



ASPHALT TECHNOLOGY NEWS

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NCAT HOSTS FHWA REGIONAL SUPERPAVE CONFERENCE

The Federal Highway Administration (FHWA) sponsored a Region 4 Superpave conference February 19-21 to provide a forum for discussing Superpave implementation. Its stated purpose was to provide information on



Jim Sorenson, Applications Group Leader, FHWA, emphasized the importance of Superpave in the regional conference held at NCAT

status of implementation by various state DOTs, to identify problem areas that had been encountered, and to offer solutions where possible. It was held at the National Center for Asphalt Technology (NCAT) at Auburn University since it acts as the Superpave center for the Southeast. It was attended by 242 people, consisting of 30 FHWA personnel, 100 DOT personnel, 88 contractors, and 24 others. Participation by industry and government was about evenly split. Most of the speakers were from the Southeast, but several national speakers were invited to provide a larger overview.

During the opening session, some of the reasons leading to the development of Superpave and a better performing HMA were spelled out. Over 90 percent of all paved surfaces in the U.S. consist of hot mix asphalt. Pavements generally do not

perform for their design life, so some improvement is needed to obtain better performance. The primary performance factor that concerns most drivers is pavement smoothness. and, of course, mixture properties have an effect on initial smoothness as well as long-term smoothness.

In the past 20 years the amount of vehicle miles traveled per year has increased by approximately 75 percent. In the past 10 years the amount of equivalent single axle loads (ESAL) applied to our roadways has increased by approximately 61 percent as well. The increased use of radial tires has been shown to be more detrimental to HMA than the bias-ply tires. All of these factors point to a need to improve the quality of HMA to meet the additional user demands.

The conference was divided into seven specific areas: policy, binder, aggregate, mix design, construction, segregation, and quality control/quality assurance (QC/QA). A brief summary of discussion on each of these topics is given below:

POLICY ISSUES

Superpave is here to stay, but changes will occur as we gain more experience. During some of the early work, mistakes will be made and performance problems may occur but we should learn from these mistakes

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and we should improve the process based on what we learn.

Superpave is geared toward performance testing and should eventually provide us with a better way to estimate performance of HMA. Performance models are not presently available, and will not likely be available in the near future. The framework is in place, however, with new binder tests and the Superpave gyratory compactor to allow prediction of performance in the future. The use of gyratory compaction, volumetric, and specifications for aggregates and asphalt binder should improve performance over the existing procedures.

Early performance appears to indicate that Superpave mixtures may be more resistant to rutting. It is important, though, that coarse aggregate and fine aggregate meet consensus quality requirements and that mixture volumetric requirements are met.

Even though Superpave mixtures have a high coarse aggregate content and are more difficult to work with, experience has shown that good smoothness can be obtained. Superpave mixtures tend to provide good surface drainage and result in less spray. This results in good surface friction properties.



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Attendees at the regional Superpave conference included FHWA, DOT, and industry personnel.

Certification of technicians continues to be a major issue. Many states presently have their own certification program and are reasonably happy with the results. One problem for contractors, however, results when they work in a number of states. This requires that individuals being certified must take classes and be tested in each state. Some type of regional certification would be beneficial. This is even more true with Superpave, where a new technology is being taught to those being certified. If certification can be done on a regional basis it will greatly cut down on duplication of training. One option would be to certify on a regional basis but allow each state to require a small amount of additional training and a test for those who have been certified on a regional basis. As much consistency as possible in implementing Superpave is needed in the various states. The use of Superpave will likely increase the cost of most HMA by 10-20 percent. This increased cost will be more than recovered with one year of additional life. This should be achievable.

One item that was pointed out several times is that we should not throw away all that we have learned in the past when we adopt Superpave. Superpave is an extension of our past experiences and is not meant to replace this past experience. We have new ways of evaluating binders, aggregates, and mixes, but we should not forget what we have learned. If Superpave provides results that seem to be contrary to our experience, we should evaluate the problem before blindly accepting a mixture based solely on results from Superpave.

BINDER ISSUES

With Superpave, asphalt binder is now an engineered product and is no longer a by-product of the refining operation. This should result in improved performance, and in some cases will result in increased costs.

Binder equipment is significantly more expensive
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than that used prior to Superpave, and there have been some reliability problems with much of the equipment. The pressure aging vessel (PAV) and direct tension test equipment have been changed significantly. Some of the equipment has had to be replaced or significant repairs made early in the life of the equipment. Some of these problems have to be expected with new equipment. With time, problems will be identified and equipment will be produced that is more reliable. No significant changes from the equipment currently available are anticipated.

Questions were raised concerning the similarities of asphalt cement having the same grades. For example, would two sources of PG 64-22 be expected to have similar performance? The belief at this point is that the source of the asphalt cement and the way the asphalt cement is produced will affect its performance. A PG 64-22 that is a neat asphalt cement will likely perform differently than a PG 64-22 that is a modified binder. The type of modification will also have an effect. While we would like for all PG 64-22 asphalt to be the same it doesn't appear that this is true. The new PG grading system is still a major improvement over the existing systems.

There were some concerns the binder testing may take too long for QC at the refinery. It is expected that after some experience with testing of Superpave binders we will be able to run one or two consistency tests for QC. For example, the dynamic shear rheometer (DSR) test is reasonably fast and we may be able to use it for consistency. Even under the old system (penetration and viscosity) a significant amount of time was necessary to conduct all of the specified tests. According to refiners, controlling the properties of the binders will take much more effort than it did with the old system.

Some work is needed by refineries to predict the PG grades that can be produced from given crudes. Years of experience have resulted in a number of methods that can be used to predict viscosity or penetration values that could be obtained from crude sources. This experience is not yet available for Superpave binders.

Polymers can be used to modify asphalt cements to meet certain grades. Some states *allow* polymers to be used to meet certain PG grades, while other states *require* that polymers be used to meet these PG grades. Again, the feeling is that the PG grade is important, but the way in which the PG grade is achieved is also important.

Some states use stiffer binders on Interstate highways and other high volume roads compared to low to intermediate volume roads. For example, some states increase the high temperature grade by two grades for high volume roads. The selected low temperature grade is generally constant and is not affected by anticipated traffic volume. Some states that have used AC-30 in the past have modified the PG grading to ensure that an asphalt cement similar to an AC-30 is specified. One state specifies an intermediate PG grade of asphalt. This high temperature grade is PG 67, which is mid way between the recommended grades of PG 64 and PG 70. Another state has changed the $G^*/\sin\delta$ (rutting factor) requirements from 1.0 to 1.3 kPa to ensure that an asphalt binder similar to an AC-30 is specified.

While there are some concerns with the cost and reliability of equipment, most in attendance felt that the Superpave asphalt binder specifications are a big improvement over the existing specifications.

AGGREGATE ISSUES

Superpave mixtures generally require a high percentage of coarse aggregate. Typical dense mixtures prior to Superpave used 30-40 percent coarse

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Left to right: Richard Stuart, South Carolina DOT; Jimmy Brumfield, Mississippi DOT; and Cecil Jones, North Carolina DOT at the Superpave conference.



