

ASPHALT TECHNOLOGY NEWS

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FEDERAL AVIATION ADMINISTRATION UNDERTAKES MAJOR HMA RESEARCH FOR AIRFIELD PAVEMENTS

The Federal Aviation Administration (FAA) has undertaken a major hot mix asphalt (HMA) research program for airfield pavements. The Airfield Asphalt Pavement Technology Program (AAPTP) was established in fiscal year (FY) 2004 through a cooperative agreement between the FAA and Auburn University. The program will be funded by the FAA and will be administered by Auburn University.

A total of \$1.6 million was

provided to the AAPTP for FY 2004, which was used to manage the program and to sponsor a number of HMA related research projects. It is assumed that this same level of funding will be provided in future years to continue this program; however, funding has been approved at this point for FY 2004 and 2005 only.

The FAA provides annual funding for a large amount of HMA for construction and maintenance of airfield pavements. Approximately 90 percent of the nation's runways are paved with hot mix asphalt. Due to this high utilization of HMA in airfields, research is needed to ensure optimum results are obtained.

Many new developments in HMA, such as Superpave for highway pavement construction and maintenance, are being finalized and adopted to improve performance and reduce cost. These new developments need to be identified and adapted to airfield pavements. There is a desire to reduce overall costs and to produce longer lasting airfield pavements. The AAPTP has been geared to

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New developments in HMA for highways need to be adapted to airfield pavements.

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Federal Aviation Administration

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achieve this objective.

The APTP will be administered by Auburn University using a process that involves three levels of oversight. A Program Coordination Group (PCG), Multiple Project Technical Panels (PTP), and individual Research Providers (RP) make up the three levels. All include avenues to receive input from FAA and other aviation industry representatives.

The Program Coordination Group (PCG) is the upper level of management. The PCG is comprised of a number of individuals that have strong interests in airfield



HMA paving in echelon in Chicago's Orly Airport

asphalt pavements. The following are some of the responsibilities of the PCG.

- Identify airport pavement issues and problems that could be eligible for research using the APTP. The objective is to improve the design, construction, repair, and rehabilitation of HMA airfield pavement to aid in the development of safer, more cost effective and durable airfield pavements.
- Recommend priorities for the research projects to be undertaken to address the issues identified from the process mentioned above.
- Review findings of the research program and recommend avenues of further research when appropriate and/or technology transfer that accelerates the implementation of findings, new technology or procedures.

A Project Technical Panel (PTP) composed of up to five individuals will be appointed for each project. Panel members will be invited to participate based upon their demonstrated experience and technical expertise, and may include individuals from local, state, and federal government agencies, universities, the HMA industry, aviation industry and other groups with related interest. Members of the PTP, who are appointed for the duration of the individual projects, will provide technical guidance and counsel in execution of the project.

Individual Research Providers (RP) make up the third tier of oversight. The providers are the people that respond to the request for proposals (RFP) and successfully negotiate a contract award. The Research Providers can come from private sector research firms,

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universities, research foundations, government and industry laboratories, and consultants. The providers are expected to conduct the research in accordance with the research plan approved by the Project Technical Panel. The following seven potential research projects have been identified by the Program Coordination Group for possible funding with the FY 04 money:

1. PG Binder Grade Selection Procedures for Airfield Pavements

Superpave Performance Grade (PG) binder selection procedures are now well established for highway pavements based on climate, 20-year traffic in ESALS, and traffic speeds. There is a need to develop selection procedures suited for airfield pavements.

2. Design Compaction Levels for Superpave Gyrotory Compaction and Aggregate Gradation Requirements for Airfield Pavements.

Again, the design compaction levels (numbers of gyrations) and the aggregate gradation requirements are available in the Superpave mix design method for highway pavement. These need to be modified to suit airfield pavements.

3. Evaluation of Stone Matrix Asphalt for Airfield Pavements

Stone Matrix Asphalt (SMA) has been used successfully in Europe for many years and has been used successfully on highways in the US for almost 15 years. There has been some SMA used on airfields in Europe but to date there is very little or no use on airfields in the US. The SMA is a premium HMA product and its use should be allowed on airfields in the US. This project will develop guidelines (including specifications, design, and construction procedures) necessary for this premium product to be used on airfields.



Airfield pavements are highly stressed during landings



Airfield taxiways have unique loading conditions

4. Development of Guidelines for Rubblization

The FAA National Airport Pavement Test Facility will be conducting tests on rubblization of existing PCC pavements. This work is funded by the FAA. This proposed project No. 4 on rubblization, to be funded by the AAPTTP, will provide some technical analysis of the results and ultimately develop structural coefficients for rubblized PCC pavements. This project will also evaluate some of the rubblization/cracking and seating that has been done on airfields and evaluate the overall performance.

5. Longitudinal Joint Construction

Lack of good performance of longitudinal joints is one of the biggest problems on airfields. Some work has been done on longitudinal joints but more is needed. The primary objective of this project is to evaluate all information available about longitudinal joints and to condense it into a usable document. Recommendations will be made concerning specification changes.

