

Superpave Program Project Status Report

BACKGROUND

The TRB Superpave Support Team has developed the following status report of all Superpave-related projects, their major objectives, the intended product, and the major follow-up activities that will ultimately need resolution. All of the projects relate, at least in some measure, to accomplishing the Superpave 2005 goals.

The report is divided into the following sections, with projects listed numerically:

- NCHRP Projects
- FHWA Projects (w/NCHRP funds)
- NCHRP Synthesis Projects
- National Pooled Fund Studies
- Future Potential Pooled Fund Studies
- State-managed Pooled Fund Studies
- Other National Studies

National and regional training will be added at a later date.

NCHRP PROJECTS

NCHRP 4-30 Improved Testing Methods for Determination of Critical Shape/Texture Factors for Aggregates

Due: *Contract Pending*

Research Agency:

Cost: \$500,000 (Phase 1
\$50,000 with approval
needed to complete rest of
work)

The objective of this research is to identify or develop, for use in central and field laboratories, suitable test methods for measuring shape, texture, and angularity characteristics of aggregates used in hot-mix asphalt, hydraulic cement concrete, and unbound base and subbase layers of highway pavements. The research should focus on the characteristics of coarse aggregates, but may also consider the characteristics of fine aggregates. While this research was originally proposed as asphalt aggregates only, AASHTO SCOR opted to include concrete aggregates as well.

The work is divided into two phases: collecting and evaluating existing information on test procedures and methods and developing a research plan; and executing the plan.

The original research statement on asphalt aggregates referenced two procedures for aggregate evaluation that offer potential improvements. They are the multiple ratio shape analysis (described below) and the use of imaging technology (x-ray tomography) to model and quantify aggregate shape and texture. Information on these procedures has been recently presented at the Superpave Mixture/Aggregate Expert Task Group meetings. It is not clear whether the research requires consideration of these techniques. Also, the research statement suggested that the research develop a plan to determine the impact that aggregate properties may have on field performance, not just laboratory values.

The current Superpave procedure for determining and describing an aggregate sample's particle shape (one number for a given ratio of maximum compared with minimum particle dimensions) provides very limited detail about the variety of particle shapes found within the sample. An improved procedure for determining an aggregate sample's particle shape is needed. Multiple ratio analysis evaluates a sample on five different ratios instead of one (<2:1, 2:1 to 3:1, 3:1 to 4:1, 4:1 to 5:1, >5:1), which gives an accurate picture of particle shapes. This procedure can be conducted with a relatively simple caliper device.

NCHRP 4-35 Research on Aggregate Properties and Effects on Superpave Designed Mixes

Due: Contract initiated

Research Agency:

Cost: \$75,000

Performance of hot mix asphalt is influenced by the characteristics of its two main constituents, asphalt binder and aggregate. SHRP emphasized developing new binder tests but only limited efforts were dedicated to aggregate tests and criteria. Over the last 10 years, the measurement of aggregate properties has received more attention, especially the effects on asphalt mixture performance. The Mix/Aggregate ETG believes that there is considerable research and evaluation ongoing in the United States and internationally. Before recommending further research, they believe the highway industry needs to collect this information in an organized format to determine what is and is not being studied. This would then allow for better organization of future research efforts.

Originally suggested as a synthesis, the topic will be released as a research contract.

NCHRP 9-07 Field Procedures and Equipment to Implement SHRP Asphalt Specifications

Due: Complete

Research Agency: Brent Rauhut Engineering

Cost: \$1,085,784

The objectives of the project were to (1) recommend quality control/quality acceptance (QC/QA) procedures for measuring and monitoring the volumetrics of plant-produced Superpave HMA and (2) develop a simplified field shear test (FST) device and method for field QC/QA of plant-produced Superpave HMA. The device would also function as a mix design tool for predicting the susceptibility of HMA to permanent deformation in service.

This project developed a QC/QA plan in AASHTO standard format for HMA paving projects incorporating Superpave mix designs. See NCHRP Report 409, "Quality Control and Acceptance of Superpave-Designed Hot Mix Asphalt." However, the research team, while developing a prototype FST device, was only able to complete limited validation testing. See follow-up work in NCHRP 9-18.

Implementation: NCHRP has sponsored a review of the current practice included in the report to see how it can be advanced. The report should be available by March 2002.

NCHRP 9-9 Refinement of the Superpave Gyrotory Compaction Procedure

Due: Complete

Research Agency: Auburn University

Cost: \$499,850

The key product is a recommendation soundly supported by experimental results to reduce, from 28 to 4, the number of possible design gyration values in AASHTO MP2 and TP4. This recommendation was accepted by the FHWA Mixture Expert Task Group and referred to the AASHTO Lead States Team and AASHTO Subcommittee on Materials.