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aggregates. Superpave mixtures will generally use 50-60 percent coarse aggregate. This will result in a significant excess in fine aggregate stockpiles unless the crushing operations are adjusted to produce more coarse aggregate. Some aggregate suppliers are hesitant to invest in these modifications until they are certain what is needed. These adjustments and other requirements for aggregates will likely result in an increase in cost for aggregates.

The flat and elongated requirements are based on no more than 10 percent with 5:1 ratio of maximum to minimum dimensions. Based on experience this is too liberal. Some states are looking at going to 3:1 maximum to minimum ratio requirements. This requirement seems to be more reasonable and will better distinguish between good and bad aggregates.

There is some concern about the requirements of fine aggregate angularity in terms of uncompacted voids. The requirement for high volume roads is 45 minimum. There appear to be some good aggregates that fail to meet the 45. There also appear to be some fine aggregates that meet the requirements but that are not particularly good performers. Even though the 45 requirement does not appear to be acceptable for every fine aggregate it does appear to be near optimum. It is better than any other requirement for fine aggregate that we have used in the past.

One of the gradation criteria that was developed as part of Superpave is the restricted zone. Most states are producing Superpave mixes that pass below the restricted zone. This provides a coarser mix that should be more resistant to rutting. The two primary reasons for the restricted zone are to help ensure that the mixture meets VMA requirements and to ensure that an excess of natural sand is not used. Some states consider the restricted zone to be a guide while other states consider it to be a specification requirement.

Permeability of Superpave mixtures has apparently been a problem on a few projects. If the in-place (mat) air voids are slightly higher than desired, permeability appears to be a problem. Mixes with aggregate gradations with an S-shaped curve appear to be more prone to permeability problems. The more accentuated the S curve, the more prone the mix is to permeability. However, the permeability should be negligible with proper mix design and in-place compaction even with a very definite S curve.

It has been difficult with many aggregates to meet the minimum VMA requirements. Aggregates with relatively high L.A. abrasion values tend to breakdown during compaction when the grading is below the restricted zone. This aggregate breakdown makes it difficult to meet the minimum VMA requirements. It is intended that the VMA be calculated based on the

bulk specific gravity of the aggregate. Several states calculate the VMA based on the effective specific gravity. Use of the effective specific gravity makes the VMA requirements easier to meet. The gradation of the aggregate as well as the aggregate shape and texture all work together to produce the desired VMA.

MIX DESIGN ISSUES

Mixtures should be designed with somewhat higher VMA than specified to provide a safety factor when mix is produced in the field. The VMA always tends to decrease during plant production of HMA as a result of aggregate breakdown and other factors. With some aggregates it may be necessary to allow the gradation to fall below the minimum control point on the 2.36 mm sieve to provide adequate VMA. This modification will increase the VMA, but it may result in draindown of the asphalt binder. If the lower control limit for Superpave mixes is lowered further then the gradation is very similar to an SMA gradation, and experience has shown that draindown results with SMA mixtures unless a fiber or polymer is used to stabilize the binder.

Many states expressed some concern that some Superpave mixtures have low optimum asphalt contents, which may result in reduced fatigue life. The primary purpose of the minimum VMA requirement is to ensure that at least a minimum amount of asphalt cement is added to the mixture. The Superpave gyratory compactor has been shown to produce a higher density in the HMA than 75 blow Marshall compaction: so for a constant gradation the gyratory compactor will result in a lower optimum asphalt content. However, adjusting the aggregate gradation can result in a mix with acceptable VMA and optimum asphalt content with the gyratory compactor.

The procedure for determining voids with the Superpave method involves compacting samples to N_{max} , determining a correction factor at N_{max} , and correcting the measured density (based on machine measurements) at N_{design} . It was mentioned that this process only gives an estimate of the voids at N_{design} , the most important point to determine volumetric. At least one state mentioned that they were compacting samples to N_{design} and then determining the actual density (by weighing in air and water) at that point. Research work has shown that the correction factor determined at N_{max} is not always accurate enough to allow the machine density at N_{design} to be corrected to actual density. Mixtures with a rough surface texture, such as the Superpave mixtures below the restricted zone, result in more error than mixtures with smoother surface texture.

The Superpave volumetric approach to mix design is a good concept but there is a need for a torture test or some other test that is at least roughly correlated to performance. Most states agreed that some additional

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type of test is needed. Many states are beginning to use laboratory wheel tracking tests for estimating performance and more states are considering this concept.

Superpave mixtures do tend to be permeable at a lower void content than typical dense-graded mixtures designed by Marshall. The likely reason for this is the high percentage of coarse aggregate, which can result in problems when designing Superpave mixtures. The standard procedure requires that the mix be evaluated over a range of asphalt contents to determine the content that provides 4 percent air voids. The problem with this concept is that mixes at the lower asphalt contents may be porous thus resulting in an inaccurate measurement of specimen bulk specific gravity and, therefore, voids. One should be careful with these mixtures when trying to measure the bulk specific gravity in the 6-7 percent void range.

Many states are concerned about the use of reclaimed asphalt pavement (RAP) with Superpave, although several states have used RAP with no significant problems. Florida typically uses 10-20 percent RAP in its Superpave mixtures.

CONSTRUCTION ISSUES

No major problems were mentioned concerning the plant production of Superpave mixtures; however, some potential problems were mentioned. There is some concern expressed about silo storage. During long term

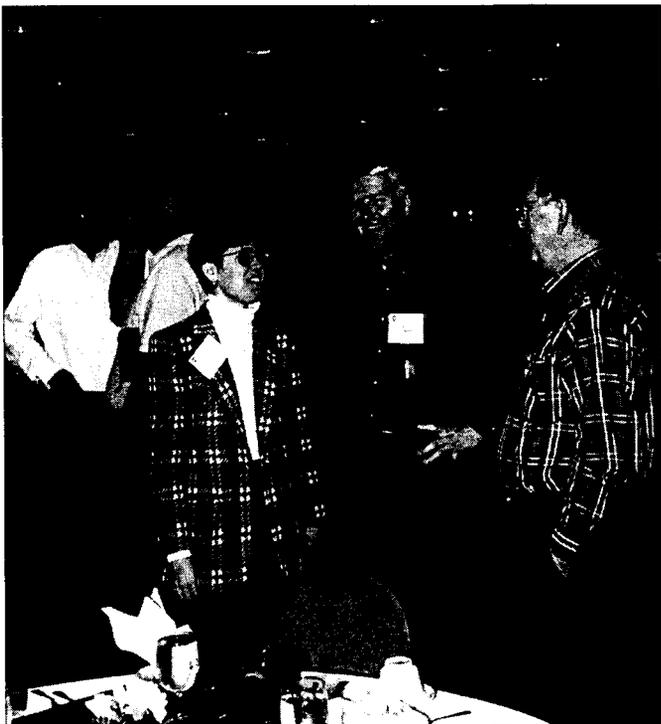
storage, the Superpave mixtures may be more susceptible to draindown than finer graded hot mix asphalts. It was also mentioned that Superpave mixtures tend to cool quicker than finer mixtures, which may result in poor or no flow from the silo. One example was given where a silo could not be emptied after a Superpave mixture was stored for a normal period of time. One likely reason that the Superpave mixtures cool quicker than finer mixtures is that the larger aggregate does not get hot all the way through when passing through the dryer. Therefore, mixtures with more coarse aggregate may tend to cool quicker.

