South Central Superpave Center Moves to Texas A&M

The South Central Superpave Center has moved from the University of Texas at Austin to Texas A&M University in College Station. This move will allow the SCSC to work closely with the International Center for Aggregate Research (ICAR), which is also based at Texas A&M.

The SCSC works primarily with a six-state region including Arizona, New Mexico, Oklahoma, Arkansas, Louisiana and Texas. Their future activities may include Puerto Rico and other national and international contacts.

The center is now working with the states in its region to formalize plans and funding for the continued activities of the center. Current plans call for the SCSC to be heavily involved in communication, training and certification, troubleshooting and forensic investigations, research and development, ruggedness and precision and bias testing, and serving as a third party laboratory.

Joe Button is in charge of the relocated center. He can be reached at 409/845-9965 or at J-BUTTON@TAMU.EDU.

Independent Team Issues WesTrack Findings

Premature rutting of some of the Superpave-designed mixtures at WesTrack caught many people by surprise. The mixtures did not perform in the field as expected. Suddenly, WesTrack, which had been designed to investigate performance-related specifications for hot mix asphalt, became a test of Superpave. The findings of an independent review team appointed to study the performance have recently been published by FHWA.

Because this facility outside of Reno, NV, was intended to study the effects of construction variability on HMA performance, only a few of its 26 original test sections actually met the targets of the mix designs. One mix design passed above the restricted zone (fine) and the other below (coarse). In addition, some of the fine mixes had an extra 2% baghouse fines (fine plus). Three different binder contents (optimum, optimum + 0.7% and optimum − 0.7%) and three air void contents (4, 8 and 12%) were used for each gradation. (Not all possible combinations were placed, such as high asphalt content and high voids.) The original 26 test sections were constructed in 1995.

Some of these mixes were expected to fail, either in fatigue or by rutting. What surprised many people was that the coarse mixes, which were expected to perform better in general, tended to show the most severe distress. Some sections showed both rutting and fatigue, although conventional wisdom would expect one or the other, not both on the same section. The progression of the fatigue cracking was also unusual, beginning with transverse cracks followed by longitudinal. Typically the longitudinal cracks develop first.

Eight sections were replaced in May and June of 1997 using a new mix design with a more angular coarse aggregate. Two other sections used conventional Nevada DOT mixes. Many of these replacement sections began to rut after only a few days of loading.

The independent review team studied reams of laboratory binder and mix testing data in developing its assessment of the factors contributing to the failures at WesTrack. Many of their recommendations have already been incorporated in applicable AASHTO standards while others are still under review. A brief summary of the major conclusions follows. For a copy of the full report, contact FHWA or visit their website at www.fhwa.dot.gov.

A high binder content was cited as the primary cause of the distress observed at WesTrack. The designed mixes also had high VMA values, which allowed a high binder content mix to still meet the voids filled requirement. The team recommends that VMA be limited to no more than 2% above the minimum specified value. The low binder content, high dust-to-binder ratio and relatively low VMA mix placed at the entrance to the curves exhibited the least amount of rutting. For coarse mixes, the forensics team recommends the dust-to-binder ratio be increased to 0.8 to 1.6; this change has been adopted as an optional note in AASHTO MP2, Standard Specification for Superpave Volumetric Mix Design. The team also identified low in-place density (high air voids) as a contributing factor.

The team expressed the need for a strength test of some type to supplement volumetric mix design for high-volume roadways. The four laboratory rut testers and the Repeated Shear at Constant Height (RSCH) test in the Superpave Shear Tester (SST) were found to correlate fairly well to field performance. The team recommended that states make use of their existing experience with these kinds of devices until a performance test is adopted.

Continued page 4
A minority opinion supported by some of the team members makes a case for why the mix placed at the entrance to the curves performed better than similar mix in the tangent test sections. Their theory is that structural design played a role. The Westrack pavement is thinner than typical Interstate pavements—only 150 mm of hot mix over 300 mm of aggregate base. The mix in the tangent sections was thinner than that in the entrance to the curves. Thinner pavements allow higher strains to build up in the pavement. These strains are concentrated in coarse mixtures at the points of contact between the aggregate particles. This theory may help explain why both rutting and fatigue cracking were observed in some of these sections.