Implementation: The changes have been incorporated into AASHTO standards.

NCHRP 9-9(I) Verification of Gyration Level in the N_{design} Table

Due: June 2003

Research Agency: Auburn University

Cost: \$276,482

The objective of this project is to verify through a series of 40 field project evaluations that the gyration levels in the N_{design} table in AASHTO MP2 are correct for the stated project traffic levels and to modify the levels as required. Data collection is now underway on 75% of the projects. “As constructed” in-place void content values are $8.4\% \pm 1.9\%$ at construction and $6.7\% \pm 2.1\%$ at 6 months. The projects will be tracked for at least 24 months.

NCHRP 9-10 Superpave Protocols for Modified Asphalt Binders

Due: Complete

Research Agency: Asphalt Institute

Cost: \$995,148

The objectives of this research were (1) to recommend modifications to the Superpave asphalt binder tests for modified asphalt binders and (2) to identify problems with the Superpave mixture performance tests in relation to mixtures made with modified asphalt binders. The final report has been published.

Currently, NCHRP 90-02, 90-04 and the Binder ETG are doing a validation/verification of the recommendations included in this project. Final recommendations on AASHTO Provisional Standards PP5 and MP 1 should be forthcoming by the end of 2002.

NCHRP Report 459, “Characterization of Modified Asphalt Binders in Superpave Mix Design” is now available.

Implementation: Many of the recommendations in the report are currently being evaluated under NCHRP 90-02 and NCHRP 90-07.

NCHRP 9-12 Incorporation of Reclaimed Asphalt Pavement in the Superpave System

Due: Complete

Research Agency: NC Superpave Center (Purdue)

Cost: \$464,202

The objectives of this research were to (1) develop guidelines for incorporating RAP in the Superpave system and (2) prepare a manual that can be used by laboratory and field technicians. Both have been completed and published.

Currently, the Mix/Aggregate ETG is reviewing the report. Changes to MP2 and PP28 were forwarded to AASHTO and included in provisional standards. Additionally, NCHRP is developing an implementation document that summarizes the report and includes implementation recommendations.

The report is available on CD-ROM (CRP-CD-8), Bituminous Materials Research Series II and also as NCHRP Report 452 and NCHRP RRD 253.

NCHRP 9-13 Evaluation of Water Sensitivity Tests

Due: Complete

Research Agency: U of Nevada-Reno

Cost: \$150,000

The objectives of this research are to (1) evaluate AASHTO T 283, and (2) recommend changes to make it compatible with the Superpave system. The revised final report has been published as NCHRP Report 444, "Compatibility of a Test for Moisture-Included Damage with Supreme Volumetric Mix Design." No further work is contemplated.

The report is available on CD-ROM (CRP-CD-8), Bituminous Materials Research Series II.

Implementation: Complete

NCHRP 9-14 Investigation of the Restricted Zone in the Superpave Aggregate Gradation Specification

Due: Complete Research Agency: Auburn University w/NCAT

Cost: \$515,392

The objectives of this research were to determine through evaluation of the performance properties of hot mix asphalt (HMA) if the restricted zone requirement is redundant with fine aggregate angularity (FAA) and volumetric mix criteria and, if appropriate, to identify the traffic levels at which it is redundant. Results show that conformance to the restricted zone is unnecessary when a mix design satisfies all consensus standards (focusing on FAA) and volumetric mix criteria. The Mix/Aggregate ETG reviewed the results and agreed that restricted zone requirements are redundant for mixes meeting volumetric requirements. Their final language has been drafted and will be forwarded to AASHTO SOM through the TRB Superpave Committee.

Final report is available as NCHRP Report 464.

Implementation: The Mix/Aggregate ETG recommended elimination of the restricted zone and the inclusion of a definition of coarse and fine mixes. Their recommendations are being forwarded through the Superpave Committee to AASHTO for processing.

NCHRP 9-15 Quality Characteristics and Test Methods for Use in Performance-Related Specifications of Hot-Mix Asphalt Pavements

Due: December 2001

Research Agency: Fugro-BRE

Cost: \$449,995

The objectives of this research are to (1) identify construction-related quality characteristics of HMA pavement that affect long-term pavement performance; (2) identify quality characteristics of as-produced FMA that reflect compositional, volumetric, and fundamental engineering properties in terms of long-term pavement performance; and (3) select and prepare for use in PRS simple, practical, and rapid tests that measure these quality characteristics in the field. An experimental plan has been developed and is currently being implemented.

Results will feed directly into subsequent PRS contract work.

NCHRP 9-16 Relationship Between Superpave Gyrotory Compaction Properties and Permanent Deformation of Pavement in Service

Due: November 2001 Research Agency: Asphalt Institute

Cost: \$250,000

Superpave mix design is based on material properties, volumetric mix properties, and densification characteristics during gyrotory compaction. Properties of the densification curve are believed to be related to permanent deformation, but their connection has not been quantified.