There has been some indication that the Superpave aggregate tends to breakdown more than the finer graded mixtures that have been used in the past. The finer aggregate can provide some cushioning effect as the aggregate is fed through the drum, and with less amount of the fine aggregate more breakdowns may occur.

Superpave mixtures tend to be very sensitive to compaction temperature. Experience has shown that mixtures can be compacted at higher temperatures, typically above 270°F, but they become tender when the temperature drops below approximately 270°F (this temperature is for a PG 6-I binder and would likely change for other PG grades, and would probably change some depending on asphalt source, refining methods, etc). Once the temperature reaches somewhere around 200°F the mixture is no longer tender and additional compaction can be obtained. One potential problem with compacting at lower temperatures, especially with vibrating rollers, is the potential for excessive aggregate breakdown. The best approach appears to be to compact the mixture before it cools to the tender stage and then do the finish rolling after it has cooled below the tender stage.

Most states have experienced some problems in compaction of Superpave mixtures. In some cases these problems were related to mix tenderness. But even when the mixes were not tender adequate compaction was often difficult to achieve. One possible reason for compaction difficulty is that Superpave mixes do tend to cool quicker, resulting in less available time for compaction. Another concern is the ratio of maximum aggregate size to layer thickness. The most common rule of thumb for finer graded mixtures is that the layer thickness should be at least two times the maximum aggregate size. The Superpave mixes have a higher coarse aggregate content and this rule of thumb may have to be increased, according to some of the attendees, to 3 to 4 times the maximum aggregate size. One should also keep in mind that we now identify aggregates by their nominal maximum size, which is one sieve higher than the first sieve with less than 90 percent of the aggregate passing. The percentage passing the nominal maximum size will often be 90-95 percent. In the past we identified aggregate sizes by the maximum size.

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Danielle Keatley, Shell Chemical Company, and Wright Aldridge, FHWA, at the Superpave conference.

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Generally 100 percent or nearly 100 percent of the material passed the maximum size sieve. So now when we designate an aggregate as 12.5 mm nominal size that is roughly equivalent to 19 mm maximum size under the old system. For this aggregate in the past we would have needed a layer thickness of at least 38 mm but for the 2:1 ratio for the new system we now recommend only 25 mm. This difference can be significant.

On many projects use of rubber tire rollers has resulted in pick up problems. On other projects rubber tire rollers have been successfully used to compact the mixtures. Each project has its own set of conditions and the best rolling techniques must be determined based on these conditions.

Work within the Florida DOT has shown that an in-place density of at least 94 percent of theoretical maximum density provides a mixture that is not permeable to water. When the density is less than 94 percent, water permeability may be a problem.

There has been some problem in correlating nuclear density readings to that of cores. The rough surface texture of the Superpave mixtures likely results in an air gap between the gauge and the pavement, thus resulting in erroneous readings. Some states have addressed this concern by requiring that cores be used for all density measurements. Other states are using nuclear gauges for density measurements.

SEGREGATION ISSUES

There has been a lot of concern in the past about segregation in hot mix asphalt. Superpave mixtures typically have a higher coarse aggregate content than conventional HMA and the feeling is that segregation may be a problem. Work to this point seems to indicate that Superpave mixtures are less likely to segregate than conventional mixtures. Segregation can still be a problem and good construction techniques should be used. Also with Superpave mixtures, there may be two types of segregation that show up: (1) coarse aggregate segregation resulting in low asphalt and high coarse aggregate content with open surface texture and (2) fine aggregate segregation resulting in high asphalt, and high fine aggregate content with a tight, flushed surface. Again, up to this point segregation has not been a big problem.

QC/QA ISSUES

A number of issues were addressed concerning QC/QA. For example, where is the binder sampled for testing? The feeling is that the binder should be sampled at or after the last point of modification. If the binder is not modified it can be sampled and tested at any point. Of course care would have to be taken to ensure that no damage nor contamination occurred to the asphalt cement

as a result of handling procedures. If the binder is modified by adding a polymer or other additive at the asphalt mix plant, the binder should be tested at that point. Some modifiers are added as the materials (asphalt cement, aggregate, modifier) are fed through the asphalt plant. Typically, in this case, there is no way to obtain a sample of the modified binder for testing.

There was some discussion of what type of QC/QA equipment is needed in the field to ensure mix quality. Most agreed that a Superpave gyratory compactor would be needed but one concern was the lack of compactor availability. At least one state had installed a compactor in a trailer that could be quickly moved from one project to another. A summary of the work under NCHRP Project 9-7 was provided, which is involved in the development of QC/QA procedures for Superpave. The final recommendations from this project were not available at the meeting. Everyone needs to be aware of this research and the findings that will soon be provided. This study will likely have a significant effect on the way Superpave is eventually implemented.

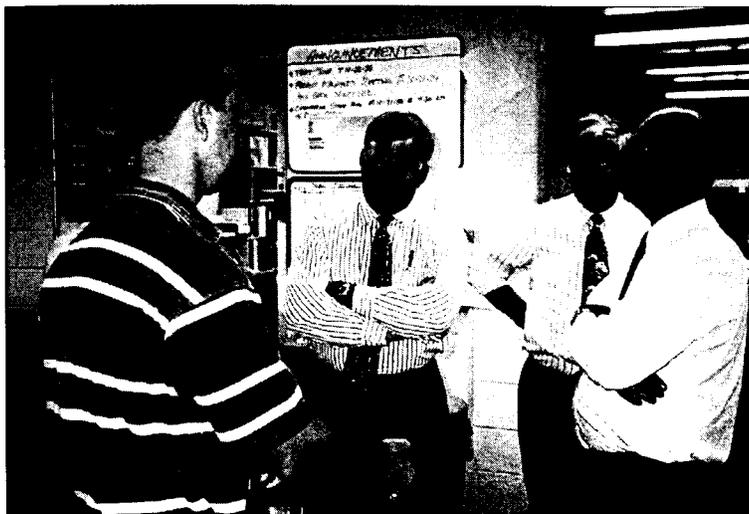
Again, the need for a certification program and central training was discussed.

In summary, the meeting was very beneficial for those in attendance. The attendees agreed in general that Superpave is a step in the right direction and it is here to stay. However, there is a lot of work that needs to be continued. We shouldn't forget all of the experience that we have learned to date but we should be willing to step forward and implement this new technology as soon as practical.



Jon Epps, University of Nevada-Reno, presenting early results from Westrack at the Superpave conference.