6. Improved Open Graded Friction Course for Airfields

The FAA requires that all HMA runways be grooved or be covered with an open graded friction course (OGFC). A lot of work has been done in recent years to improve the performance of OGFC's for highway pavements. This project will evaluate this work for possible adoption for airfields.

7. National Certification Plan for Airport HMA Technicians

One of the biggest problems with the construction of HMA pavements is getting qualified technicians, inspectors, etc. to ensure that a good HMA is being constructed. The objective of this project is to evaluate the need for a national certification program and to develop a plan to implement that program.

Two of the above seven projects: (a) PG Binder Grade Selection Procedures for Airfield Pavements, and
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PUTTING RESEARCH INTO PRACTICE

The following papers were presented at the annual meeting of the Transportation Research Board (TRB) held in Washington, D.C. in January. These summaries are obtained from research projects with a limited scope. Before using this information in the field we recommend that you read the entire paper.

1. EVALUATION OF TWO COMPACTION LEVELS FOR DESIGNING STONE MATRIX ASPHALT (Xie, Watson, and Brown)

Stone Matrix Asphalt (SMA) mixtures have been commonly designed using the 50-blow Marshall method. This standard has been proven to be adequate by several projects in Europe and North America. Recent studies have shown more interest in using the Superpave Gyratory Compactor (SGC) instead of the Marshall compaction procedure. One of the most important reasons for using the SGC is that it better simulates the degradation and aggregate orientation found in field compaction.

Current SMA design guidelines list two compaction options to design SMA: 50 blow Marshall or 100 Gyration by SGC. The design guidelines also note that 75 gyrations should be used if the aggregate has a Los Angeles abrasion value higher than 30. States such as Georgia have found that 100 gyrations with the SGC are excessive for their materials and result in mixtures with lower than desired optimum asphalt contents. Georgia found that for their materials the optimum SGC compactive effort should be between 50 and 75 gyrations.

The objective of this study was to determine if SMA mixtures can be designed successfully using a lower compaction level compared to the standard 100 gyrations by SGC.

Five aggregates with a range of LA abrasion loss from 17 to 36 percent were selected for the study. Three nominal maximum aggregate size (NMAS) mixtures were selected: 19 mm, 12.5 mm and 9.5 mm. The asphalt used in this study was Superpave performance grade PG 76-22. Cellulose fiber at a rate of 0.3 percent by total mixture weight was used to eliminate the potential for asphalt binder draindown.

The standard 100-gyreration compaction level was first used to design SMA mixtures, and provide a reference for the lower compaction level. Based on the

information from 100 gyrations compaction, a lower compaction level, which could reach a “locking point” for all SMA mixtures, was selected. In this study, the “locking point” was defined as the first occurrence at which two successive gyrations resulted in no more than 0.1 mm difference in height. With two compaction levels, five aggregates, three NMAS, there were a total of 30 mix designs.

The Asphalt Pavement Analyzer (APA), which is a loaded wheel tester, was used to evaluate the rutting potential of SMA mixtures designed by the two compaction levels. Testing with the APA was conducted at 64°C. The air void content of test specimens was 6.0 plus or minus 0.5 percent. Hose pressure and wheel load were 690 kPa and 445 N (100 psi and 100 lb), respectively. Testing was carried out to 8,000 cycles and rut depths were measured continuously.

The following conclusions were drawn from this study:

- Based upon aggregate locking point, 65 gyrations appear to be an appropriate design level for all of the tested SMA mixtures.
- SMA mixtures designed by 65 gyrations had an average of 0.7 percent higher optimum asphalt content, and an average 1.5 percent higher VMA than those designed by 100 gyrations. All mixtures designed by 65 gradations met the minimum 6.0 percent asphalt content and minimum 17 percent VMA requirements for SMA mixtures. In comparison, nearly half of the mixtures designed by 100 gyrations failed to meet these two requirements.
- All SMA mixtures designed by 65 gyrations had achieved stone on stone contact as verified by volumetric tests.
- The additional 35 gyrations (from 65 gyrations to 100 gyrations) resulted in as high as 1.7 percent breakdown on the critical sieve.
- SMA mixtures designed by 65 gyrations had an average APA rut depth of 3.9 mm, and most of them (13 of 15 mixtures) had satisfactory rutting resistance (less than 5 mm APA rut depth).

From this study, 65 gyrations was shown to provide a design that produced a more durable SMA mixture, while still maintaining the good rutting resistance of an SMA mixture. The successful design by 65 gyrations for all five aggregates in this study indicates that a lower design compaction level may allow the use of more aggregate sources for SMA mixture.

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2. ASPHALT MIX DESIGN METHOD FOR PERMEABILITY (Maupin)

The new Superpave mix design system resulted in gradations that were coarser than those used previously, and although previous rutting problems were solved, permeability problems began to become apparent. Wet spots remained on some pavement surfaces several days after a rain. Therefore, there was concern that the durability of the new Superpave mixes would be affected by the porous characteristics. The Florida Department of Transportation was one of the first state agencies to recognize the problem and investigate the permeability characteristics of their Superpave mixes.