The review team consisted of the following people: Ray Brown, NCAT; Larry Michael, Maryland DOT; Ev Dukat, Mathy Construction Co.; Jim Scherocman, Consulting Engineer; Gerry Huber, Heritage Research Group; and Ron Sines, New York State DOT. John D’Angelo and Chris Williams were FHWA liaison members.

A survey question pertaining to aggregate gradation asked if the plot of the aggregate size went above, below, or through the maximum density line. The intent was to determine the mix classification as fine or coarse without listing the individual aggregate sizes. Except for Colorado DOT, those mixes going through the maximum density line did not pass through the restricted zone. Since Colorado’s mix specification is based on volumetric analysis, aggregate properties, and the Lottman test, several of their mixes do pass through the restricted zone. However, Colorado does require that the mixes fall within the control points.

Regarding the request for unique features associated with the Superpave technology many of the states indicated that additional bins were required to obtain the required aggregate gradation. Also, several indicated that the “tender zone” was a problem during compaction but was overcome by waiting for the mix to cool and then compacting.

There is a need to continue this effort, including a similar inventory of subsequent projects as well as a follow-up study to track the in-depth details, performance and cost of those projects having unique characteristics. It is important that this process be continued within the RMAUPG region and considered for study on a national basis. Because trends and performance information are beginning to appear, it is important for the user producer group to begin making plans for follow-up surveys and analysis of the collected data and to begin scheduling distress surveys to evaluate performance of the field projects. It is particularly important to document the findings from the new and reconstruction projects in order to get a true representation of the Superpave technology.

The Rocky Mountain User/Producer Group Tracks Superpave Projects

Denis E. Donnelly
Durango Construction

In the research phase of the Strategic Highway Research Program, the design and performance of Superpave projects were tracked within the Long Term Performance Program and then by the Federal Highway Administration. Now that the state highway agencies are implementing the Superpave technology as part of their asphalt pavement construction program, there is a need to track these projects and follow up on their performance. This need is especially evident when modifications to the Superpave concepts are being made on project by project basis. These modifications often result in poor performance with the Superpave technology being blamed rather than the application of that technology.

The Rocky Mountain Asphalt User/Producer group (RMAUPG) is in the third year of monitoring the design, construction, and performance of Superpave projects. The intent of the RMAUPG activity is to track the properties of the asphalt binder and mixture being placed by the member states using Superpave technology. The overall goal is to document the performance of the new design procedures in order to determine how well they are working. The primary focus is on those asphalt paving projects using the binder test procedures. Superpave mixture design properties are also included in the inventory. A relatively simple data format was developed which could be completed with information readily available. States were requested to complete this information on all projects completed on an annual basis. The data was then compiled into a database and analyzed for variability.

The process is designed to be performed at a relatively low cost while providing background information and justification for a larger follow-up study, if needed. In addition, general trends could be developed and provided to the user on a short-term basis. Those projects having unique characteristics or those with unique performance trends would then be selected for follow-up analysis activity at a later date.

Each of the nine member state highway agencies in the Rocky Mountain Asphalt User/Producer Group were requested to submit information on Superpave projects constructed in their states. This information pertained to the project identification, design parameters, material properties, construction factors, and performance indicators, if available. The survey asked for unique construction problems associated with the Superpave technology. States were asked to indicate if such changes as additional aggregate bins were used, if the “tender zone” was a concern during compaction, the need for changes in mix temperature, and other construction associated issues. The states were also asked to only include information from projects with more than 10,000 tons of Superpave material placed.

A total of 88 projects was submitted for the 1998 database as compared to 63 projects submitted from the 1997 construction season. Colorado continued to lead the way with 40 projects, followed by Utah and Arizona with 16 and 13 projects respectively.