Tennessee DOT engineers visited NCAT in October; from left to right: Shane Buchanan, NCAT; Gary Head, Tennessee DOT; Doug Hanson, NCAT; and Dennis Cook, Tennessee DOT.



NOTES FROM SUPERPAVE MIXTURE AND BINDER EXPERTTASK GROUP (ETG) MEETINGS

MIXTURE ETG MEETING

The last Superpave mixture ETG meeting was held in San Antonio on March 5. Three action items were discussed: (a) guidelines for designing of Superpave mixture containing reclaimed asphalt pavement (RAP), (b) protocol for evaluation of new Superpave gyratory compactors, and (c) changes to the 2.36 mm sieve lower control point. On the last item, most reviewers were reluctant to advise recommending any change concerning the control point until more data/evaluation can be conducted.

The following motion concerning the cautionary use of laboratory rut testers was carried at the meeting: "Rut testers, properly calibrated, have been utilized by some agencies as effective proof testers. However, they should not be used to predict actual pavement performance because of actual differences of in-service temperature and loading conditions. The devices use empirical evaluation of some measured response to a loaded wheel(s) as an indicator of performance. Local criteria from one region is not applicable in another. As such, each potential user needs to develop their own evaluation of wheel test results using local conditions."

Since the meeting, the FHWA has prepared draft guidelines for design of Superpave mixtures containing RAP and the protocol for evaluation of new Superpave gyratory compactors. These documents will be distributed to user agencies and industry and reported to the Asphalt Technical Working Group at its May meeting. Copies of these documents can be obtained from John Bukowski of the FHWA, who is chairman of the Mixture ETG (phone 202-366-1287) or Prithvi (Ken) Kandhal, Associate Director of NCAT (phone 334-844-6242).

BINDER ETG MEETING

The last Superpave Binder ETG meeting was held in San Antonio on February 26-27. Binder testing equipment related topics were discussed.

Bending beam Rheometer. The influence of the initial (within 50 millisecond to 0.1 second) "spike" in the load trace on the outcome of the test results was discussed. There was general agreement that the only measurement that may be affected was the test result at eight seconds.

Other changes the ETG agreed were needed included adding a loading shaft radius and nose diameter, and support width and radius to the test standard.

Dynamic Shear Rheometer. David Anderson presented a statistical evaluation of DSR test results using various plate diameters and test temperatures. The conclusions were that measurements of G^* were still more variable than desired while phase angle measurements were very repeatable.

Direct Tension Tester. A preliminary comparison of test results using various direct tension testers indicates there is still some testing variability issues that need to be addressed. A metal load cell in the general shape of a direct tension sample has been fabricated and will be used to calibrate the DTT load cell.

Monte Symons of the FHWA reported the latest temperature algorithm developed from the LTPP SAPT data. This model uses air temperature, latitude, and depth below the pavement surface as inputs to determine the low pavement temperature. The general consensus of the ETG was that the new model provided more reasonable estimates of low pavement temperatures.

Additional information on the Binder ETG can be obtained from John D'Angelo of the FHWA, who is chairman of the Binder ETG (phone 202-366-0121).

ASPHALT FORUM

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

Indiana (John Haddock, Indiana DOT)

Are there many states that are currently using bituminous underselling? If so, how do they determine which pavements need to be undersealed? Any other information on underselling would be appreciated.

(The Asphalt Institute Construction Leaflet No. 13, CL-13, July 1975, titled "Underselling Portland Cement Concrete Pavements with Asphalt" gives some guidelines on how to identify pavements which need undersealing and specifications for undersealing. — editor)

Illinois (Jim Gehler, Illinois DOT)

A few HMA paving projects last year exhibited a distinctive oily brown color during construction. It became very apparent during the compaction process. The asphalt binder was being physically separated from the aggregate particles as if it were stripping off, leaving behind a thin brownish coating on the aggregate particles. Therefore, a "brown asphalt" study was initiated. The investigation, to date, has not identified the cause for this type of stripping. As a result, Illinois DOT (IDOT) is currently investigating the use of waste burner fuels at the HMA plants and the use of dust suppressants at aggregate quarries. Illinois would like to know if other states have any specifications or restrictions on the types of burner fuels or on the use of dust suppressants in the production of aggregates. IDOT's contact person on this issue is Bruce Peebles (phone 217-782-7210).

IDOT has evaluated a few aggregate sources that have demonstrated excessive, variable aggregate mass

loss when tested in the ignition furnace. These sources have a 3 to 4 percent correction factor. Illinois would like to know if any other states have experienced similar problems. IDOT's contact person on this issue is Mark Rademaker (phone 217-782-7210).

Missouri (Jim Campbell, Missouri Highway & Transportation Department)

1. How many states have experienced tender mix problems with Superpave'?
2. Do any states question the use of AC-2.5 and AC-5 viscosity graded asphalt cements for use as base asphalt grades in polymer modified binders'?
3. VMA is related to the nominal maximum size of the aggregate and the fineness or coarseness of a mix. Do any states question the minimum Superpave VMA requirements? Are they set too high?
4. Gradation control points and maximum density line. To create VMA in a mixture the designer must pull the combined aggregate gradation further from the maximum density line. Does this create mix stability problems in the field?

(Some of these issues were discussed in the FHWA Region 4 Superpave conference — see the cover story in this issue. It is quite common to use low viscosity base asphalt cements for manufacturing polymer modified binders. The soft base asphalt cement contributes to good low temperature characteristics and the polymer contributes to good high temperature characteristics of the binder. — editor)

Utah (Wade Betenson, Utah DOT)

The Western Regional Superpave Center in Reno has conducted its first training session on Superpave volumetric mix design for 15 individuals in Utah. Both Utah DOT and the industry personnel participated.

Ohio (Dave Powers, Ohio DOT)

Are any states willing to share their specifications (Task Force 31, SHRP or other) for SBR, SBS modified asphalt binders? Please contact Dave Powers at 614-275-1300.

JOIN US!

We at NCAT hope you enjoy this issue of Asphalt Technology News. It is provided free of charge. If you wish to be added to our mailing list, please send your business card or your name and mailing address to:

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Maryland (Larry Michael, Maryland State Highway Administration)

Two teams have been developed in conjunction with the Maryland's Superpave implementation plan to insure a smooth transition. The Superpave Strategic Planning Team (composed of state and industry leaders) works to provide guidance, problem-solving assistance, and technology resources for Maryland. The Superpave Technical Team (composed of SHA technicians and contractor personnel) uses the recommendations from the Superpave Strategic Team to develop unified methods for handling Superpave projects.

Alabama (Robert Jackson, Alabama DOT)

Alabama would like to know if any agencies have found a polymer that is not acceptable for use in hot mix asphalt. A wide variety of polymers are available and we are interested to know if there are some that provide less than satisfactory performance. Also, does anyone have experience producing acceptable Superpave mixes even though the mix is produced using an aggregate gradation that passes through the "restricted zone"?