The National Center of Asphalt Technology began a series of studies dealing primarily with the field measurement of permeability. The Virginia Department of Transportation (VDOT) also began to investigate the permeability of their Superpave mixes by researching test methods and making measurements on field cores. Another point to consider when designing mixes is that the change of permeability with change of air voids should be low. If a small change in air voids produces a large change in permeability, it is likely that permeability will fluctuate excessively during production. Therefore, work concentrated on the testing of mixes in the laboratory using the falling head permeameter developed through the efforts of ASTM Subcommittee D04.23.

Because of inherent variability in the permeability test, multiple tests must be performed on a mixture to obtain a reasonable estimate of permeability. It was proposed that during mix design permeability tests be

performed on specimens prepared in the laboratory at several void contents and that a regression be developed so that the maximum allowable permeability could be checked at the minimum void content that is permitted in the pavement. For such a mix design process requirement to be viable, it should be repeatable between laboratories. Comparison testing between laboratories using the requirement described above has not been done. In the early stages of development, a comparison was made between two VDOT laboratories on a variety of Superpave mixes, and the results are presented in this paper.

The purpose of this investigation was to compare permeability results for selected Superpave mixes between two laboratories. Ten mixes (both 9.5 mm and 12.5 mm) collected from field projects were tested and compared, as were results of field cores for six of the projects.

The plan for the investigation was to collect samples of mixture from paving projects and develop air void permeability regressions from the laboratory testing. The semi-log regressions were then used to determine the permeability of each mixture at 7.5 percent air voids for each laboratory. The comparison of the estimated permeability for each laboratory indicates how well the results of different laboratories could be expected to agree if the test method was used for mix design approval.

Laboratory specimens were compacted by the Superpave gyratory compactor in each laboratory. The weight of mixture for each specimen was adjusted to

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NCAT's Asphalt Technology Course January 31-February 4, 2005



Back, L-R: Joe Moore, Ed Archuleta, Brian Myers, Brent Arabie, Frank Marbury, Brian Waller, Don Watson (Instructor), Jeff Murrell, Richard Reitenour
Front, L-R: Michael Jones, Mike Kappell, Jonathan Frost, Chris Hammond, Dean Sunas, Stephen Ashworth, Jamie Creech, Justin Vensel, Jason McDonald, Yuhong Wang



NCAT hosted the panel meeting of the NCHRP Project 01-40, "Independent Review of the Recommended Mechanistic-Empirical Design Guide and Software" in March

yield the desired void content in the compacted specimens. The target thickness of the laboratory specimens was 38 mm, which corresponded closely to the thickness of the pavement layer.

Several cores were also taken from the pavement where the placed mix was sampled, and the cores were tested for permeability. The aim was to see how core permeability compared to permeability measured on specimens made in the laboratory.

The following conclusions were drawn from this study and recommendations made:

- Examination of the regression plots showed good agreement between the two laboratories in most cases when the estimated permeability was compared at 7.5 percent air voids.
- Comparisons of field cores and laboratory regressions on six projects indicated that laboratory permeability estimated pavement permeability rather well.
- Because of the promise shown by experimentation with the permeability test, VDOT plans to implement use of a permeability test as part of the asphalt mix design procedure during the 2005 construction season to help ensure durability. The regression type method of analyzing the data described earlier can be used. Instruction in how to perform the test and analyze the data has already been provided, and a pilot study is in progress where mix designs are being checked on a selected basis statewide.

3. FIELD EVALUATION OF A POROUS FRICTION COURSE FOR NOISE CONTROL (McDaniel and Thornton)

Increasingly pavements are being designed to help control traffic noise. Noise is a growing concern in urban areas and in suburban and rural areas near housing developments.

To mitigate noise complaints, barrier walls are being erected, but they can cost over one million dollars per mile and have limited effectiveness. Experience and evidence is mounting that noise can be more cost effectively controlled by designing quieter pavement surfaces. European experience with porous asphalt pavements indicates that these pavement surfaces can reduce noise generation.

The main objective of this research project was to evaluate the performance of porous friction course (PFC) and stone matrix asphalt (SMA) surfaces compared to conventional HMA surfaces. Performance was assessed in terms of tire/pavement noise as well as other initial performance measures.

The performance evaluation included three field test sections in Indiana. The PFC and SMA sections were constructed on Interstate Highway 74 east of Indianapolis in August 2003. The third section consisted of a conventional HMA section located on US52 in West Lafayette that was paved in July 2003.

All three mixtures used steel slag aggregate from the same source, though in different proportions and combined with various other aggregates and additives.

Field testing was conducted on the three experimental sections (PFC, SMA and HMA) to evaluate noise, surface texture and surface friction. Differences in the amount of splash and spray between the PFC and SMA were observed, but not quantified.

Noise measurements were conducted in the field using the pass-by and close-proximity methods. The close-proximity method (CPX) uses microphones mounted near a vehicle tire to measure noise. The pass-by method measures the noise generated as vehicles travel past a stationary microphone near the side of the road. The same field sites were used for both measurements for comparison.

The surface textures of the three pavements were measured by NCAT using the Circular Texture Meter (CTM) as described in ASTM E 2157-01. The CTM uses a laser displacement sensor to measure the surface profile.

