cost effective and long lasting. As a result, most agencies now allow RAP in their highway mixes.

Contractor Perspective

HMA producers can use RAP with relatively inexpensive additions to their mixing plants. For Doug Fog, Plant Operations Manager for Brooks Construction, recycling is a critical component of his operation. "Recycling is extremely important to us. We view it as a tremendous commodity for Brooks. We have eight plants and we use RAP at six of them. So it is a big part of what we are doing," stated Fog.

Like many contractors, Brooks Construction relies on the use of RAP to gain more access to state highway job opportunities. "Our state allows recycling on many of the larger highway jobs and if you want to get those, you better run RAP," said Fog. The key to using RAP successfully, according to Fog, is to be smart about it.

In order to maximize the efficient use of RAP, Brook Construction manages the reclaimed materials. "We separate our RAP stockpiles so that they are ready to use in specific mixes. We have stockpiles of surface, intermediate and base grades and we try to use them properly. For example, the surface grade has a high AC content. And the RAP has the same top size as the mix's virgin aggregate, which makes it very easy to use," stated Fog.

Methods of Recycling

The most common method of recycling is through heat transfer. RAP is added to superheated aggregates, typically 450-plus °F—depending on atmospheric pressure, moisture content, ambient temperature and type of aggregate. This heat transfer process can be accomplished in either a batch or drum mixing plant.

There are several methods of batch plant recycling. The most commonly used method is to introduce RAP from a separate bin and feed it into a pug mill or weigh hopper via belt conveyor and chute. Up to 40 percent RAP can be recycled using this method. The factors that can affect the production rate include altitude, virgin aggregate type, ambient temperature and dryer efficiencies.

Another, less commonly used, RAP-entry method is through the bucket elevator. When using this method, some contractors remove the screens from the batch tower and feed RAP up the elevator. This method can be successful provided some additional proportioning control is in place. This method enables the contractor to operate his batch plant somewhat like a drum mix plant.

A batch plant modification may be necessary to deal with steam that is generated when the virgin aggregate comes into contact with cold, wet RAP—culminating in a steam explosion. The contractor may have to add exhaust duct work to vent the steam back to the dryer's exhaust stream and pollution control equipment.

Drum Mix Recycling

Like batch plant recycling, there are various methods used for adding RAP in a continuous mix, or drum, plant. The most common method is the center-entry method. RAP is introduced to the drum downstream and away from the burner flame, and is protected by a dense veil of virgin aggregate that provides a shield from direct exposure to the burner flame. Asphalt is then blended into the final mix by the mixing drum's flighting systems and steel dams. If properly accomplished, this method can accommodate up to 50 percent RAP.

Other methods of recycling with a drum plant include the use of a secondary drum or by using a pugmill. Some contractors have elected to use a plant having a secondary mixing drum after the virgin aggregate has been heated in a separate dryer. The dried aggregate is discharged from the dryer to a blending drum where the RAP, asphalt binder and fillers are all blended together before discharge into a silo system.

A pugmill can be used in much the same way as a blending drum. Virgin aggregate, RAP and filler are mixed together away from exposure to the burner flame thus eliminating the problems that exist in some continuous mix plants.

A secondary mixing drum that is used to blend the RAP and virgin components is shown on the left. The primary dryer is on the right.

Multiple Benefits

In addition to the obvious benefits of reducing production costs and providing an HMA mix that is equal to or better than a virgin mix, recycling asphalt pavements have the added environmental benefits of:

- Reusing valuable, and perhaps scarce, aggregates;
- Reducing the amount of virgin asphalt binder needed; and
- Conserving valuable landfill space from unnecessary disposal of old asphalt.

Thus, using RAP provides multiple benefits—cost savings, conservation and long lasting pacvements.