(Georgia DOT has some acceptable Superpave mixes that have gradations through the "restricted zone". However, Georgia DOT uses 100 percent crushed material and does not allow any natural sand in Superpave mixes. — editor)

Virginia (Bill Maupin, Virginia Transportation Research Council)

Has any one experienced cracks forming in HMA overlays during compaction process over paint strips or thermoplastic materials on underlying surface? How did you combat the problem?

Kentucky (Allen Myers, Kentucky Department of Highways)

We have the following questions for other agencies:

- How many states regularly use some version of a rut-testing device? Does this device have the capability of testing samples in a submerged condition? What parameters (temperature, wheel load, hose pressure, number of cycles, etc.) are used?
- How are other states handling the training and certification of personnel in Superpave procedures (binder and mixture)? Is most training completed at nationally recognized sites (Asphalt Institute, Superpave Centers, etc.)? Have any states developed in-house Superpave training programs?
- Are any states using the ignition oven as an option for asphalt content determination? Has any state experienced excessive loss of aggregate through the ignition oven when analyzing a mixture containing dolomite?

Mississippi (Alfred Crawley, Mississippi DOT)

Some states are reporting high permeability in HMA as they change HMA mix design methods. The Mississippi DOT conducted some research in the mid 1980's. Stripping was observed in some HMA courses which had an open-graded friction course as the riding surface. The gyratory testing machine (GTM) was used to evaluate the stripped HMA mix.

Florida (Jim Musselman, Florida DOT)

Florida has had some problems with excessive permeability of coarse-graded Superpave mixes, and as a result has developed a relatively simple permeability test that can be used to quantify the permeability of an asphalt pavement core sample. Data obtained on projects in Florida indicates that the in-place air void content needs to be no greater than 6 percent to assure the pavement is impermeable.

Australia (John Bethune, Australian Asphalt Pavement Association)

During April, 1997, a joint AUSTROADS/AAPA publication entitled "Selection and Design of Asphalt Mixes: Australia Provisional Guide" is planned for distribution. As the title indicates, it will be reviewed as further validation data becomes available. The guide aims to be:

- performance related
- able to produce mixes with improved service properties (particularly rut resistance)
- affordable in terms of new equipment cost and
- rapid and easy to use

Asphalt Recycling guide: This joint AUSTROADS/AAPA publication has been recently issued. The guide is intended to provide systematic guidance to practitioners for the selection, design and construction of pavement rehabilitation treatments using asphalt recycling to ensure the effective use of these valuable technologies.

**SUPERPAVE VOLUMETRIC MIX
DESIGN WORKSHOPS**

Superpave volumetric mix design workshops will be held at NCAT on October 22-24, 1997; November 19-21, 1997; December 17-19, 1997; March 4-6, 1998; and March 25-27, 1998. These workshops consist of two and a half days of intensive lecture, demonstration, and hands-on training on Superpave mix design procedures. Upon completion the participants will be able to conduct the Superpave mix designs in their laboratories.

Please call (334) 844-NC AT(6228) for brochure or information, or visit our web site at:
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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. We are reporting observations and conclusions from these papers which may be of value to field engineers. These comments are obtained mostly from research projects with a limited scope; before application to practice we recommend that you read the entire paper to determine its limitations. Titles of the papers are given, with names of authors in parentheses, followed by a brief summary.

1. EVALUATION AND SELECTION OF AGGREGATE GRADATIONS FOR ASPHALT MIXTURES USING SUPERPAVE (Anderson and Bahia)

The most striking feature of Superpave mixtures is often the aggregate gradation. For many users, mixtures meeting Superpave gradation requirements represent a substantial change to their current mixtures. Aggregate gradation is controlled in Superpave using control points and restricted zone. The control points serve three purposes: control the top size of the aggregate; control the relative proportion of coarse and fine aggregate; and control the amount of dust. They also implicitly identify the aggregate gradation as dense graded.

The function of the restricted zone was also envisioned as threefold: to minimize the risk of poor volumetric properties; to minimize the amount of rounded, fine sands; and to encourage the development of a strong aggregate structure in the mixture. Superpave defines the restricted zone as a zone lying on the maximum density line, between the 2.36 and 0.3 millimeter sieves, "through which it is usually undesirable for the gradation to pass" (SHRP Report A-407, 1994). SHRP A-407 continues that it is "recommended (but not required)" that aggregate gradations pass below the restricted zone as traffic increases.

With these guidelines, 128 trial aggregate gradations, representing 32 mixture designs, were evaluated by the Asphalt Institute from 1992 to 1996. Aggregate gradation and compaction properties were analyzed for each of the trial blends in an effort to identify common traits of successful mixtures that could be used as a guideline to aid the Superpave mix designer in selecting appropriate aggregate gradations. Since, in the evaluation of aggregate structures, the percentage of air voids is normalized to 4 percent, the most difficult mixture criterion is the percentage of VMA. As such, VMA became the property evaluated as the important

mixture trait in this study.

VMA is influenced by a number of factors such as asphalt content, gradation, and aggregate angularity, particle shape, and surface texture. However, the mix designer typically has control over aggregate-asphalt proportioning and combined gradation. Trial aggregate gradations were evaluated based on their resulting VMA when compacted using the Superpave gyratory compactor.

Based on the data set obtained on 128 trial aggregate gradations, the best way to develop mixtures that will have a reasonable assurance of meeting VMA criterion is to develop aggregate gradations that are "S-shaped". These gradations have substantial intermediate aggregate between the nominal maximum sieve and the 2.36 mm sieve. Using the data set discussed above, 43 of 109 aggregate gradations (1 2.5 and 19 mm nominal size only) would be considered somewhat S-shaped. Of the 43 S-shaped aggregate gradations, 25 met the minimum VMA criteria. The common characteristics of the 18 failing mixtures included: high dust content (greater than 5 percent, eight mixes); absorptive aggregates (water absorption greater than 2 percent, six mixes); and rounded aggregates (two mixes). The lack of a good correlation between VMA and aggregate gradation further underscores the concept that VMA is dependent on many factors in addition to gradation. It was also observed that the slope of the SGC compaction curve, log number of gyrations versus $\% G_{mm}$, differentiate between different aggregate gradations. Finer gradations and those with more rounded aggregates typically have lower compaction slopes. Since it is a compaction characteristic, the slope can probably account for aggregate shape and texture in addition to gradation.

2. EFFECT OF COMPACTION METHOD ON RUTTING SUSCEPTIBILITY MEASURED BY WHEEL-TRACKING DEVICES (Stuart and Mogawer)

The Federal Highway Administration (FHWA) has been conducting a study to validate Superpave binder tests, binder specifications, and mixture tests using its accelerated loading facility (ALF). Other laboratory tests that have been developed to predict the performance of mixtures are also being evaluated. Five surface and two base mixtures are being used in the study. The base mixtures have a larger nominal maximum aggregate size and less binder.