A Dynamic Friction Tester (DFT) was used to obtain direct measurements of the surface friction of all three surfaces in the field in accordance with ASTM E 1911-98.

The following conclusions were drawn from this field study:

- Both close-proximity and pass-by noise testing showed that the PFC produced the lowest measured tire/pavement noise levels, the conventional HMA produced the next lowest noise levels, and the SMA produced the highest noise levels.
- Close-proximity testing at two different speeds showed the HMA produced noise levels that were 3.5 dB higher than the PFC, and the SMA produced noise levels that were 4.7 dB higher than the PFC.
- Pass-by noise measurements at 80 kph (50 mph) showed that the HMA produced noise levels were 4.2 dB higher than the PFC, and the SMA produced noise levels were 5.9 dB higher than the PFC.
- Since the decibel scale is logarithmic, not linear, these differences in noise level are significant.
- Surface texture measurements confirmed that the PFC had a much higher surface texture than the

conventional HMA. The SMA also had a higher surface texture than the HMA, but not as high as the PFC.

- The PFC also provided higher friction than the HMA and SMA in terms of International Friction Index.
- Visual observations of splash and spray show that the PFC also significantly reduces water on the pavement surface, resulting in better visibility for drivers.

The long-term performance of the PFC section will be monitored to determine how long the improved performance will last.

4. REFINEMENT OF THE HOT MIX ASPHALT IGNITION METHOD FOR HIGH LOSS AGGREGATES (Hurley and Prowell)

The asphalt ignition test was developed at the National Center for Asphalt Technology (NCAT) for determining the asphalt content of HMA mixtures. Asphalt content is calculated as the ratio of the difference between the initial mass of the HMA and the mass of the residual aggregate (after ignition) to the initial mass of the sample expressed as a percentage. The ignition test provides a clean aggregate sample, which can be used for gradation analysis. The presence of dolomitic aggregates or high loss material in general, has been shown to result in higher measured asphalt contents due to excessive aggregate breakdown (loss) during the ignition test. The ignition furnace cannot distinguish between the binder being removed from the sample and the aggregate breakdown, thus resulting in asphalt content higher than the actual.

Several states have experienced the excessive aggregate breakdown when dealing with dolomitic or other high loss aggregates. Limited research has been conducted by these states to resolve this problem. The Illinois Department of Transportation identified a few carbonate sources in the northwestern part of the state for which a consistent correction factor could not be determined. The Iowa Department of Transportation experienced problems with dolomites from the upper Mississippi River Valley. The Ontario Ministry of Transportation has conducted significant investigations into aggregate breakdown in the ignition furnace, including the development of a modified test method.

The main objective of this study was to refine the current ignition method so that it can be used effectively for hot mix asphalt mixtures containing some dolomitic or high loss aggregates, which tend to lose mass excessively during the ignition test.

Six real life mix designs were used in this study. Four of the mix designs contained dolomitic aggregates, while

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RESEARCH IN PROGRESS

We have discontinued the publication of this column in this newsletter because it can now be accessed on NCAT's homepage (www.ncat.us). Click on "Information" at the top of the page, then "Research in Progress." It is updated frequently based on the information received from the Departments of Transportation and other sources.



Osamu Takahashi, a professor from Nagaoka University of Technology, Japan, is visiting NCAT from February 2005 till January 2006. His visit has been sponsored by the Japanese Ministry of Education. Prof. Takahashi will study the latest asphalt mix design procedures in the U.S.

the other two mix designs contained other high loss aggregates (a basalt aggregate and a serpentinite/chlorite aggregate). Three nominal maximum aggregate sizes, NMAS, (9.5, 12.5 and 19.0 mm) were used in this study. A single, unmodified PG 64-22 binder was used for all testing.

Alternative methods were evaluated and compared to the standard ignition method using a Barnstead International furnace. They included: the Troxler NTO Infrared oven, the Ontario Method, and the Tempyrox Pyro-Clean oven used for cleaning glassware and metals.

In a conventional ignition furnace, the furnace chamber is heated with a radiant heat source consisting of an electric heating element encased in a refractory ceramic material. The heating element heats the air in the furnace chamber, which in turn heats the sample. This is known as convection heating. The asphalt binder ignites when the sample reaches a temperature of approximately 480°C. In order to maintain ignition, a blower pulls air into the sample chamber.

The Troxler Model 4730 ignition furnace uses an infrared heating element to heat the sample. Unlike convection heating, where the air in the sample chamber must first be heated, infrared heating uses electromagnetic energy waves to excite the molecules in the sample thereby producing heat. However, the sample then heats the furnace chamber by conduction/convection.

The Ontario Method uses the standard ignition furnace. However, the end point is altered. AASHTO T308 (Method A) specifies the end point as the point when the sample mass does not change by more than

0.01 percent for three consecutive minutes. With high loss aggregates, the degradation of the aggregate can exceed this amount even after all of the binder is removed. The Ontario Ministry of Transportation Test Method LS-292 specifies that the sample has reached the end point when the sample mass changes less than 1 gram over three consecutive minutes. This converts to a percentage loss of 0.07 percent for a 1500-gram sample and 0.05 percent for a 2000-gram sample. The calibration samples are burned at 540, 480, and 450°C. The highest temperature, which results in a correction factor less than 1.0 percent is selected.