Understanding the True Economics of Using Polymer Modified Asphalt through Life Cycle Cost Analysis

BY MARK BUNCHER AND CARLOS ROSENBERGER, ASPHALT INSTITUTE

This is a follow-up to the related article published in the Spring 2005 edition of Asphalt magazine that discussed the new Asphalt Institute (AI) study titled Quantifying the Effects of PMA for Reducing Pavement Distress. The results were published in AI Engineering Report (ER) 215 and summarized in AI Informational Series (IS) 215.

This study analyzed an extensive collection of field performance data, making direct comparisons between polymer modified asphalt (PMA) mixes and unmodified conventional mixes. The data included 84 pairs of PMA and unmodified companion test sections from the FHWA Long Term Pavement Performance (LTPP) program and other governmental agency test sections located across the United States and Canada.

While comparisons are insightful regarding relative pavement performance differences between PMA and conventional mixes under similar conditions, they do not directly answer the question of how much longer a pavement should be expected to last with PMA. To quantify the expected improvement in pavement life based on the field data, the study used mechanistic-empirical prediction models for rutting and load-related fatigue cracking. Projected service-life increases were then reported based on specific site conditions of the foundation, existing pavement and drainage as well as traffic and climate. A final part of the study showed how a typical maintenance and rehabilitation schedule for unmodified HMA pavements could be extended with the use of PMA just in the wearing surface, as well as in both the wearing surface and base layers.

The purpose of life cycle cost analysis (LCCA) is to evaluate the overall long-term economic efficiency between competing alternative investment options.

Typically in LCCA, costs of all activities over the analysis period are computed back to a net present worth (NPW), accounting for the discount rate over time. **This article uses LCCA to compare the activity timelines of alternative PMA strategies provided in the referenced report.**

Assumptions made in this analysis are based on constructing a 14.5-inch thick HMA pavement, maintenance activities based on Pennsylvania DOT policy, an analysis period of 40 years and a discount rate of 4 percent. Prices and quantities assumed are shown below.

MIX PRICES *(from Maryland DOT's Pavement Selection Process)*	
Wearing (PG 64-22)	$36/ton or $1.97/sy-in
Wearing (PG76-22)	$41/ton or $2.24/sy-in
Binder and Base (PG 64-22)	$35/ton or $1.91/sy-in
Binder and Base (PG 76-22)	$40/ton or $2.19/sy-in
Milling	$1.40/sy
HMA Patching	$36/sy
Quantities (per mile)	
Mainline: 2-lanes @12 ft. ea.	14,080sy
Shoulders: 1 @ 10 ft. and 1 @ 4 ft.	8,212sy

ASSUMED PRICES AND QUANTITIES

The three example scenarios shown in the referenced report are:

1) Using conventional unmodified mixes for all layers
2) Using PMA for the top 2-inch wearing surface only
3) Using PMA for both the wearing surface and bottom 4-inch base layer (consistent with a Perpetual Pavement).

The schedule of maintenance and rehabilitation activities associated with each of these alternatives was shown in Figure 1 of the related article in the last edition of *Asphalt*.

The initial cost and NPW (back to Year 0) of each activity during the 40-year analysis period for Scenarios 1, 2 and 3 are shown in the three tables to the right. Costs are based on the per-mile quantities provided in the earlier table. With Scenario 1, resurfacing is scheduled for years 10 and 28 and structural overlays for years 18 and 34. By using PMA in the wearing course (Scenario 2), the resurfacings at years 10 and 28 are eliminated. By building a Perpetual Pavement and using PMA in the wearing and base courses (Scenario 3), the structural overlays at years 18 and 34 are replaced with resurfacings. The total NPW, or life cycle cost, is tabulated for each scenario.