The 1998 survey asked for the type of construction project - overlay, reconstruction, or new construction project. Overall, 11 of the 88 projects submitted were new or reconstruction projects. Thus, the majority were overlays of existing projects with most including a mill and fill process.
Newly Formed Committees Oversee Superpave

Following the slashing of FHWA funding under TEA-21, the states, operating jointly through AASHTO, stepped in to continue the important work of moving Superpave into routine practice. Work to further refine and develop Superpave is ongoing in many areas, as summarized in the article by Tom Harman on page 8. Three committees are overseeing much of this work.

The three committees formed under the Transportation Research Board (TRB) replace the former Asphalt Technical Working Group (TWG) and the Binder and Mixture Expert Task Groups (ETGs). TRB has assumed the management functions formerly performed by FHWA and the new committees operate under TRB guidelines. The three new committees are the TRB Superpave Committee, the ETG for Superpave Asphalt Binder Technology and the ETG for Superpave Mixtures and Aggregates. Each committee is composed of representatives of the states, industry and academia plus liaisons from FHWA, AASHTO and industry groups like NAPA, the Asphalt Institute and the National Stone Association.

The TRB Superpave Committee is in charge of overall program guidance. They review the work to be done through AASHTO and FHWA in support of Superpave implementation and research. This committee looks at funding needed to complete the needed research and implementation tasks and keeps the overall program on track.

The two ETGs are essentially subcommittees of the Superpave Committee. The Binder ETG reviews all issues related to implementation of the Superpave binder specifications and tests. The Mix and Aggregates ETG advises the TRB Superpave Committee on mix and aggregate issues. More details on some of the hot topics before these committees follows.

TRB Superpave Committee

The TRB Superpave Committee met for the third time in early November. Major items of discussion at this meeting included a review of the Superpave-related research in the FY 1999-2000 National Cooperative Highway Research Program (NCHRP), a look ahead at the FY 2001 research program and a discussion of the long-range plan for Superpave. The committee was also briefed on the outlook for funding in FY 2001, the activities of the Superpave Lead State Team, the accomplishments of the new expert task groups and the activities of the Superpave Centers.

Tom Harman summarizes much of the ongoing research in the article on page 8. Topics proposed to start in FY2001 include:

- Calibration and Validation of the Superpave Performance Model System
- Field Verification of Material Characterization Models and Tests
- Evaluation of SST/IDT testing
- An Improved Test Procedure for Determining Moisture Damage Susceptibility
- Commercialization of a Simple Performance Tester
- Courses on Mechanistic Design and Updates on Superpave

This is a proposed list only and has not been formally adopted by the committee, but it does give an indication of the anticipated activities.

The Superpave Committee is responsible for managing the overall research program for Superpave and making course corrections if necessary to assure the program is on target. One issue they must deal with is where the funding for the various required work items can be obtained. This committee oversees the NCHRP funds allocated to Superpave and must determine if those funds are being used appropriately.

The committee is developing a long-range plan to identify the steps needed to make Superpave the norm. When does Superpave stop being a special program and simply become the routine asphalt program? While the plan is not yet final, some key goals have been established. Goal 1 is to complete the research refinements to allow selection of binder type and mixture proportions based on environmental conditions and pavement layer. Goal 2 involves completion of the models and tests to predict pavement performance. Goal 3 is to integrate the binder and mix requirements into a performance-based quality control program. Goal 4 is to ensure state and industry personnel understand the system (i.e. training). Current plans call for these goals to be met by 2005, which is an aggressive, but doable, timeframe. Additionally, an aplan will be developed for the field validation program.

Mixture and Aggregates ETG

The first meeting of the new Mixture and Aggregate ETG was held in late September. Tim Aschenbrener, of the Colorado DOT, did a survey of several states to identify areas of concern for the consideration of the committee. Specific concerns included construction issues like tenderness, segregation and permeability; the need for a strength test to be used in addition to volumetric controls; VMA criteria; the need for a reliable stripping test; guidelines for field verification of mixtures; further refinement and validation of N_design; aggregate consensus properties; and mixing and compaction temperatures. Some on-going research will address many of these concerns. An expanded survey will be used to guide future ETG priorities.