The Tempyrox Pyro-Clean system functions on the basis of *pyrolysis oxidation*. This process allows for the volatile organics to be removed from a material in an oxygen-deprived atmosphere to the point at which there is nothing remaining except carbon ash. Room air is then pumped into the cleaning chamber to release the carbon ash. What remains is free of any and all organics. Smoke and hydrocarbons produced during this procedure are destroyed inside a high temperature *oxidation chamber* located on top of the cleaning chamber.

The following conclusions were drawn from this study:

- The Tempyrox Pyro-Clean furnace, commonly used for cleaning laboratory glassware, produced the lowest aggregate correction factors.
- The standard ignition method and the Ontario method, both using the Thermolyne ignition furnace, produced the smallest bias or error in measured asphalt content.
- The standard deviation of the corrected asphalt contents for these high loss sources was higher than the within-lab standard deviation reported for AASHTO T308. The only exception was the Alabama source using the standard ignition method.
- The Ontario Method and Tempyrox Oven generally reduced the variability of asphalt content measurements for high loss aggregates.
- The Ontario method significantly reduced, but did not eliminate, aggregate breakdown on the 0.075 mm sieve.

The Ontario method appears to be the best method for immediate implementation for determining the asphalt content by the ignition method for high loss aggregates. A furnace using the Tempyrox technology but including an internal scale may be the best solution to problems with high loss aggregates. Such a device could virtually eliminate the need for a correction factor when testing most reclaimed asphalt pavement (RAP) materials.

ASPHALT FORUM

*NCAT invites your comments and questions. Questions and responses are published in each issue of **Asphalt Technology News**. Some are edited for consistency and space limitations.*

Connecticut (Keith Lane, Connecticut DOT)

What amount of diesel fuel (in gallons) are other states permitting to flush out filling lines on PG binder deliveries?

Is any agency using the latest AASHTO T-283 specification with hydrated lime to detect the use of acid modified PG binders? Is it successful?

Florida (Gregory Sholar, Florida DOT)

What is your opinion on FHWA Technical Advisory (TA) on PWL specification development? If you have a PWL specification, does your state conform to the TA? If you do not have a PWL specification, does

the TA provide the basis and encouragement to implement such a specification?

Kentucky (Allen Myers, Kentucky Transportation Cabinet)

What is the experience of other states with asphalt binders modified with elastomeric terpolymers? For those states satisfied with the performance of SBS-modified asphalt binders, what is your opinion of replacing the SBS modifier with an elastomeric terpolymer? How does the performance of HMA pavements containing these two types of modifier compare?

Mark Your Calendar Now!

The National Center for Asphalt Technology
invites you to attend and participate in

The NCAT Pavement Test Track Conference

November 15 & 16, 2005

at The Lodge at Grand National
just a few miles north of Auburn, Alabama

This two-day meeting will highlight the research findings from NCAT's 1.7-mile oval pavement test facility. Tour the track to see first hand how the research is conducted and how test sections have performed. Learn about the first structural experiment and how data is used to validate and calibrate mechanistic pavement models. See and hear the results of studies comparing the performance of different HMA mixtures developed by NCAT engineers. Discover how states are implementing results from the test track.

Visit the NCAT website www.ncat.us or call Carol Mims at 334.844.6228 for registration information.

PROFESSOR TRAINING COURSE IN ASPHALT TECHNOLOGY

NCAT has written and published an up-to-date college textbook on asphalt technology. NCAT has also developed a training program for college and university civil engineering faculty that will allow them to offer state-of-the-art undergraduate and elective courses in asphalt technology. This 8-day intensive course is conducted at NCAT in June every year. This year it will be held on June 14-23. The course has been updated to include Superpave binder and mix technology, and stone matrix asphalt (SMA). Some financial assistance attending this course is available. Please call NCAT at **334.844.NCAT** for a brochure or information or visit our web site at www.ncat.us.

NCAT HAS DOMAIN NAME

NCAT has a domain name, to make it easier to find our web page. The new address is **www.ncat.us**. You can also reach our web page by going to our old address, www.eng.auburn.edu/center/ncat/.

ASPHALT FORUM RESPONSES

The following responses have been received to questions raised in the Fall 2004 Asphalt Forum.

A number of asphalt suppliers in Florida have indicated concern that their competitors may be using acid or chemically modified binders. We are neither aware nor do we have any evidence that this is occurring. Our questions are: (a) what is the effect on performance of the binder and/or mix of acid or chemical modification of binders that meet all specification requirements? And (b) how would an agency specify and test the binder to make sure no acid or chemical modification has been made if indeed the current specification requirements are inadequate? **(Gale Page, Florida DOT)**

Connecticut (Keith Lane, Connecticut DOT)

We are aware that some binder suppliers utilize the acid modification process, but we have not yet identified any binder or mixture distress related to this process.

I understand the state highway agencies that are concerned with this issue are testing Superpave HMA mixtures at their facilities by using 1 percent of hydrated lime with AASHTO T-283 protocol to detect acid modification and its adverse reactions to the HMA mixture usually indicated by extremely low TSR values.