The table on the next page summarizes and compares the initial and life cycle costs for each of the three scenarios. Scenarios 4 and 5 were added to take a more conservative approach, where the 2.5-inch binder course was also modified just below the modified 2-inch wearing course to achieve the same extended performance in Scenarios 2 and 3 respectively. While PMA increased initial construction cost by 1 percent per inch of PMA used, the overall life cycle cost savings over 40 years was substantial. Even with

YEAR	ACTIVITY	COST, $	NPW, $
0	HMA Construction 10" Base 2.5" Binder 2" Wearing	668K	668K
10	Resurfacing 2" Mill/Fill 1% Patching	87K	58K
18	(not on shoulders) Structural Overlay 2" Mill 3% Patching and Scratch 2.5" Binder 2" Wearing (including shoulders)	285K	141K
28	Same as Year 10	87K	29K
34	Same as Year 18	285K	75K
	Annual Maintenance ($1.8K/yr)	73K	33K
	(costs are per mile) **Total NPW: $1,005K**		

SCENARIO 1: USING UNMODIFIED HMA FOR ALL LAYERS

YEAR	ACTIVITY	COST, $	NPW, $
0	HMA Construction 10" Base 2.5" Binder 2" Wearing	682K	682K
18	Resurfacing 2" Mill 3% Patching and Scratch 2.5" Binder 2" Wearing (including shoulders)	298K	147K
34	Same as Year 18	298K	79K
	Annual Maintenance ($1.8K/yr)	73K	33K
	(costs are per mile) **Total NPW: $941K**		

SCENARIO 2: USING PMA FOR WEARING COURSE (TOP 2")

YEAR	ACTIVITY	COST, $	NPW, $
0	HMA Construction 10" Base 2.5" Binder 2" Wearing	709K	709K
18	Resurfacing 2" Mill/Fill (including shoulders)	141K	70K
34	Same as Year 18	141K	37K
	Annual Maintenance ($1.8K/yr)	73K	33K
	(costs are per mile) **Total NPW: $849K**		

SCENARIO 3: PERPETUAL PAVEMENT: PMA FOR WEARING (TOP 2") AND BASE (BOTTOM 4") COURSE

Scenario	Initial Cost, $	Initial Cost Increase, %	LCC	LCC Savings, %
1) All layers unmodified	669K	—	1,005K	—
2) PMA for Wearing (2”) Course	682K	2.0%	941K	6.5%
3) Perpetual Pavement: PMA for Wearing (2”) and Base (4”) Courses	709K	6.0%	849K	15.5%
4) More Conservative Approach: PMA for Wearing (2”), Binder (2.5”) and Base (4”) Courses with same schedule as Scenario 2	698K	4.5%	964K	4.5%
5) More Conservative Approach: PMA for Wearing (2”), Binder (2.5”) and Base (4”) Courses with same schedule as Scenario 3	725K	8.5%	864K	14.0%

SUMMARY OF COSTS

the more conservative Scenarios 4 and 5 where more PMA was used, the life cycle cost savings were 4.5 percent and 14 percent respectively.

It should be noted that this analysis does not consider user delay costs, which would be reduced with the longer service lives of PMA mixes. Considering user delay costs makes the use of PMA even more attractive.

It is important to emphasize that these are examples illustrating the framework for an analysis to quantify the long-term economic benefits of using PMA, or any other premium mix for that matter. Each agency should use their unique set of estimated LCCA inputs such as performance periods, prices, designs, strategies, discount rates and user cost considerations.

When performing LCCA, agencies should consider the extended performance lives that are typically achieved from using PMA or any premium mix. When comparing asphalt and concrete pavement alternatives, this applies as well. Too often, the performance periods assumed for initial asphalt construction and overlays do not consider the improvements realized for using premium materials and mixes.