The ETG members also identified key issues of concern to the aggregate industry. These issues include specific test procedures, like the fine aggregate angularity test; the allowable criteria used for some parameters, including VMA and flat and elongated content; ruggedness of the consensus tests; the restricted zone; the use of fine-graded Superpave mixtures and test standardization.

Other issues currently under discussion and review by the ETG include:

- comparisons between SGCs and verifying compliance of individual SGCs with the specifications,
- optimizing the aggregate blend,
- mixing and compaction temperatures,
- N_design
- field aging of mixtures, and others

The next meeting of the Mixture and Aggregate ETG will be March 28-29, 2000, in Washington, DC.

Continued on page 9
Survey Says ... Mostly Minor Problems Encountered

Rebecca Mc Daniel
NCSC Technical Director

A recent survey conducted by the FHWA, Maryland Division, shows that, overall, problems encountered with Superpave construction have been relatively minor. Some problems have been noted with segregation, compaction and the tender zone, but in many states there are no more problems with Superpave than with other mixes.

The survey was sent to all FHWA Division Offices and 41 responses were received, including responses from 6 states that have not yet used Superpave. In most cases, responses were provided by the state agency, not FHWA.

Regarding segregation, 18 states reported seeing segregation on Superpave mixes and 17 reported no problems or minor problems (figure 1). Two of the states without problems use material transfer vehicles. Respondents commented that segregation seems to be related more to bad construction practices than to Superpave and that those contractors who had segregation problems before are having problems with Superpave. End of load segregation was the most common type observed, with 20 states reporting. Five states reported seeing centerline segregation and one each reported quarter point, transverse and longitudinal segregation. Seven states reported seeing less segregation with Superpave mixes than with conventional mixes, 20 see the same amount, three see somewhat more and one sees more (figure 2).

Ten states reported seeing the tender zone on Superpave mixes, 20 reported minimal problems and four reported no problems (figure 3). Problems were observed with mixes through and below the restricted zone. In most cases, the tender zone could be dealt with by properly identifying the tender zone and either staying off the mat in that temperature region or using wide track rubber-tired rollers.

The questionnaire also probed some possible causes of the tender zone. Six states noted tender zone problems with more than one type of binder and five reported seeing problems with a specific binder grade, but 15 states did not think the problem was related to specific binders. One state commented that tender zones may have always existed but are becoming more obvious with coarser mixes. There was no consensus on the question of whether tender zone problems are related to specific nominal maximum aggregate sizes. Nine states said it was not and 18 states said it had appeared with specific nominal sizes. Of those that thought it might be related, however, some reported that larger aggregate sizes gave the most problems and others had more trouble with smaller sizes.
A total of 18 states reported problems in obtaining the required density with Superpave mixes in 1999; 15 reported no density problems (figure 4). Lower roller speeds, lower amplitudes, changing the frequency, adding more rollers and gaining experience reportedly improved the situation. Nine states related having somewhat more trouble achieving density on Superpave projects than on non-Superpave projects and another nine reported having more problems, 15 reported having the same level of difficulty and one state reported less difficulty (figure 5). In at least one case, part of the problem was a change in the specifications to require percent within limits.

![Figure 4: Density Problems?](image)

![Figure 5: More Density Problems?](image)

Other problems relayed included five states with concerns about permeability and eight that expressed some difficulty with meeting volumetric requirements, especially VMA. Non-uniform PG70-22 binder posed a problem for one state and another had problems with a liquid modifier that coagulated. One state noted a major problem with getting correlation between different gyratory compactors. Another state expressed its distrust of the results of the T283 test for moisture susceptibility.

There were many comments expressed that the agencies were essentially seeing the same types of problems and behavior with Superpave mixtures as with their conventional mixtures, with no significant differences.