Kansas (Cliff Hobson, Kansas DOT)

The Kansas DOT has observed reduced effectiveness of amine based anti-stripping agents when acid is used to modify the binder. Also, the addition of an amine based anti-stripping agent has reduced the grade of PG binders that were acid modified.

Test the PG grade binder before and after the addition of an amine based anti-stripping agent to see if the anti-stripping agent reduces the binder grade. If the binder grade is reduced, the binder was acid modified. At the present time, performance graded asphalt binders used by the Kansas DOT must meet all the requirements of AASHTO M320 after the addition of 0.5 percent (by mass) high molecular weight, amine anti stripping agent. Polymer modified binders must also meet Separation (ASTM D5976) and Elastic Recovery (ASTM D6084) requirements.

Nebraska (Laird Weishahn, Nebraska DOT)

PG binder suppliers in Nebraska have also voiced their concerns on this subject. The biggest effect was noted when liquid anti stripping agents were required to meet TSR specifications. Simple chemistry says that if you add a liquid anti-stripping agent (a base) to an acid in a binder that a chemical reaction will take place. We found that the high temperature PG grade decreases as much as one PG grade.

We do not accept acid modified binders. If suspected, we will test it by adding a small percentage of liquid anti-stripping agent. If the high temperature grading goes down, it is potentially an acid modified binder.

South Carolina (Milton Fletcher, South Carolina DOT)

We share the same concerns as the Florida DOT with acid or chemically modified binders.

The Tennessee Department of Transportation is in the process of revising the cold milling specification. An increased number of mill and overlay projects are underway and smoothness is tough to achieve. Are any other states taking similar action? **(Brian Egan, Tennessee DOT)**

Connecticut (Keith Lane, Connecticut DOT)

We have used a milling specification satisfactorily for several years. It requires that a 10-foot straight edge be used to ensure that the maximum high-to-low groove does not exceed 3/8 inch as well as ensuring that the maximum spacing (peak-to-peak) is limited to 3/8 inch. We would be happy to share a copy of this specification.

Kansas (Cliff Hobson, Kansas DOT)

The Kansas DOT has a Pavement Smoothness Specification for flexible pavements. Special Provision 90P-0039-R09 states that the contractor shall produce pavement with an average profile index of 30 inches/mile or less per 0.1 mile section, in general. Pavement surfaces having an initial profile index greater than 30 inches/mile per section on an individual trace shall be corrected to reduce the profile index to 30 inches per mile or less per section for that trace. A pavement section is defined as a continuous area of finished pavement 0.1 mile in length and one lane (12 feet nominal) in width. Pay adjustments will be based on the initial average profile index determined for the sections prior to performing any corrective work. We would be happy to share a copy of this specification.

Nebraska (Laird Weishahn, Nebraska DOT)

For a mill and overlay project in Nebraska we treated this as two opportunities for the contractor to meet smoothness specifications and it worked very well. If they choose, the HMA contractor may have some smoothness requirements placed on the milling subcontractor. We specify smoothness of the overlay and very seldom is a contractor in a disincentive situation; the majority of the time they're in incentive situations.

Nevada (Michael Dunn, Nevada DOT)

On mill and overlay projects, the Nevada DOT currently requires 3 to 7 inches per mile, measured with a profilograph and a two-inch blanking band. This process has worked well for us.

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—Asphalt Forum Responses

(continued from page 10)

New York (Gary Frederick & Chad Corbett, New York State DOT)

The New York State DOT required the use of a 9-meter long moving reference device (e.g. floating beam, ski or other suitable device) for milling operations on several mill and overlay projects with a ride quality (smoothness) specification. The milled surfaces were required to meet a 12-mm surface tolerance when measured parallel to the centerline by a 5-meter straight edge or string line and when measured perpendicular to the centerline by a 3-meter straight edge or string line. An improved milled surface was observed on these projects.

Ontario, Canada (Kai Tam, Ontario Ministry of Transportation)

Ontario typically requires contractors to meet its smoothness specification for single lift pavement constructed over a milled surface in southern Ontario and all multiple lift contracts.

(a) *Has any agency implemented a process to qualify/certify HMA paving contractors for DOT work? If so, how has it been working?*

(b) *This question is for those agencies that require contractor quality control (QC). Has the quality of HMA pavements improved since the implementation of contractor QC?*

(Dennis Duffy, Washington DOT)

Connecticut (Keith R. Lane, Connecticut DOT)

(a) Not at this time.

(b) We have used QC by contractor in concert with the implementation of Superpave design method with some measured success.

Kansas (Cliff Hobson, Kansas DOT)

(a) Not at this time.

(b) Yes, the quality of HMA pavements has improved, but the improvements are attributed to Superpave Specifications as well as the QC/QA approach since the Kansas DOT implemented both changes at the same time.