The objectives of this project are to (1) determine the relationship between mix properties measurable during Superpave gyratory compaction and permanent deformation of pavements in service and (2) recommend any practical modifications to existing Superpave gyratory compactors, test methods, or both, to measure the identified properties.

Results to date suggest that the best candidate property, $N@SR_{max}$ (# of gyrations at maximum stress ratios) may identify gross mixture instability, but it does not provide an accurate estimate of rut depth.

The draft final report is under review by the project panel.

Implementation: The contractor is developing a draft procedure in AASHTO format.

NCHRP 9-18 Field Shear Test for Hot Mix Asphalt

Due: October 2001

Research Agency: Penn State

Cost: \$200,000

This is follow-on to NCHRP 9-07. The objectives of this project are to (1) enhance and refine the field shear test (FST) device and procedure for quality control and quality assurance (QC/QA) of the production and lay down of Superpave hot mix asphalt; (2) validate the effectiveness of the FST method in field QC/QA and as a mix design tool for predicting the susceptibility of HMA to permanent deformation in service; and (3) facilitate the implementation of the FST as a standard method in field QC/QA and in mix design.

Phase I results were highly encouraging, and the panel recommended a contract extension of several months to provide the project team with adequate time to evaluate a promising prototype field shear test device of new design. The redesigned FST was found capable of performing a variety of tests, but the best results were obtained from the frequency sweep procedure described in AASHTO TP7 at high temperatures and high frequencies. Under these conditions, the equipment produced dynamic modulus values and phase angles in the same range as those generated using the full-sized Superpave shear test equipment described in AASHTO TP7; moreover, these results were found to be fairly sensitive to changes in asphalt concrete composition. However, while the data repeatability of the redesigned FST is similar to other methods for measuring asphalt concrete stiffness, it remains too high for QC/QA testing.

The final report will be published as NCHRP RRD 262.

Implementation: None anticipated.

NCHRP 9-19 Superpave Support and Performance Models Management

Due: March 2002

Research Agency: U of MD

Cost: \$2,100,000

This project continues work started in July 1995 under sponsorship of the Federal Highway Administration (FHWA). The original FHWA project was divided into two phases. Phase I, completed in September 1996, evaluated the Superpave performance models developed through the Strategic Highway Research Program. In Phase II, begun in November 1997, the contractor was tasked with development and validation of an advanced material characterization model and the associated calibration and testing procedures for hot mix asphalt used in highway pavements. It also includes a simple performance test to complement the Superpave volumetric mix design method.

Task A. User support for Superpave Version 2.0 Software. *Complete.*

Task B. Enhanced and recalibrated version of the Superpave thermal cracking model. *Complete*. The model has been incorporated in the 2002 Design Guide.

Task C. Finalize protocols for simple performance tests that can be incorporated in the Superpave volumetric mix design method. The candidate tests for permanent deformation and low-temperature cracking gave results that are highly correlated with the field performance of MnRoad, WesTrack, and FHWA ALF experiments. The tests include the dynamic modulus, static creep (flow time), and triaxial repeated load permanent deformation (flow number). Field evaluation is currently underway. Eventually, the output will feed into NCHRP 9-29 and a national pooled fund for procurement. The validation, however, is severely hampered by a lack of retained loose mix from LTPP projects and gaps in traffic and performance data. *Complete*.

Task D and E are coordination tasks.

Task F. Develop an advanced material characterization model and associated calibration and testing procedures to support performance prediction models for permanent deformation, fatigue cracking, thermal cracking, and reflection cracking distresses in HMA pavements.

Task G will provide further validation of the products developed in Task F.

A panel meeting is scheduled for April 2002.

NCHRP 9-20 Performance-Related Specifications for Hot-Mix Asphalt Construction

Due: Complete Research Agency: Nevada Auto Test Center Cost: \$1,500,000

Commonly known as the WesTrack Project, the objectives of this research were to (1) develop performance-related specifications (PRS) for HMA pavement construction by examining how deviations in materials and construction properties, such as asphalt content and degree of compaction, affect the eventual pavement performance; and (2) provide early field verification of the Superpave mix design method.

The final report has four parts: (1) WesTrack Project Overview, (2) Performance-Related Specification; (3) WesTrack Database (Overview and User's Guide); and (4) Observations and Lessons. It will be published as NCHRP Report 455. The Federal Highway Administration is publishing the supporting technical reports and the WesTrack database on CD-ROM for joint distribution with the NCHRP report. The *PAVSpec* software is not available for public distribution at present; it is being beta-tested and validated as part of NCHRP Project 9-22.