The new AASHTO Superpave™ software for the design and production of asphalt concrete mixes is being readied for a January 2000 distribution. The new software consists of five modules that share a common database and user interface:

- Volumetric Mix Design
- Field Quality Control (QC)
- Field Quality Acceptance (QA)
- Binder Performance Grade Verification
- Laboratory Test Data Entry

The AASHTO Superpave software is based on the version developed by the Superpave models contract team at the University of Maryland under contract to the Federal Highway Administration (FHWA). This version was delivered to the FHWA just as the AASHTO Subcommittee on Materials approved more than 50 changes to four Superpave mix design standards. These changes were fully implemented through a project sponsored by the National Cooperative Highway Research Program. The AASHTO Superpave software now conforms fully to the new PP28-99 and MP2-99 mix design standards. The software has been through several cycles of review and beta testing, including a pilot implementation by the Maryland State Highway Administration (see the November 1999 issue of the FHWA Focus newsletter for an article on training for MSHA asphalt contractors).

An AASHTO Task Force, chaired by Sam Miller of the Maryland State Highway Administration, has been established to oversee Superpave software licensing, support, maintenance, and enhancement services. These services will be provided by iENGINEERING Corporation as a contractor to AASHTO. The AASHTO Superpave software is expected to be ready for a January 2000 rollout. A user support center will be in place by the time the first software copy is licensed. Work has already begun on an e-business web site for software licensing, distribution, and on-going user support and maintenance through AASHTO.

Watch the AASHTOWare web site (http://www.aashtoware.org) for details regarding software availability and support. Alternatively, you can contact Kurt Johnson, the AASHTO Project Manager for the Superpave software, at kurtj@aashto.org.
Superpave - What's the Latest Scoop in Research

Thomas Harman (202/493-3072 or Tom.Harman@fhwa.dot.gov)
FHWA Asphalt Pavement Team Leader
Turner-Fairbank Highway Research Center

Editor's note: the following article is reprinted from the Pennsylvania Asphalt Paving Association (PAPA) Bulletin.

In 1992 the asphalt industry had its first glimpse of the new Superpave system. At that time, Superpave provided us with a framework asphalt binder specification, a volumetric mix design procedure using gyratory compaction, first generation performance models and DCS-based software. Most of the equipment needed was either prototype or research grade. And no AASHTO specifications were available. In 1992 only a few dozen engineers understood the new system and less than a handful of contractors had any experience with placing the new mixes.

Since 1992 our industry has been working hard through expert task groups, user-producer groups, national and local associations, and lead states. Today we have standard equipment and test specifications. Every State highway agency has the Superpave equipment. Over two thousand engineers and technicians have been trained. And over 1500 projects have been placed. So...

"Are we finished?"

"Not quite." We still have to address several user needs by continuing efforts in several research areas. State highway agencies and the asphalt industry (the Superpave users) are looking for Superpave to include a simple performance test in the near future, (i.e. a laboratory test(s) to assure that a volumetric mix design will perform in the field). Users are also looking for improved binder characterization, improved guidance for RAP usage, a better moisture sensitivity test, resolution of the construction tenderness issue, updated Superpave software and refined aggregate standards. On the research end, we are looking for continued development of performance models and the development of performance-related specifications (PRS) for construction.

The good news is efforts are underway to address this list of the most significant user needs currently on the Superpave horizon. What I would like to do is to share with you the status of some of key activities and whom you may want to contact for more information.

Before I get started, I need to make you aware of what happened to the Asphalt technical working group (TWG) and the various expert task groups (ETGs). The current highway bill entitled, Transportation Equity Act for the 21st Century, TEA-21, greatly reduced the flexibility of resources available for highway research and technology transfer. Subsequently, AASHTO, through the National Cooperative Highway Research Program (NCHRP), has stepped to the plate to help FHWA fund and manage critical Superpave activities. In addition, the Transportation Research Board (TRB) will be managing the ETGs and has created the TRB Superpave Committee to replace the TWG. So it's not business as usual, but we are getting the job done.