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Evaluating Laboratory Fatigue Performance of Asphalt Mixtures

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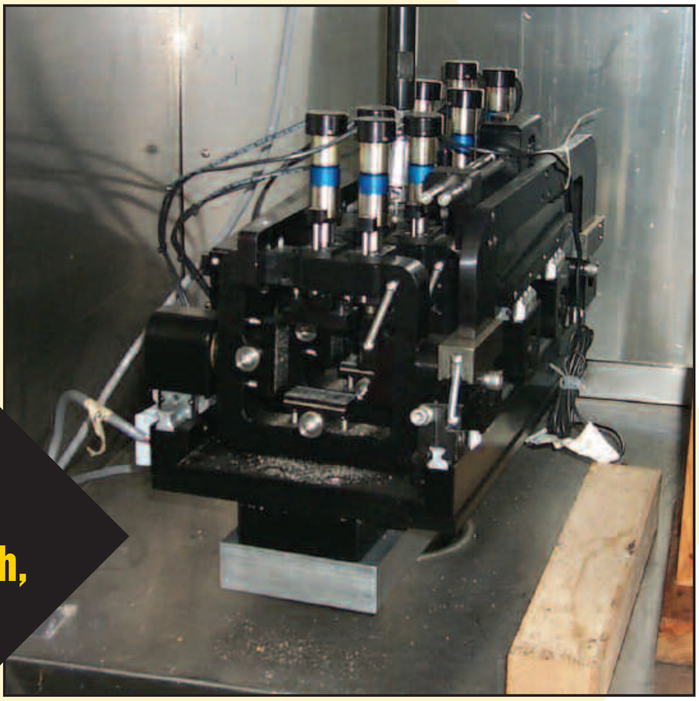

Figure 1: Flexural Beam Fatigue Fixture

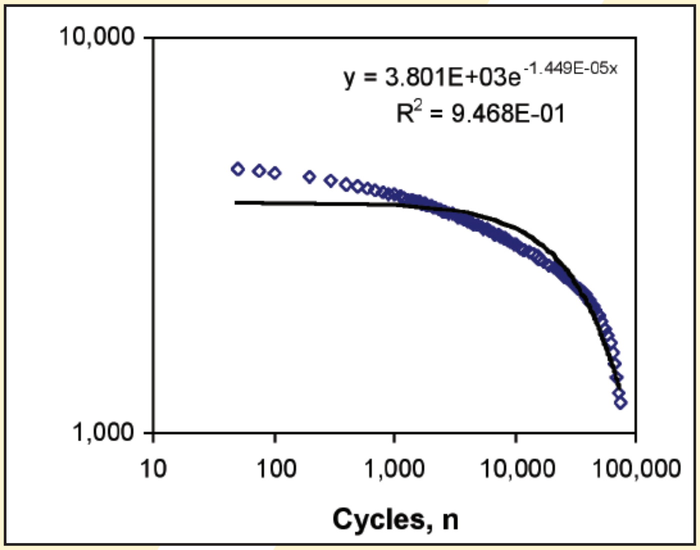

Figure 2: Typical Beam Fatigue Data – Single Test Condition

Fatigue cracking was one of the three principal distresses identified by the Strategic Highway Research Program (SHRP) that is experienced by asphalt mixtures in service. As part of the accelerated performance testing program of SHRP, researchers at the University of California at Berkeley refined laboratory fatigue testing and analysis procedures using the four-point flexural beam fatigue fixture (Figure 1). In the test, an asphalt mixture beam specimen (2" x 2.5" x 15") is produced and tested at a specified strain level and temperature (usually 20°C) by repeatedly loading the specimen in the center of the beam. As the specimen fatigues, microcracks are formed and the stiffness of the asphalt mix specimen decreases. As the microcracks increase, the specimen stiffness decreases rapidly (Figure 2).

Flexural beam fatigue data is analyzed principally by plotting mix stiffness as a function of loading cycles. The number of cycles to failure, N_f, is defined as the loading cycle when the mixture stiffness drops to 50 percent of the original stiffness. SHRP research indicated that the cycles to failure in the flexural beam fatigue test could be related to the actual number of loading cycles required to cause fatigue cracking of asphalt pavements. In the laboratory, the fatigue test is often used to compare the expected fatigue performance of different asphalt mixtures using different aggregates, asphalt binders, and modifiers.