The French pavement rutting tester (PRT), Georgia loaded-wheel tester (LWT), and Hamburg wheel-

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tracking device (WTD) are three wheel-tracking devices being evaluated. These devices are used to evaluate the rutting susceptibility of asphalt mixtures. The three wheel-tracking devices and ALF ranked the five surface mixtures similarly. However, the ALF provided a statistically significant decrease in rutting susceptibility with increased aggregate size in the base mixes, whereas the wheel-tracking devices did not. The study was expanded to include investigating the effects of different compaction methods on how mixtures rank in terms of rutting susceptibility. It was hypothesized that the degree of correlation between the wheel-tracking devices and ALF pavement performance may depend on the compaction method.

Four mixtures were tested: two base mixtures with AC-5 and AC-20 asphalt binders and two surface mixtures with AC-5 and AC-20.

The slab samples for the French PRT were compacted in the laboratory by two different compactors: The French plate compactor and a linear kneading compactor. The French plate compactor compacts slabs using a reciprocating pneumatic rubber tire that rolls back and forth on the mixture. The linear kneading compactor has vertically aligned steel plates which are placed on top of the mixture. A steel roller then transmits a rolling action force through the steel plates, one plate at a time. Slabs were also cut from ALF pavements, thus providing a third compaction method for the French PRT.

Beams or slabs for the Georgia LWT and Hamburg WTD were compacted in two lifts using a vibratory tamper. Slabs were also obtained from the ALF pavements, which provided a second compaction method for these two wheel-tracking devices.

The following conclusions have been drawn from this study:

- **French PRT:** The slabs compacted by the linear kneading compactor showed a significant decrease in rutting susceptibility with an increase in nominal maximum aggregate size while the slabs compacted by the French plate compactor did not.
- **Georgia LWT:** Each base mix had a lower average rut depth compared to its companion surface mixture (with lower nominal maximum size) for both compaction methods. However, the differences were not statistically significant and they did not match the large differences in performance provided by the ALF.
- **Hamburg WTD:** Each base mix performed better than its companion surface mix for both compaction methods. However, the differences were statistically significant for the AC-5 mixtures only.
- **All Wheel-Tracking Devices:** The rankings based on rutting susceptibility of slabs compacted and tested

in the laboratory did not match the rankings provided by the ALF.

**3. CONSTRUCTION AND PERFORMANCE OF
ULTRATHIN FRICTION COURSE
(Kandhal, Johnson, and Lockett)**

The Novachip process, also known as ultrathin friction course, was developed in France in 1986. The process utilizes a single piece of equipment to place a thin, gap-graded hot mix asphalt onto a relatively thick layer of polymer modified asphalt emulsion tack coat.

The equipment consists of (a) a receiving hopper to accept the HMA from trucks, (b) two auger conveyors that elevate the HMA into an insulated storage bin, (c) an insulated emulsion storage tank, (d) a delivery conveyor which delivers the HMA from the storage bin to the screed box, (e) an emulsion spray bar for tack coat application, and (f) a distribution auger and a vibratory screed to place and level the HMA. Two Novachip projects were constructed in Alabama in 1992 to achieve the following objectives: (a) document the materials and the construction procedures utilized in the construction of the Novachip surface course, and (b) monitor and evaluate the performance of the Novachip test sections at regular intervals for a period of three years.

Control sections consisting of conventional dense-graded HMA were also constructed for comparison.

Both granite and crushed gravel aggregates were used in the Novachip mixes whereas granite aggregate was used in the control mixes. An AC-20 asphalt cement was used in all HMA mixes. A SBR latex modified CRS-2 asphalt emulsion was used for tack coat in the Novachip test sections. The specified application rate was $1 \pm 0.2 \text{ L/m}^2$ ($0.22 \pm 0.05 \text{ gal/sqyd}$). The machine traveled at a rate of 24-27 m (80-90 feet) per minute. Rolling of the Novachip mix was accomplished in static mode.

This paper gives the construction details and performance of Novachip after 3-3/4 years in service. Since this was the first Novachip project in the U.S. with the machine imported from France, some equipment related problems were encountered. The surface texture of Novachip is very similar to that of a typical open-graded friction course. No significant raveling was observed on the two projects after about 3-3/4 years' service, which indicates very good bond between Novachip and the underlying surface. The Novachip surface has significantly higher pavement surface friction numbers compared to dense-graded HMA wearing course. It appears to be a potential alternate for chip seals, micro surfacing, and open-graded friction courses.

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(RESEARCH INTO PRACTICE,*Continued from page 11)***4. SELECTION OF THE MOST DESIRABLE HMA MIXTURES****(Sebaaly, Ridolfi, Gangavaram, and Epps)**

Aggregate properties and gradations in conjunction with the properties of asphalt binder have been shown to significantly impact the strength and performance of HMA mixtures. This paper summarizes the data and analysis of a laboratory research study which evaluated four gradations and four asphalt binders in conjunction with five sources of Nevada aggregates. The objective of this research program was to select the most desirable HMA mixture for a given aggregate source. The measured performance indicators of the mix included: resilient modulus as a function of temperature, tensile strength, permanent deformation, moisture susceptibility, and low temperature cracking.

All four gradations for each aggregate source were within the Superpave control points. However, one gradation passed through the restricted zone, one gradation was above the restricted zone, and two gradations were below the restricted zone. Three of the four coarse aggregates satisfied the Superpave coarse aggregate angularity criterion. All fine aggregate sources satisfied the Superpave criteria for angularity.

The five asphalt binders consisted of one AC-20 asphalt cement, two polymer-modified AC-20 binders, one AC-30 asphalt cement, and one polymer-modified AC-30 binder.

The Hveem mix design method was used to establish the optimum asphalt content with 1.5 percent lime in accordance with Nevada DOT practice.

The following selection criteria for desirable HMA mixtures has been developed from the statistical analysis of a seven-year database on the strength properties of Nevada DOT's HMA mixtures, and is based on the 80 percentile of the mixtures.

- Minimum resilient modulus (Mr) at 25°C of 1,500 MPa for polymer-modified AC-20 mixes and 1,850 MPa for all other mixes.

- Minimum Mr at 40°C of 350 MPa

- Minimum tensile strength (TS) at 25°C of 450 kPa

- Minimum resilient modulus and tensile strength retained ratios of 70 percent.

The permanent deformation of all mixes was evaluated with a dynamic, confined creep test at 40°C conducted on 102-mm diameter by 204-mm high specimens. The criteria for desirable HMA mix was a maximum allowable permanent strain of 1 percent under 12,000 cycles.

The thermal stress restrained specimen test (TSRST) was used to predict the low temperature performance of the HMA mixtures. The TSRST consists of subjecting

a 50x50x250 mm HMA beam to a cooling temperature gradient of 10°C/hour while maintaining it at a constant length until the beam fractures.

The following conclusions have been drawn from this study which involved a total of 64 mix designs:

- A total of 10 mixtures failed the Nevada DOT Hveem criteria. These mixtures were not evaluated for other criteria.

- The mix strength property criteria represented by the Mr at 25°C, Mr at 40°C, and TS at 25°C eliminated a total of six mixtures with Mr at 25°C being the most severe criterion.

- The moisture susceptibility criteria proved to be the most restrictive failing a total of 16 mixtures.