A simple performance test: As you know, Superpave mix design is volumetrically based. It does not include a "strength test" such as Marshall stability and flow or Hveem stabilometer. This is being addressed under a contract, originally started by FHWA, now under NCHRP. The project manager at NCHRP for this project is Dr. Matthew Witczak (408/965-2759 or Witczak@asu.edu). The principal investigator for the study is Dr. Matt Witczak (408/965-2759 or Witczak@asu.edu).

Improved binder characterization: The Superpave binder specification has been refined under the watchful eyes of the binder expert task group (ETG) chaired until recently by FHWA's John D'Angelo (202 366-0121 or John.DAngelo@fhwa.dot.gov). The binder ETG, now under TRB's direction, is currently refining the specification to include a refined version of the direct tension test (DTT) - for low-temperature characterization. The DTT will be used in combination with the bending beam rheometer to determine the low temperature grade of the asphalt binder. The combined tests will be primarily used only for modified binders. FHWA has just awarded a contract to Instron to supply the State highway agencies with the new DTT.

In addition, the binder ETG is looking closely at the findings of NCHRP 9-10, Superpave Protocols for Modified Asphalt Binders, being conducted by the University of Wisconsin's Dr. Hussain Bahia (608 265-4481). Hussain is developing new test protocols to increase our understanding of the performance of complex binders (modified asphalts).

Improved Guidelines for RAP usage: Guidelines for the use of RAP in Superpave were developed by the mixture ETG chaired until recently by FHWA's John Bukowski (202 366-1287 or John.Bukowski@fhwa.dot.gov) and myself. Building on this effort is NCHRP 9-12, Incorporation of Reclaimed Asphalt Pavement in the Superpave System, being conducted by the North Central Superpave Center (Purdue University) Rebecca McDaniel (765/463-2317, ext. 226, or rsmcdani@purdue.edu). Please see http://www2.nas.edu/trbcrp/ for the complete status of this project.

A better moisture sensitivity test: During the SHRP research program an effort was made to develop a better moisture sensitivity test. The result was the environmental conditioning system (ECS). However, subsequent research showed the ECS did not work as well as AASHTO T-283 (modified Lottman procedure). But, the modified Lottman procedure calls for 4 inch Marshall specimens, not 150 mm gyratory specimens. Enter NCHRP 9-13, Evaluation of Water Sensitivity Tests, being conducted by the University of Nevada Reno's Jon Epps. The goal of this study was to refine the modified Lottman procedure to effectively use gyratory specimens. Jon and his team have met the goal of the study and a draft final report has been completed. For complete status, check the web site.

Now refining the Lottman procedure to address bigger specimens does not necessarily give us a better moisture sensitivity test. The Lottman procedure has always worked okay, but we still need something better. In August of 1999 a panel convened to discuss moisture sensitivity and develop a problem statement for a new NCHRP project. In the interim, some agencies and researchers are augmenting their analysis to include testing of water saturated beams in torture tests, such as the Asphalt Pavement Analyzer (a.k.a. Georgia loaded wheel tester) and the Ham-
burg wheel tracker, and binder testing using the pull-off test (see Jack Youtcheff 202/493-3090 or Jack.Youtcheff@fhwa.dot.gov).

**Resolution of the construction tenderness issue:** During the placement of some Superpave mixes, contractors experienced tenderness during compaction. General guidelines for handling tender mixes are available through the National Asphalt Pavement Association (NAPA) (301 731-4748) in special report 180, Superpave Construction Guidelines. In addition, FHWA (John D’Angelo) has contracted with the National Center for Asphalt Technology (NCAT) to develop more specific guidelines on addressing the tenderness issue.

**Updated Superpave software:** During SHRP, the researchers set out to develop a computer-based system to allow everyone to do Superpave mix designs. That meant it had to work on all computers. At the time of SHRP, Bill Gates was only a millionaire and very few people had even heard of Windows. So the software was written in a DOS-based language. By the time the software was completed, it was obsolete. Since then we have been writing spreadsheets, using gyratory manufacturer’s software, or using the FHWA demonstration project 90’s database (see John D’Angelo).