NCHRP 9-21 Superpave Advisory Structure

Due: Continuous Management Agency: TRB Cost: \$250,000/yr

This project provides for the organization, management, and documentation of the TRB Superpave Committee and support activities with Expert Task Groups (ETG). The project funding is subject to annual review and request. Currently, three ETGs have been established. They consist of the Mix/Aggregate ETG, the Binder ETG, and the Communications and Training ETG. It is expected that the Committee will remain active through completion of the Long-Range Plan.

NCHRP 9-22 PRS - Beta Testing and Validation of HMA

Due: January 2004

Research Agency: Fugro-BRE

Cost: \$500,000

The objectives of this project are to (1) evaluate and define the HMA PRS and supporting software developed through the WesTrack project in a series of field trials, (2) calibrate and validate the performance models for Levels I and H, and (3) develop a training course curriculum and materials to assist the implementation of the HMA PRS and software by state highway agencies. NCHRP Projects 9–15 and 9–20 feed directly into this project.

Work is currently underway to evaluate the software developed under NCHRP 9–20 as a “shadow specification” in field projects completed in 2001 in AZ, CO, FL, MD, and IL. Fieldwork is being done under NCHRP 90-01 (mobile laboratory). Future work will include incorporating the 2002 Design Guide models into the next version of PRS, rather than the WesTrack models.

NCHRP 9-23 Integrated Climatic Model (ICM) Validated with LTPP Seasonal Monitoring Program

Due: August 2003

Research Agency: Arizona State University

Cost: \$430,000

The objectives of this research are to (1) validate the latest version of Integrated Climatic Model (ICM) developed in NCHRP Project 1–37A with data from the full Long-Term Pavement Performance Seasonal Monitoring Program; (2) develop practical guidelines for selecting ICM input data sets; (3) verify the estimated period or rate of aging simulated by the current Superpave binder and hot mix asphalt conditioning procedures—AASHTO provisional practices PP 1 and PP2—with data from Long-Term Pavement Performance Specific Pavement Studies and other relevant field experiments; and (4) revise the current conditioning procedures as necessary for their use with the materials characterization test and model under development in NCHRP Project 9–19 for the Superpave performance model system. Fieldwork began late in 2001 to gather data needed to accomplish objectives 1 and 3.

NCHRP 9-25 Requirements for Voids in Mineral Aggregate for Superpave Mixtures

Due: October 2003

Research Agency: AAT

Cost: \$400,000

The objective of this research is to develop recommended mix design criteria for VMA, VFA, or calculated binder film thickness, as appropriate, to ensure adequate HMA durability and resistance to permanent deformation and fatigue cracking for coarse and fine, dense-graded mixes in the context of the Superpave mix design method.

NCHRP 9-26, Precision Statement for AASHTO T 312

Due: January 2003

Agency: AASHTO Materials Reference Laboratory

Cost: \$150,000

The objectives of the research are to (1) develop a precision statement for AASHTO T 312-01, “Standard Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor;” (2) update the current precision statements for AASHTO T 166, “Bulk Specific Gravity of Compacted Bituminous Mixtures” and ASTM D2041-00, “Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures;” and (3) develop a preliminary precision statement for determination of the bulk and maximum specific gravities of bituminous mixtures with the CoreLok device.

Currently, the main interlaboratory test program is underway with 27 laboratories participating; materials include 12.5-mm and 19-mm HMA mixes with both low- and high-absorption aggregates.

NCHRP 9-27 HMA In-place Air Voids, Lift Thickness, and Permeability

Due: October 2003 Research Agency: Auburn - NCAT Cost: \$350,000

The objectives of this research are to (1) determine the minimum HMA lift thicknesses and minimum in-place density necessary to achieve an impermeable, durable pavement and (2) recommend improvements to AASHTO T 166, “Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface—Dry Specimens,” to achieve a precise, uniform, and more accurate determination of the bulk specific gravity of compacted HMA specimens.

Work began in April 2001.

NCHRP 9-28 Field Verification of the Advanced Materials Characterization Model and Test

Due: November 2002 Research Agency: ASU Cost: \$400,000

Task F of NCHRP Project 9–19, “Superpave Support and Performance Models Management,” will provide three products: an advanced materials characterization (response) model for Superpave performance model system; a materials characterization test to support the model; and a general description of the performance prediction model framework. Model calibration and evaluation in Task F is limited to a single reference mix design, although sensitivity testing will be conducted to confirm that the measured laboratory responses and material responses are sensitive to changes in mix properties, such as asphalt and air voids content.

The final step of the material characterization model is its verification with materials of known performance in controlled field experiments. This effort will employ, as is possible, materials and data from the field performance evaluation underway in Task C of NCHRP Project 9–19, but additional controlled field performance projects, such as LTPP SPS–1 and SPS–9, may be included if possible.