Kentucky (Allen Myers, Kentucky Transportation Cabinet)

(a) For ten years, the Kentucky Transportation Cabinet has maintained a qualification program for HMA plant and mix design personnel. A Superpave Plant Technologist is qualified to perform daily inspection, process control testing, and acceptance or verification testing at the HMA plant site. A Superpave Mix Design Technologist is qualified to submit, approve, and adjust HMA designs. Both department and contractor personnel are required by specification to maintain these qualifications. We believe that this qualification program has significantly improved the quality of HMA in

Kentucky. Our technologists are now performing tests properly, analyzing the results intelligently, and promptly making the appropriate decisions concerning HMA production and adjustment.

The Kentucky Transportation Cabinet has also recently developed an Asphalt Field Technician qualification program. This qualification concerns department inspectors and contractor personnel involved in HMA paving operations. An Asphalt Field Technician is qualified to oversee field placement of HMA, including proper techniques for truck loading and unloading, paver operations, and field compaction. Currently, our specifications do not require this qualification; however, both department and contractor personnel will be required to maintain this qualification in the future.

(b) Since adopting HMA acceptance using contractor's test results in the mid-1990s, the Kentucky Transportation Cabinet believes that the quality of our HMA pavements has improved. However, the improvement certainly cannot be credited to contractor QC alone. During this period, we implemented several changes that greatly improved HMA quality. For example, our technician qualification program resulted in a much more informed and involved testing staff. Also, implementing HMA acceptance by mixture volumetrics and core density resulted in cleaner aggregates, higher VMA, higher asphalt binder contents, and better levels of compaction. Finally, our extensive use of polymer-modified asphalt binders has improved pavement performance tremendously. Therefore, it is very difficult to isolate the role of contractor QC in HMA pavement improvement in Kentucky. However, we can confidently state that accepting HMA by contractor testing has not negatively affected our pavements in any apparent fashion.

Mississippi (Richard Sheffield, Mississippi DOT)

(a) The Mississippi DOT has not required contractors to be qualified; only their QC technicians are required to be qualified.

(b) Absolutely! Our specifications require mix adjustments almost "on the fly" as QC test results are reported. We have had very minimal mix problems during the last two or three years. However, HMA mat density is still a concern on some projects.

Nebraska (Laird Weishahn, Nebraska DOT)

(a) The Nebraska DOT certifies asphalt testing technicians in the department laboratory. It has worked very well.

(b) The contractor does QC testing and the department does QA/verification testing. We cannot relate quality of HMA pavements to an agency doing the testing, but contractor testing is where it belongs. Mix design specifications and process control specifications also relate to quality. Training contractor personnel in proper production, placement, and compaction processes completes the quality in HMA pavement's circle.

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NCAT TEST TRACK UPDATE

As of the end of February 2005, approximately 5.8 million ESAL's have been safely applied to the NCAT Test Track's experimental test sections. The typical loading configuration now consists of five heavy triple trailers.

After the application of 58 percent of the planned loading, rutting on the Track averaged 3.3 mm, while roughness averaged 68.1 inches per mile (each within the middle 150 feet of all experimental sections).

The eight structural experimental test sections continue to produce valuable insight into mechanistic-

empirical structural pavement design. David Timm, the principal investigator of the structural aspect of the track, and his research team have identified predictable relationships between temperature and strains at the bottom of both modified and unmodified HMA base layers as well as between predicted and measured strains for the eight different structural test sections. Strain magnitude, surface cracking and rutting performance are being used to evaluate the new AASHTO system for mechanistic-empirical design.

The entire loading fleet is equipped with wireless data loggers tapped into the OEM computer network to document parameters such as engine load, fuel economy, GPS position, etc. in real time. Work continues to quantify the effect of surface mix properties within each experimental test section on vehicle rolling resistance (thus, fuel economy), an effort that is aided by the intermittent use of multiple gyroscope, accelerometers and precision GPS.

The photographs of two failed structural test sections N1 and N2 were shown in the fall 2004 issue of the *Asphalt Technology News*. The accompanying photograph shows the surface of the failed test section N1 in an advanced stage of failure prior to its recent replacement.



Advanced fatigue cracking in structural Test Section N1

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SPECIFICATION CORNER

Connecticut - Superpave has now been fully implemented to include both construction and maintenance of HMA contracts with all of the quality control done by the contractor.

A cold weather specification has been developed that goes into effect after October 1 every year and mandates the use of a material transfer vehicle (MTV) on all limited access roadways.

Florida - The Superpave specification has just been revamped. As part of the process, thousands of data points were analyzed to verify and adjust the percent within limits (PWL) specification. PG 76-22 binder will be required in the top structural layer for projects with 10 million to less than 30 million ESALs; and in the top two structural layers for projects with 30 million or more ESALs. Fine graded mixtures will now be allowed for projects with design ESALs of 10 million or more.

Kentucky - The Kentucky Transportation Cabinet is continuing efforts to reduce the number of HMA bid items by eliminating some of the lesser-utilized ones. Starting in 2005, the ESAL Class 1 designation that applied to routes with less than 300,000 (20-year) ESALs will be eliminated. The polish-resistant aggregate tiers have also been consolidated from four to three. Finally, the PG 70-22 binder will no longer be routinely specified. Primary binder grades will be PG 64-22 and PG 76-22 only.