Today something new is on the horizon. Developed as part of the FHWA models contract, a new, Windows-based software package has been developed. The principal investigator in this effort is the University of Maryland’s Dr. Charles Schwartz (301 405-1965). Superpave version 2.1 is a Microsoft Access-based program with separate modules for testing, mix design, binder classification, field quality control, and quality acceptance. In a workshop hosted by Maryland DOT’s Larry Michael on July 8, 1999, contractors were given a chance to review the final product. Overall, this is a very comprehensive package. It takes time to learn, but it provides an excellent platform to Superpave. The software was showcased at the annual AASHTO Subcommittee on Materials (SCM) meeting in August. This software will be sold as AASHTO-Ware.

**Refined aggregate standards:** The Superpave consensus property standards are being examined currently in studies being conducted by the International Center for Aggregate Research (ICAR at Texas A&M), University of Illinois and Purdue University. The mixture ETG will review the research findings and propose any future changes to the Superpave specification.

Continued development of performance models: One of the ultimate goals of asphalt research is to have a unified material and structural analysis system. To achieve this, there are many steps along the way. Currently NCHRP 9-19, the models contract, is developing material characterization procedures and a framework models system. A future NCHRP project will generate environmental effect models to be combined with the framework models system and this will be followed by another NCHRP project to calibrate and validate the refined models.

In parallel with this effort, the AASHTO structural design guide will be updated to incorporate the new mixture modeling concepts. It is anticipated all of this work will be completed over the next ten years.

**Development of performance-related specification (PRS):** FHWA’s first major step in the development of PRS was the construction and loading of a test track in Nevada, known as WesTrack. FHWA’s Dr. Terry Mitchell (202/493-3147 or Terry.Mitchell@fhwa.dot.gov) was the contract manager. As many of you are aware, some of the mixes at WesTrack rutted prematurely. FHWA pulled together an expert team to look into the failures at the track. The team include Ray Brown (NCAT), Larry Michael (MD DOT), Ron Sines (NY DOT), Gerry Huber (Heritage Research), Erv Dukatz (Mathy Construction) and Jim Scherocman (Consultant). The forensic team’s report has been published and is available through the FHWA’s Report Center at (301/577-0818, Report Number FHWA-RD-99-134 or at the TFHRC web page (www.tfhrc.gov). The WesTrack project is being completed as NCHRP 9-20, Performance-Related Specifications for Hot-Mix Asphalt Construction (WesTrack).

The prototype PRS and software will be validated and field tested on at least five projects around the United States beginning in 2000. This effort will be conducted under NCHRP 9-22, Beta Testing and Validation of Hot-Mix Asphalt Performance-Related Specifications.

Lastly, I would like to make you aware of a few other activities going on here at the FHWA Turner-Fairbank Highway Research Center (TFHRC). First we are completing an extensive study of the Superpave binder specification using the full-scale, accelerated load facility (ALF) machines at TFHRC. This project is being headed up by Kevin Stuart (telephone 202/493-3073 or e-mail at Kevin.Stuart@fhwa.dot.gov). The results of this study are helping us to better understand the complexity of modified binders and to assist other contracting efforts like the models contract. Right now we are developing the next ALF experiment entitled, “ALF 2000.” Kevin is again heading up the effort. This time our focus will be to look more into understanding and addressing the issue of fatigue cracking.

Well, I hope you found this article informative. If you have any questions or comments, please let me know.

Newly Formed Committees Oversee Superpave  
Continued from page 5

Binder Technology ETG

The Binder ETG met for the first time in October 1999. Major technical issues discussed included improving repeatability of DSR testing; the Direct Tension Tester (DTT) and ruggedness testing; recommendations based on NCHRP 9-10 including revisions to the rolling thin film oven test, the Laboratory Asphalt Stability Test (LAST) and the Particulate Additive Test (PAT); testing complex binders; the FHWA polymer asphalt program and technician training in the Northeast.