The objectives of this research are to conduct a field verification of the selected material characterization model and material characterization test; to prepare the verified test in the form of draft AASHTO standard methods; and to recommend test equipment configurations to carry out the draft method in routine laboratory operations.

This work is underway as Task G of NCHRP 9–19.

NCHRP 9-29 Simple Performance Tester (SPT) for Superpave Mix Design

Due: April 2003 Research Agency: AAT Cost: \$349,937

NCHRP Project 9–19, “Superpave Support and Performance Models Management,” is tasked with identifying these simple performance tests. Three good candidates for permanent deformation and one for fatigue cracking were recently identified. A test protocol has been developed for each test by the Project 9–19 research team. One of the recommended simple performance tests, dynamic modulus, is also the prime candidate for HMA materials characterization for pavement structural design in NCHRP Project 1–37A, “Development of the 2002 Guide for the Design of New and Rehabilitated Pavement Structures: Phase H.”

Adoption of the simple performance test for routine use in the Superpave mix design method will require the production of commercial test equipment. This will include development of equipment specifications, equipment evaluation, ruggedness evaluation, and final procedure verification—all leading to a national procurement for the state DOTs and eventual widespread adoption and use in the HMA industry.

The objective of this research is to design, procure, and evaluate simple performance testers for use in Superpave mix design and in HMA materials characterization for pavement structural design. The testers will evaluate the resistance of Superpave-designed HMA to permanent deformation and fatigue cracking during mix design and, possibly, in field quality control.

The research agency sponsored two workshops in 2001. A Users Workshop, held on May 30, reviewed the protocols and explored the possibility that one piece of equipment could do both mix evaluation and quality control. The consensus was that it would be very difficult to do both. A Manufacturer's Workshop was held on July 30 to obtain industry member comments and recommendations. The research agency issued an RFP in November 2001, looking to buy two first article units by June 2002 for further evaluation. Two manufacturers were selected and procurement contracts issued; the first articles are due for delivery in July 2002.

NCHRP 9-30 Development of a Models Validation Experimental Plan

Due: April 2003

Research Agency: Fugro-BRE, Inc.

Cost: \$200,000

The objective of this research is to develop a detailed, statistically sound and cost-effective experimental plan to refine the calibration and validation of the performance models incorporated in the proposed 2002 design guide with laboratory-measured hot mix asphalt (HMA) material properties for future use in mix and structural design methods.

The Superpave mix design method will confirm and refine volumetric mix designs on the basis of predicted performance (permanent deformation, fatigue cracking, and low-temperature cracking) for project-specific structural section, traffic, and climate. Development of the required performance model system is planned for completion in FY 2005 and is expected to heavily rely on the state-of-the-practice performance models identified for hot-mix asphalt in NCHRP Project 1-37A, Development of the 2002 Guide for the Design of New and Rehabilitated Pavement Structures.

NCHRP 9-31 Air Void Requirements for Superpave Mix Design

Due: October 2003

Research Agency: AAT

Cost: \$250,000

In the Superpave mix design method, specified volumetric mix properties are evaluated at a design air void content of 4 percent regardless of the traffic loading and climatic conditions. However, because of local experience and concerns about achieving adequate hot-mix asphalt (HMA) durability and performance, some agencies have modified this requirement.

The objective of this research is to recommend for future field validation the range of design air void content, within the context of the Superpave mix design method, required for adequate durability and resistance to permanent deformation and fatigue cracking of dense-graded HMA.

NCHRP 9-32 Evaluation of Indirect Tensile Testing and Identification of Future Activities

Due: Phase III Project 9-29

Research Agency: AAT

Cost: \$100,000

The Strategic Highway Research Program (SHRP) developed the Indirect Tensile Tester (IDT) to measure HMA material properties for use in prediction of low-temperature cracking. The IDT test method is contained in AASHTO TP9. Both the NCHRP Projects 9–19 and 1–37A contractors have identified the TP9 method as the most promising available for predicting low temperature pavement performance. Work is also underway to examine whether AASHTO TP9 can be performed with simpler, less expensive equipment than the current IDT.

The objectives of this research are to collect and analyze available IDT test data and derived HMA material properties; evaluate the application and utility of the test in mix designs and analysis; and recommend a future course of action for the equipment and associated test method.

NCHRP 9-33 Superpave Mix Analysis Method, Software, and Manual

Due: RFP will be issued in mid-2002 Research Agency: Cost: \$500,000

The objective of this research is to develop a complete working version of a Superpave mix design method for preparing project-specific mix designs that are durable and well performing. The method will take advantage of (1) the volumetric design method in AASHTO MP2 and PP28, (2) the simple performance tests developed in Task C of NCHRP Project 09–19, (3) the HMA materials characterization tests and performance models from the 2002 Pavement Design Guide and (4) the fully calibrated integrated climatic model from NCHRP Project 09–23.