Beginning in 2005, a new procedure is being implemented for the contractor to submit, and the department to approve, reference asphalt mixture designs. The new practice will simplify and expedite the mix design approval process for both parties.

Mississippi - The test temperature for testing PAV residue by the dynamic shear rheometer (DSR) has been increased from 25 to 26.5°C for the PG 67-22 binder. This change was made to comply with the testing protocols and temperature algorithms set up for performance-graded binders.

Nevada - Two paving grade binders are used in Nevada – PG 64-28NV (North) and PG 76-22NV (South). The requirement for direct tension test for these binders will be deleted and the wording in AASHTO T320 will be adopted. The requirement for direct tension test is no longer needed because of the Nevada DOT specification requirements for cold temperature ductility.

The waiver for toughness and tenacity adhesive head failures has been deleted from the PG 64-28NV specifications. It is believed that the previous specification was partially responsible for the supply of some unsatisfactory material during the 2004 construction season.

The specifications for all emulsions will be changed to require testing within 21 days of the date sampled. The previous requirement was 30 days. It is believed that reducing the time period between sampling and testing would be helpful in identifying the properties of the material.

South Carolina - Beginning in July 2005, all HMA mixtures will be designed using the Superpave gyratory compactor. This involves maintaining the present gradation limits on all mixes and switching to the gyratory compactor instead of the Marshall hammer.

Other key issues in the specification include the allowance of RAP in South Carolina's high volume surface mixes that utilize PG 64-22 binder and incorporating an asphalt plant certification procedure that will replace the AASHTO M 156 requirements in the current specification.

Australia - Austroads (an association of Australian and New Zealand road transport and traffic authorities) has developed a new publications website (www.austroads.com.au), which makes all Austroads publications available to users on line. In conjunction with the new publications website Austroads is developing a comprehensive series of guides covering the range of road authority operations. These web-based information modules will become available over the next few years, with the joint Austroads/AAPA (Australian Asphalt Pavement Association) module due for completion in mid 2005. These new modules will progressively replace the existing Austroads guides and specifications. They are being produced specifically for online publishing, with links between related publications and reference material. The Asphalt segment will cover the principal types of asphalt, selection of asphalt mix type, selection of component materials, asphalt mix design, performance characterization, and the specification, manufacture, quality control and placing of hot mix asphalt.

EUROPEAN PAVER LAYS TWO COURSES AT THE SAME TIME

The University of Erfurt (Germany) and Hermann Kirchner GmbH Construction Company have developed the Compact-asphalt paving method. In this method, the paver paves two asphalt layers at the same time. One of the advantages is that a thin surface layer can be used. The thin surface layer is paved together with the binder layer. Together, the two layers have more heat capacity and a better compaction can be achieved. Besides paving motorways and country roads in Germany, this method has also been used in Sweden and the Netherlands. Until now about one million square meters of paving has been done.

In many parts of the US, skid-resistant aggregates are not available locally and have to be hauled over long distances. With this paver, the top layer that may be no more than one-half inch HMA surface can consist of the

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SMA and binder layer mix being fed separately into paver hoppers



General view of the Compact-asphalt paving train



Two screeds in operation

expensive skid-resistant aggregate whereas the lower layer which may be significantly thicker can consist of the locally available aggregate.

The four photographs accompanying this article show the Compact-asphalt paving on Route A20 near Klempenow (about 170 km north of Berlin) in July 2004. The paving width was 10.5 meters.

Federal Aviation Administration

(continued from page 3)

(b) Development of Guidelines for Rubblization, are expected to be the first two projects under this program. For the latest information on this program go to the website at <http://www.aapt.us>.

It is expected that the Airfield Asphalt Pavement Technology Program funded by the Federal Aviation Administration and administered by Auburn University will go a long way in obtaining cost effective and long lasting HMA airfield pavements.

Asphalt Forum Responses

(continued from page 11)

Ontario, Canada (Kai Tam, Ontario Ministry of Transportation)

(a) Yes, since 1998 it has been required that contractors must have an approved quality control plan before they can bid. Making contractors comply with their QC plans during construction had mixed results. Review and approval of revisions to QC plans became too time-consuming and costly as contractors attempted

to make them easier to comply with. The Ministry has now switched from reviewing QC plans to a QC performance specification. Also, by Jan 2006, contractors will be required to submit a declaration that they have a quality management system in place to qualify to bid.

(b) General opinion is yes, but objective comparisons have not been made.



Mat behind the paver consisting of binder course and SMA



NCAT's Asphalt Technology Course February 28-March 4, 2005



*Back, L-R: Robert James (Instructor), Brian Prowell (Instructor), James Williams, Justin Gay, Saleem Khattak, Lorell Duteil, Steve Ritenour, David Tag
Middle, L-R: Jingna Zhang (Instructor), Audrey Perine, Osamu Takahashi, Cindy Drake, Don Watson (Instructor), Rodger Young, Gary Webb, Greg Milburn,
John Rajek, Pat Ernst, Mark Baum
Front, L-R: Kim Yeong Min, Choi Ji Young, Chris Jacobsen, Jeff Casey, Ben Zmuda, Jeremy Adkins, Vince Auriemma*



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