ETG members voted to recommend AASHTO adopt some suggested changes to AASHTO TP5, Standard Test Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR). These changes are intended to improve the repeatability of the test by facilitating proper trimming and loading of the sample and controlling the temperature.

Changes to AASHTO MP1, the Standard Specification for Performance Graded Asphalt Binder, will also be recommended to AASHTO. The ETG will recommend that the DTT be dropped from MP1 and that a new version of MP1A be developed to include the DTT and recent recommendations from low temperature research.
Mr. Oscar Rodriguez of Rodriguez Engineering Laboratories in Austin, Texas has proposed a very plausible explanation for the “tender zone” that is sometimes experienced with Superpave mixtures. During the first pass or two of the breakdown roller, Superpave mixtures rarely exhibit tenderness. However, during these first few passes of the roller, significant water, from the steel wheel roller, is applied to the surface of the asphalt mat. On the first pass, water flowing down the front of the lead steel wheel can readily flow deep into the uncompacted mat.

The relatively thick asphalt films in Superpave mixtures help entrap the water/steam. The volume of the water, of course, increases by a factor of 1728 when it changes from liquid water to steam. The vapor pressure of the resulting steam fluffs (increases the volume) and lubricates the hot mat, thus drastically reducing its shear strength and making it appear tender under the weight of subsequent rollers. After some period of time, much of the steam escapes through the pores in the mat, and the mat cools below the boiling point of water and the tenderness disappears.

Mr. Rodriguez pointed out that changing the grading to a finer mixture (thus with lower permeability) has relieved the tenderness problem. He also indicated that the tender zone has been experienced with other coarse-graded (but non-Superpave) asphalt mixtures in Texas and elsewhere. This could help explain the difficulty in duplicating tenderness in the laboratory. In fact, this theory may help explain many tenderness problems. Other factors known to contribute to tenderness would naturally exacerbate tenderness when steam is entrapped in the mat.

Studies at TTI have shown that as the grading of hot mix asphalt becomes coarser the void structure also becomes “coarser.” That is, a given volume percent of air voids in a coarse mixture will be made up of fewer, larger voids than the same volume percent of air voids in a fine mixture. This is true whether the aggregate top size increases or a higher percentage of coarse aggregate of the same size is used in the mix. An example of this phenomenon is easily demonstrated. Based on work with sand-asphalt used in East Texas several years ago, a well-designed, compacted fine-grained sand asphalt mixture may contain about 18% air voids and will be almost impermeable to water. A coarse-graded asphalt mixture containing 2-inch top size aggregate and compacted to 5% air voids, on the other hand, will be quite permeable to water. The trend with Superpave mixtures is to use slightly larger top size aggregate than previous conventional dense-graded mixtures. Further, they generally contain a significantly higher percentage of coarse aggregate. For this reason, Superpave pavements have experienced problems with water permeability.

Mr. Rodriguez has offered to support a research study at the South Central Superpave Center (SCSC) at the Texas Transportation Institute to investigate this theory. No experiment plan has been developed but it will likely involve field and laboratory testing. The simplest method to prove this theory would be to locate a Superpave mixture that is experiencing tenderness and then set aside a test section where the initial rolling would be conducted without the use of water. To prevent the mixture from sticking to the steel wheels, an asphalt release agent or a lubricant such as diesel should suffice for this simple experiment. If tenderness disappears when the water is no longer used and reappears when water is again applied with the breakdown rolling, this should serve to substantiate the theory.

The obvious cure for this problem is to perform breakdown compaction using something besides water to prevent sticking of the steel wheel to the mat. An economical method to prevent sticking without water needs to be developed.

For more information, contact Joe Button at the SCSC, Texas Transportation Institute, Texas A&M University, College Station, Texas (409/845-9965).

Any comments or responses to this theory? Address your comments to the editor, who will coordinate with Joe Button and publish a dialog in the next issue of the Superpave Center Newsletters.