NCHRP 9-34 Improved Test Procedure for Determining the Moisture Damage Susceptibility of Bituminous Pavements

Due: Contract pending Research Agency: Cost: \$400,000

The objective of this research is to develop an improved conditioning procedure for the moisture sensitivity of compacted HMA from the existing ECS method and the SPT developed under NCHRP Project 09–19. The new procedure will be sensitive to the effects of normal variability in material and mix properties expected during laboratory mix design and field construction.

FHWA NCHRP PROJECTS

NCHRP 90-01 Superpave Mix —Protocol Refinement and Field Validation

Due: December 2004 **Research Agency:** FHWA **Cost:** \$2,750,000

This project seeks to validate results from selected NCHRP projects quickly and efficiently through the use of the staff and resources of the FHWA Mix Team. Under this project, the Federal Highway Administration (FHWA) has refined and validated over 15 new and modified pieces of SHRP mix test equipment and procedures since the research was formally concluded. As NCHRP research continues to fill the gaps in the Superpave system, parallel and follow-up work is required for refinement and validation.

The scope of work includes the following:

Task 1—Support Field Testing of Simple Performance Tester (NCHRP 9–19 and 9–29)

Task 2—Gyratory & Permanent Deformation (NCHRP 9–16)

Task 3—Evaluation of Aggregate Tests (NCHRP 4–19(2))

Task 4—Superpave Compaction & Performance (NCHRP 9–20)

Task 5—QC/QA (NCHRP 9–07)

Task 6—Development and ruggedness testing of Superpave Gyratory Validation Kit

Current Activities:

Hydrated lime has been found to affect calibration, as well as the asphalt binder. Work was begun on a revised calibration procedure for the ignition oven, to compensate for dust in the mix. The laboratory experiment has been expanded to include various binders. This study is currently on hold until completion of the gyratory Angle Validation Kit work.

Field evidence indicates variability in gyratory data from lab to lab and a procedure for defining this variability is needed. Manufacture of a new device for calibrating the gyratory compactor, the Angle Validation Kit (AVK), is complete. An experimental design has been developed to evaluate the AVK. Preliminary data indicate that the internal angle for the gyratory compactor is less than that reported by measurement of the external angle. The current experiment will provide data to establish the required internal angle and a procedure for calibration. This new specification should remove variability caused by differences in gyratory compactors.

Refine NCHRP 9–7 tolerance database, on additional and larger projects. Data are being compiled from the existing laboratory database on completed field trials to determine production variability of volumetric properties. A paper detailing data collection and test variability was presented at AAPT. Additionally a refined procedure for field mix verification has been prepared and is currently being reviewed by the TRB Mix/Aggregate ETG.

Evaluation of the bulk specific gravity procedure for compacted specimens to reduce variability and improve accuracy. The preliminary laboratory experiment has been completed and data analysis is underway.

Evaluations of NCHRP 9–9 and Lead State recommended changes to Superpave.

Work as part of NCHRP Project 9–22 Performance Related Specifications, field trials and validation work in AZ, CO, FL, MD, and IL

Upcoming Activities:

Work on NCHRP 9–29 Development of the Simple Performance Test.

Documentation:

An interim report on the AVK was released in September 2001.

Five other reports, all included in various TRB publications, have been completed.

NCHRP 90-02 Superpave Binder Equipment & Test Procedures—Refinement and Field Validation

Due: December 2004

Research Agency: FHWA

Cost: \$1,000,000

This work will concentrate on the implementation of NCHRP 9–10, Modified Asphalts, and the output of NCHRP 90–07, Understanding the Performance of Mixtures with Modified Asphalt Binders, as well as the support of studies emanating from the Binder ETG recommendations. Under this study, updated specifications for modified binders and new test procedures will be completed. The Superpave Centers, AASHTO Materials Training Course, NM courses, and private sector training will also develop training documentation for use.

Current Activities:

Ruggedness for the Direct Tension Test—the first set of binders has been tested and the data analysis from the first sample will be used to refine the ruggedness procedure.

A new low temperature, binder criteria was developed and has been included in the AASHTO provisional specifications as MP1A. This new specification will make the low temperature criteria blind to modifier type.

Minutes for the Binder ETG were developed and distributed.

Evaluation of NCHRP 9–10 recommended changes to the RTFO Test —Laboratory experiment has been completed and a report developed indicating that the Modified RTFOT procedure developed by NCHRP 9–10 does not produce the results indicated by the contractor.

NCHRP 90-03 Superpave Mix Tenderness

Due: December 2001 Research Agency: Asphalt Institute

Cost: \$50,000

On several construction projects, Superpave mixes have developed tenderness problems during placement, which leads to difficulty in achieving proper compaction. FHWA, through a cooperative agreement with the Asphalt Institute (AI), intends to determine the cause of this problem, and recommend methods to avoid the problem. The research is intended to produce a new mixture design guide to help designers avoid mixes prone to tenderness during construction.