For more information or to get a quote on performing flexural beam fatigue testing and analysis, please contact either Mike Anderson (manderson@asphaltinstitute.org) or Gary Irvine (girvine@asphaltinstitute.org).

FOR LAB SERVICES CONTACT MIKE ANDERSON AT MANDERSON@ASPHALTINSTITUTE.ORG

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- Penetration Grade Verification (AASHTO M20)
- Emulsified Asphalt Analysis (AASHTO M140)
- Cutback Asphalt Analysis (AASHTO M81/82)

Finding the Open Road: Take a Roadtrip for Life

by Brian Clark

"What should I do with my life?"

That's the question Mike Marriner, Brian McAllister and Nathan Gebhard asked themselves four years ago after graduating from college in Southern California. Three months and 17,000 miles later they found an answer and a mission by "road-tripping" in a shaky neon green RV to meet and interview the chairman of Starbucks, a lobsterman from Maine, the first female Supreme Court Justice, the director of Saturday Night Live, and over 75 other successful leaders and career professionals.

Hitting the Road

They booked the interviews with no connections. Rather, they used an old school tactic known as the "cold call" with the aid of 411 directory assistance. The three also filmed each interview on the trip—which they dubbed "Roadtrip Nation"—with one purpose in mind: "To collect their stories and learn how they got to where they are today," says Mike Marriner. "The people we interviewed didn't have it figured out in their early 20s, but we wanted to know how they made their decisions. What was their compass at critical points in their lives? How did they define their own roads in life?"

> "When you get that perfect, smooth beautiful road, the experience is unbelievable."

What the three learned changed their perspectives completely. "We were really impacted by Manny the lobsterman in Maine and Howard Schultz, the founder of Starbucks," says Marriner. "When you sit down and talk with these men, you learn that they each followed the same relative philosophy. For Manny, it was life on the sea. For Howard, it was coffee. But each knew what he liked and was passionate about it."

Telling the Story

The fledgling filmmakers soon found an audience as the first Roadtrip Nation documentary aired on PBS affiliates across the country in 2003 and was later published as a best-selling book. This summer a 12-part PBS series will feature three other simultaneous roadtrips of college students as they traveled across the nation during the summer of 2004.

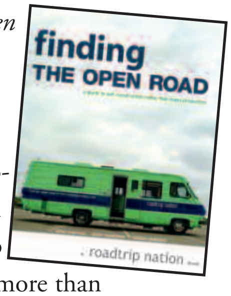
Life on the Road

So what do the founders of Roadtrip Nation think about asphalt pavements? "When you get that perfect, smooth beautiful road, the experience is unbelievable. And our mood in the vehicle is really affected by the quality of the trip," says Marriner. "Asphalt definitely contributed to the overall experience and I think the road construction industry is doing important work."

Through their camera lens, Roadtrip Nation documented a variety of people and places represented throughout the United States, but one thing remained constant: the road. "The open road is really a symbol for life. A big part of life is to go out there and explore all the different roads you can," says Marriner. "By physically getting on the road, you gain a new understanding of life. And the road is a very valuable tool that most people don't recognize. Believe me, a good road is the best, especially when you are in a shaky RV!"