- Of the HMA mixes only four mixes failed the criteria of 1 percent maximum permanent strain in the permanent deformation test. The low number of failing mixes indicates that the Mr at 25°C and 40°C criteria eliminated most of the mixes with poor resistance to permanent deformation.

- The TSRST data indicate that the asphalt binder is the main contributor to the mixture's resistance to low temperature cracking.

- The HMA mix gradation above the Superpave restricted zone did not generally produce desirable HMA mixtures. On the other hand, the gradation passing through the restricted zone did produce some desirable mixes.

AGGREGATE SPECIFIC GRAVITY FOR VOLUMETRIC MIX DESIGN - BULK OR EFFECTIVE?

Standard Marshall and Superpave volumetric mix designs require the use of *bulk* specific gravity of the aggregate (AASHTO T 84 and T 85) for calculating the voids in the mineral aggregate (VMA) and the amount of asphalt binder absorbed by the aggregate. However, some highway agencies use the *effective* specific gravity of the aggregate for calculating the VMA. The VMA values calculated with the *bulk* specific gravity can be significantly different than those calculated with the *effective* specific gravity in case of absorptive aggregates. We would like to hear arguments from both camps (those in favor of using the *bulk* specific gravity and those in favor of using the *effective* specific gravity). The discussion will be published in the next issue of the **Asphalt Technology News**.

- Editor

SPECIFICATION CORNER

Alabama - Superpave binder specifications were implemented on January 1, 1997. Quality assurance for the binders is still controlled by the same general program adopted for viscosity graded asphalt cements. Nine Superpave projects will be let in the spring of 1997. At least one of these projects will require a polymer modified PG 76-22 binder. The number of Superpave projects per year will be doubled until the full Superpave implementation is achieved by the year 2000. Ignition furnaces are being introduced as an acceptable way to determine asphalt binder content.

Florida - In order to reduce the permeability of coarse-graded Superpave mixes, Florida DOT is setting the target density level at 94% of G_{mm} (theoretical maximum density) based on pavement cores, and is increasing the minimum lift thickness to four times the nominal maximum aggregate size. Any pavement with failing densities will be evaluated for excessive permeability prior to acceptance. Pavements with unacceptable permeability values will be removed and replaced.

Georgia - Effective January 1, 1997, the Georgia Department of Transportation (GDOT) implemented the Superpave performance graded (PG) binder specification. This specification gives the requirements for four paving grades (PG 76-22, 67-22, 64-22 and 58-22). Georgia, prior to 1997, was an AC-30 state. If PG 64-22 was specified as the main paving grade, materials received in Georgia would be comparable to an AC-20. Georgia has previously experienced performance problems on high traffic volume routes due to hot summer climate. Therefore, GDOT has used AC-30 as their standard paving grade and generally allows the use of AC-20 in mixes containing RAP. To correct this situation, GDOT specifies a PG 67-22 as the standard paving grade for HMA mixtures. This is equivalent to the AC-30 that was formerly used in the state. PG 64-22 can be used in recycled HMA mixtures. Also in GDOT'S polymer grade, PG 76-22, GDOT requires a maximum phase angle. By doing so, GDOT insures that material with favorable elastic properties is received.

Illinois - Illinois DOT (IDOT) may have up to nine Superpave demonstration projects this year. These projects will use "proven" Marshall designs that will be compacted in the gyratory compactor. The number of gyrations (N_{des}) will be picked off the compaction curve at 4 percent air voids and used in the field for process control. Performance-graded asphalt binders will be specified on these projects; however, the aggregate consensus properties will not be used. Illinois

is looking at the aggregate consensus properties and will modify these requirements for Illinois needs. IDOT will adopt and specify these modified aggregate consensus properties for the 1998 Superpave demonstration projects. The ignition test is required on the 1997 Superpave projects to control asphalt content. In addition, the ignition test may be used on any QC/QA project for determining asphalt content in 1997.

Indiana - All hot mix asphalt placed this year on projects employing Superpave specifications will come from certified hot mix plants. These plants are certified according to the Indiana Certified Hot Mix Asphalt Producer Program. This program allows the producer to take responsibility for all aspects of the production of quality hot mix asphalt in accordance with contract requirements while the Department of Transportation monitors the producers production, sampling, and testing procedures. Testing is completed by, or under the direct supervision of, the producer's certified bituminous technician and covers the aggregate stockpiles, blended aggregate, and the hot mix asphalt.

Kansas - About three projects are being let this year to implement a QC/QA Superpave specification.

Kentucky - The following specification changes are of significance:

- Acceptance of hot mix asphalt (HMA). (1) All mixtures will be accepted by mix volumetric in 1997; (2) The HMA sampling/testing frequency has been changed from two per day's production in 1996 to one per sublet (1000 tons) in 1997 (four sublets equal one lot); (3) Compaction acceptance will be by roadway cores for most major highways; and (4) The coring frequency has been changed from one per 2500 ft. of 12-ft. lane in 1996 to four per sublet in 1997.
- Implementation of Superpave. (1) All asphalt binders will be classified by the PG system in 1997; (2) Each of the states's 12 Districts will receive a Superpave gyratory compactor (either through the equipment budget or purchase from project funds); (3) At least one project will be selected in each District in 1997 for Superpave mixture specifications; and (4) Superpave mixture training for state and industry personnel will be conducted in 1997.

Maine - Twelve pilot projects with QC/QA specifications with both incentives and disincentives for Superpave mixes will be advertised. This is in anticipation of a switch to Superpave volumetric mix
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design statewide in 1998. Maine will allow the use of PG 64-22 in lieu of AC-20 binder this year.

Maryland - Superpave projects are specified using ES AL'S, PG binders, and references to relevant AASHTO standards. It is planned to control stone matrix asphalt (SMA) mixes by the use of Superpave gyratory compactor.

Michigan - The Superpave will be implemented over the next two years. The Superpave specification recommended by the FHWA will be used during this construction season. Modifications to the specification, if needed, will be made at the end of this year. More projects will be constructed in 1998 with the modified Superpave specification. PG binders will be accepted based on the properties of the binder recovered from HMA. Field control of HMA will be done with Superpave gyratory compactors.

Mississippi - The Mississippi DOT (MDOT) has implemented Superpave binder specifications for all hot mix asphalt contracts let in January, 1997 and beyond. Two PG grades are used, PG 64-22 as the standard grade and PG 76-22 for pavements with heavy traffic. The PG 76-22 grade specifications include a requirement that it be made by modifying an asphalt cement meeting a PG 64-22 grade with an approved polymer. MDOT adopted an interim policy in early 1996 requiring a PG 76-22 binder to be used on interstate routes and all others having design ESALS ≥ 3 million. Beginning with contracts in January, 1997, all HMA mix designs will use the Superpave gyratory compactor (SGC) with field control by either the SGC or Marshall. Beginning in August, 1997, all contracts will require both HMA mix design and field control by SGC.