Lab experimentation has begun on the project. A method was developed to produce mixes in the lab with up to 2% moisture in the mix. These mixes will be used to determine the effect of excess moisture on mix properties. A procedure is also under development to sample mix at the hot mix plant and capture the actual moisture in the mix at the time of sampling.

A field study was conducted in Florida to evaluate the moisture content of tender mixes on the roadway. During the field sampling tenderness problems were not present on the roadway.

The research team is currently attempting to identify several projects with tender mixes in the field to be used for field validation and to field validate previous lab results.

An interim report has been submitted to TRB for publication in the 2002 proceedings.

NCHRP 90-04 Investigation of Modified Asphalt Systems

Due: December 2003 Research Agency: FHWA & Asphalt Institute

Cost: \$200,000

This project will validate and refine the Laboratory Asphalt Stability Test (LAST) and the Particulate Additives Test (PAT) developed under NCHRP 9–10, Protocols for Modified Asphalt Binders. Products include the development of a commercial version of the LAST, and refinement of the protocols for both the LAST and the PAT.

A draft report on LAST was sent to the Binder ETG in September. The report recommends that no further work be done; use of the test should be left to the discretion of producers.

NCHRP 90-05 Fine Aggregate Specific Gravity Test

Due: December 2001 Research Agency: NCAT

Cost: \$50,000

The Superpave Design System centers on the determination of volumetric properties of the hot mix asphalt. A key test in this process is the Fine Aggregate Specific Gravity Test. This test is used to determine aggregate properties as well as volumetric properties of the mix. The current

test is subject to operator interpretation of aggregate saturated surface dry appearance, which leads to high variability in the test results. An automated process for determining the Fine Aggregate Specific Gravity would remove operator interpretation and reduce variability in the test results and the determination of mix properties. This work is being performed through a cooperative agreement with the National Center for Asphalt Technology.

Three manufacturers have supplied prototype equipment—Gilson, Instrotek, and Thermolyne. This equipment is currently being evaluated by comparing their test results with existing AASHTO procedures. Thermolyne and Instrotek have each changed their procedure some after initial testing. Testing is continuing on the revised procedures.

NCHRP 90-06 Ruggedness Testing of Superpave Shear Tester and Indirect Tensile Tester
Due: Complete Research Agency: Multiple Cost: \$250,000

This effort consisted of ruggedness testing of two devices developed during SHRP—the Superpave Shear Tester and the Indirect Tensile Tester. The Superpave Regional Centers and FHWA’s Turner-Fairbank Highway Research Center conducted the work with the assistance of the Asphalt Institute.

The project is now completed; its findings were used to update AASHTO TP7 and TP9. Reports have been distributed.

NCHRP 90-07 and 90-09 Understanding the Performance of Mixtures with Modified Asphalt Binders and Asphalt Mastics
Due: December 2003 Research Agency: FHWA Cost: \$1,450,000

NCHRP 9-10 entitled, “Evaluation of SHRP Binder Protocols,” has developed new tests and procedures to address deficiencies in the current Superpave binder specification. AASHTO requires that the 9-10 work be validated prior to acceptance of any proposed changes. This project will, through accelerated performance testing, validate and refine the recommendations from NCHRP 9-10 and develop a Superpave binder specification that will better distinguish the performance of modified asphalt binders.

Tasks include:

- Identify modified asphalt binders representative of those currently specified by state highway agencies;
- Evaluate these modified binders using existing and proposed asphalt binder tests.
- Prepare Superpave mixes with the tested asphalt binders;
- Conduct DSR Mastic testing;
- Evaluate the mixtures using accelerated laboratory performance tests, including the proposed Simple Performance Test, and determine distresses related to rutting, fatigue, thermal cracking, and moisture sensitivity. Certain mixtures will then be selected from this process for full-scale testing at the FHWA load test facility.
- Advise AASHTO on adoption of the new specification, after full consultation and guidance from the Binder and Mix/Aggregate ETGs.

The data generated from this project will also be used to validate the products being developed under NCHRP 9-19, “Superpave Models Contract” and the proposed models in the new AASHTO 2002 Design Guide.

A pooled fund study is now in draft format for distribution to the states. The study is aimed at validating the proposed binder tests and specification.

Six interim reports have been written and distributed to the Binder and Mix/Aggregate ETGs.