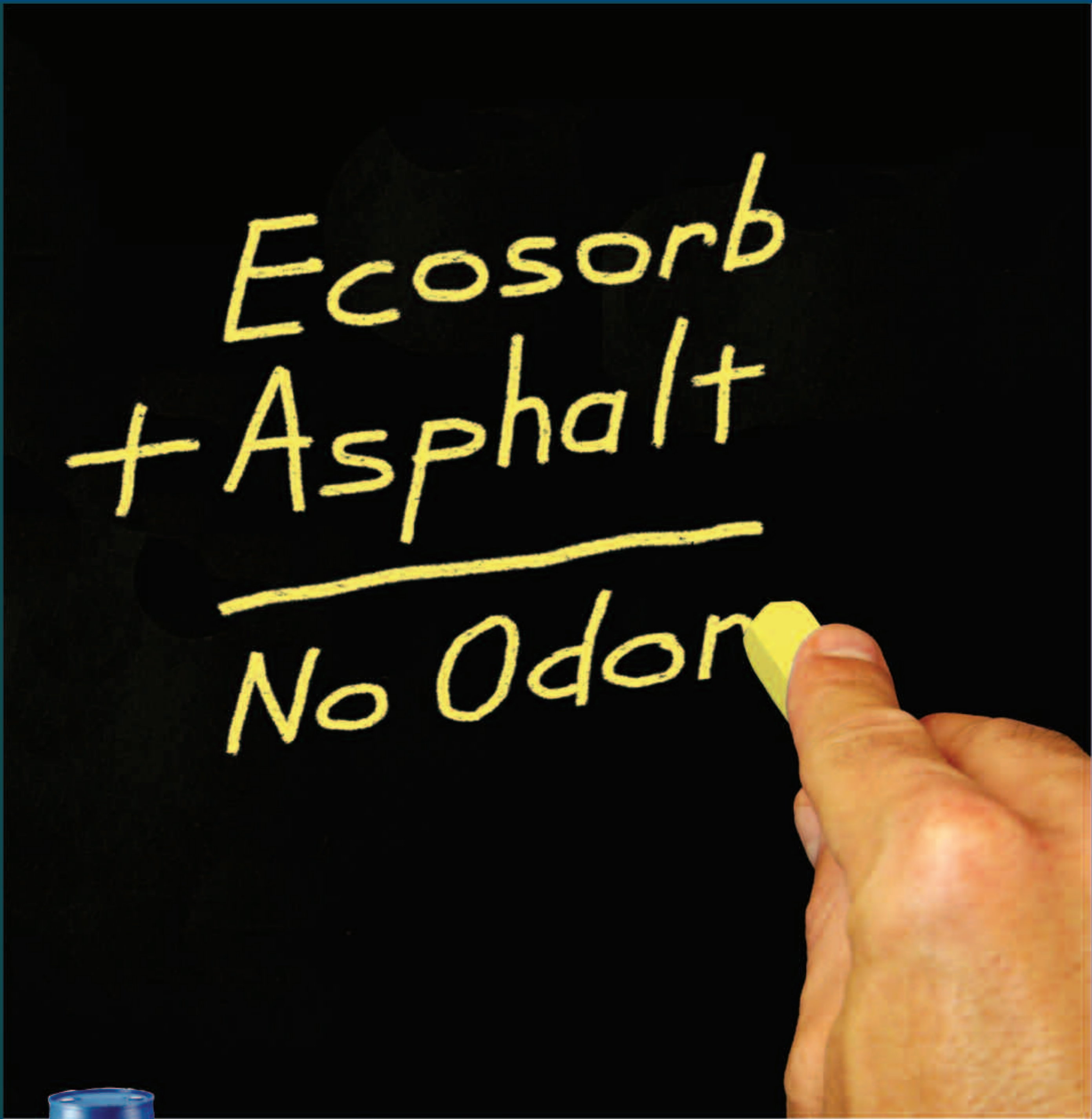
Finding your own Road

Roadtrip Nation has released its third book, *Finding the Open Road: A Guide to Self-Construction Rather than Mass Production*, which shares the history of Roadtrip Nation and a how-to-roadtrip guide, in addition to more than fifty interviews from recent trips. "The book features a step-by-step plan for determining your own route, which is important because you should never stop exploring," says Marriner. "Road trips are not just for college students. We know a policeman in New York who, every summer, plans a weeklong road trip for the entire family.



"Roadtripping helps keep you from focusing only on the day-to-day routine. The point is to keep widening the lens to explore and discover new things about life," adds Marriner. "Get out of your comfort zone. Meet new people. Then define your own road and be passionate about it."

For more information, visit the Roadtrip Nation website at www.roadtripnation.com.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