Missouri - The Superpave PG binder grading system has been implemented this year. Currently PG 64-28 is being specified in all interstate mixes, PG 64-28 in all high traffic pavements that lie south of Route 36, and PG 58-34 in all high traffic pavements that lie north of Route 36.

Montana - The following specification changes have been made:

- Contractor Optioned Asphalt Binder. This new specification permits a paving contractor to substitute a performance graded (PG) binder for a standard penetration graded asphalt. This will allow refineries which are ready to supply PG binders the option to do so. There is no financial incentive at this point for the switch, however.
- Performance Graded Asphalt Binders. This Montana specification was initially used on one project in 1996 and will be used on approximately five to seven jobs in 1997.

plant Mix Surfacing -Grade "S" ("S" as "Superpave"). This new specification incorporates and ties together the Superpave mix design process, the Superpave gradations, and the Superpave mix criteria for use in upcoming projects. Two projects were constructed in 1996 using the Grade S specification, with good results. These specifications are all being instituted in an effort to implement Superpave in Montana. Montana will also let to contract one project in 1997 that will require the contractor to cut cores from newly placed HMA to determine the mat density for acceptance purposes. This departs from the current practice where nuclear gauge is used. This tentative change will eliminate the core to nuclear gauge correlations and will provide a better tool to manage in-place voids.

New Hampshire - New Hampshire DOT is changing the standard aggregate sieve sizes (such as #10, 20, 40, 80 sieves) to the sizes specified in Superpave. The Department is also metricating its standard specifications and manuals.

New Jersey - New Jersey DOT is moving towards an end result acceptance specification for HMA. The first Superpave project will be constructed this year on State Route 27 in Princeton. Six Superpave jobs have been planned for 1998.

North Dakota - As part of a continuing effort to implement Superpave, the North Dakota DOT is moving toward PG binders. All of the central lab asphalt technicians have been trained in Superpave mix design procedures and Superpave binder testing methods. Currently, Superpave mix designs are being developed on an experiment basis. The QC/QA asphalt program has been implemented, and is used on most major projects, based on ESALS and total tonnage.

Ohio - Ohio operated under QC/QA for a number of years for most hot mix. The remaining method specification hot mix has now been moved under QC/QA but with a twist. The Department is operating under two acceptance methods for these recently changed mixes and may eventually move all mixes to this process. The concept is that the department will verify the contractor data and use the contractor data in pay calculations. The twist is that contractor mix control, following his QC plan, responsiveness and cooperation are all considered and if problems exist acceptance can move into a riskier plate sampling and statistical acceptance plan similar to current Ohio specification Section 448.

Ohio is using SBR and SBS polymers in heavy traffic HMA mixes. However, the reason is not for rut resistance which is a benefit but for the slowed aging effects, reduced deterioration (joint and segregated

areas), resistance to moisture damage, and crack resistance found with these products. Since the Superpave does not adequately measure the benefits of these modifiers a method specification is in place until an adequate system for specifying the desired quantity of polymer can be put together.

Last year's change for establishing the optimum asphalt content at 3.5 percent air voids on all secondary routes is working out well.

Oklahoma - Superpave PG binder specification was implemented on January 1, 1997.

Pennsylvania - The Pennsylvania DOT is currently in the process of implementing a special provision for material transfer vehicles (MTV). This special provision will allow the Department to specify and require the use of a MTV on particular projects that are designed with large stone mixtures which are prone to segregation. This special provision was jointly agreed to by the Department and Industry as a method to help reduce end-of -load segregation.

In addition, the Department is currently in the process of revising its general restricted performance specifications for HMA courses to address overcompaction of the mat. Until now, the specification was a single-tailed specification and only assigned penalties and reduced payment factors for lot averages or single sublots not compacted to a density of at least 92 percent of the maximum theoretical density. The specification is now being revised to a double-tailed specification and will assign penalties and reduced payment factors for lot averages or single sublots which are either undercompacted or overcompacted to a density greater than or equal to 97 percent of the maximum theoretical density.

South Carolina - The use of PG 64-22 in lieu of AC-20 or AC-30 for all Marshall and Superpave mix designs has been implemented with the January 1997 letting. The contractor must perform all Marshall mix designs. The DOT continues to perform all Superpave mix designs.

Texas - The QC/QA specification for HMA has been revised to reflect the re-assignment of testing responsibilities. The DOT personnel will conduct the tests involving pay factors whereas the contractor will conduct quality control (QC) tests.

Utah - Utah DOT (UDOT) has fully implemented the Superpave binder specifications along with a binder management program to ensure the quality of the PG asphalt binders. UDOT has also implemented the Superpave volumetric mixture specifications. The Superpave gyratory mix design is being turned over to

the contractor to conduct with an AMRL accredited laboratory.

UDOT has recently purchased 26 NCAT ignition ovens for asphalt content testing and has conducted training on its use. The ignition ovens will be used this construction season in place of asphalt extraction testing.

Virginia - Only PG binders will be used in 1997. PG 64-22 is the primary asphalt binder, PG 70-22 and 76-22 are also used. Contracts for one Superpave project in each district are being let. Contractors are responsible for HMA mix design.

West Virginia - The use of PG binders has been incorporated into asphalt specifications beginning this year. However, there is some concern about the variability of testing between labs using the new binder test equipment. With a statistical based binder certification system this variability could cause problems. One Superpave project is scheduled for 1997. It consists of a 100 mm overlay on Interstate 79 just north of Charleston. The existing pavement is concrete. The project specifies 75 mm of a 19 mm Superpave mix and a 25 mm lift of a 9.5 mm Superpave skid resistant surface mix. All of the Superpave materials and design requirements will be used on this project.

Wyoming - The first HMA paving job using a PG asphalt binder will be constructed this year. QC/QA specifications were used on two projects last year. ten projects will use these specifications this year.

New Brunswick, Canada - In 1997 construction season the New Brunswick DOT will tender approximately 175,000 tons of end result specification HMA. Acceptance criteria is based on asphalt content, gradation, compaction, thickness, and smoothness. These contracts will also include use of a PG 58-34 binder.

The Department has purchased a total of seven ignition ovens for determination of asphalt content and gradation.

Ontario, Canada - A new specification has been developed for acceptance of hot mix asphalt based on contractor's test results. The specification requires contractors to produce a QC plan prior to start of work as part of contract bidding requirements. This specification will apply to contracts greater than 30,000 tons of hot mix asphalt.

A Non-Standard Special Provision, Interim Guidelines and Protocol for Supply of performance graded asphalt cement (PGAC) have been developed for implementation of PGAC in 1997.

NCAT's 1997 ASPHALT TECHNOLOGY COURSE ATTENDEES AND INSTRUCTORS



Left to Right: (Row 1) Adam Finocchi, Marc Elias, Martin Calawa, Tim Bishop, Mike Bishop, Brett Harris, Chris Bishop (Row 2) Javier Ibarra, Kamel Alqalam, Andy Byra, Mary Stroup-Gardiner, Ray Brown (Back Row) Ken Kandhal, Richelle Suzuki, Wes Bolinger, Doug Hanson



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