NATIONAL POOLED FUNDS

Study Number SPR-2 (176) Validation of NCHRP Asphalt and Asphalt Mixture Specifications Using Accelerated Loading

Lead: FHWA
Participating States: AR, CA, CT, FL, GA, IL, IN, IA, KS, MA, MI, MN, ND, NE, NJ, NC, OH, OK, OR, PA, SC, TX, VA, WA, WI
Contractor: Purdue University
Phase I: Evaluate the sensitivities of tests used to measure the rutting resistance of an asphalt paving mixture, to changes in three material properties: (1) voids in the mineral aggregate, (2) fine aggregate angularity, and (3) aggregate gradation. Four tests were evaluated: (1) a full-scale accelerated pavement tester, (2) a laboratory wheel-tracking test called the PurWheel, (3) a triaxial compression test, and (4) the Superpave Shear Tester. Phase II—Expansion of Phase I. The properties of the materials tested in Phase I were varied widely in order to evaluate the pavement and laboratory mixture tests. The best tests were then to be used in Phase II. Under Phase II, the number and types of materials were expanded to determine how the three material properties affect rutting performance.

Objective: Validate the device for precision and bias for testing bulk specific gravity of HMA samples.

Status: Project has been completed, and a computer disc (CD) documenting the work is available from Indiana DOT.

Study Number SPR-2 (211) Bulk Specific Gravity Round Robin Using the CoreLok Vacuum Seal Device

Lead: FHWA
Participating States: AL, CA, CT, GA, MN, MT, NB, RL SC, TX, WA, WY, CFL, and WFL
Contractor: NCAT
Objective: Validate the device for precision and bias for testing bulk specific gravity of HMA samples.
Status: States have received their equipment. NCAT has prepared and shipped samples. State testing is underway.

Completion Date: *March 2002*

FHWA ALF - Field Validation of 90-07 Mixes with Modified Binders

Laboratory testing done under NCHRP 90-07 suggests that a field validation procedure for rutting and fatigue properties is desirable for the family of binders used in the study. It is proposed to conduct a pooled fund study and the FHWA ALF. A preliminary plan is now under development; a decision will be made after consultation with representatives from the Binder and Mix/Aggregate ETGs.

The first Technical Working Group under this pooled fund study was held on November 6 and 7, 2001 at TFHRC. Eleven DOTs attended the session and helped outline the experiment and emphasis areas. To date, nearly \$100,000 has been committed to the study. The solicitation is just now being released.

Simple Performance Tester

Upon completion of the work under NCHRP 9–29, the FHWA will seek support for the national procurement of the final version of the Simple Performance Tester.

STATE-MANAGED POOLED FUNDS

Study Number: SPR-3 (084)

Title: Use of Dynamic Modulus (E*) in Hot Mix Asphalt Designs

Lead State: Connecticut

Participating States: CT, CA, JIL, MO, NE, NC, and PA

Status: UCONN has been working to get their equipment set up in order to perform E* tests and have had issues with being able to prepare gyratory compacted specimens to the height required for testing. They are awaiting the current E* protocol from ASU and once received, plan to send it out along with aggregates and binders to a number of labs (FHWA, NCAT, ASU, Purdue, and maybe others) for a round robin evaluation. There are also plans to perform E* testing on representative mixes sent to UCONN from the participating states.

Study Number: SPR-3 (044)

Title: North Central Superpave Center

Lead State: IN

Participating States: IL, IA, KS, MI, MN, MO, and WI

Study Number: SPR-3 (045)

Title: Use of Reclaimed Asphalt Pavement Under Superpave Specifications

Lead State: IN

Participating States: IL, MI, MN, WI, and MO

Study Number: SPR-3 (048)

Title: South Central Superpave Center

Lead State- TX

Participating States: OK, LA

Study Number: SPR-3 (056)

Title: North East Superpave Center

Lead State: Pennsylvania

Participating States: DC, MA, NK NJ, NY, PA, VT, DE, MD, RI, and ME

OTHER STUDIES

Western Research Institute

The Western Research Institute has received nearly \$34M for basic asphalt research work under both ISTEA and TEA-21. The research team has several tasks that may impact Superpave. They are:

- Task 11, Asphalt-Water Interaction (Moisture Damage)
- Task 12, Mastics/Asphalt Thin Film Behavior

- Task 13, Aging and Validation
- Task 14, Crack Phenomenology: Formation and Healing Performed by TTI
- Task 15, Asphalt Chemical and Physical Analyses

The area of most concern to the Committee was the asphalt-water interaction. WRI acknowledged the enormous complexity of the issue and its seriousness. As a first step, the major mechanisms must be clearly considered and understood, and WRI's efforts will include chemical as well as physical tests. They are addressing step-by-step adhesive failures, cohesive failures, dissolution of the aggregate (raveling), fatigue cracking from wet oxidation, and stripping from oxidation products forming surfactants and acids. WRI is also addressing waxes (linear hydrocarbons) that protect the pavement from stripping and water-in-oil emulsions that decrease the viscosity of asphalt and lead to rutting.