***N*ational**

***C*ooperative**

***H*ighway**

***R*esearch**

***P*rogram**

*S*uperpave *R*esearch

*F*illing *G*aps
*S*olving *S*hortcomings

Gaps and Shortcomings

- Volumetric Mix Design
- Modified Binders
- Use of RAP
- HMA Moisture Susceptibility
- QC/QA

Gaps and Shortcomings

- Precision and Bias
- Simple Performance Test
- Performance Models
- Mix Design and Analysis

Volumetric Mix Design

Verify Superpave criteria for aggregate properties, gradation controls, and mix volumetric properties.

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

Is conformance to the restricted zone needed when a mix design satisfies FAA and volumetric mix criteria?

NCAT (Completed)

9-14: *Investigation of the Restricted Zone . . .*

"Mixes meeting Superpave and FAA requirements with gradations that violated the restricted zone performed similarly to or better than the mixes having gradations passing outside the restricted zone."

9-14: *Investigation of the Restricted Zone. . .*

"The restricted zone requirement is redundant for mixes meeting all Superpave volumetric parameters and the required fine aggregate angularity (FAA)."

9-25: *Requirements for VMA for Superpave Mixtures*

Recommend criteria for VMA, VFA, or film thickness to assure durability and resistance to rutting and fatigue cracking.

Advanced Asphalt Technologies (October 2003)

9-31: *Air Void Requirements for Superpave Mix Design*

Recommend the range of design air void content required to assure durability and resistance to rutting and fatigue cracking.

Advanced Asphalt Technologies (October 2003)

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

Identify tests and criteria to better define measurement of aggregate shape and texture and their relation to HMA and PCC performance.

(For FY 2002 award)

Modified Asphalt Binders

Is AASHTO MP1 truly transparent to the use of modified asphalt binders?

9-10: *Superpave Protocols for Modified Asphalt Binders*

- **MP1 does not fully describe the enhanced field performance of modified binders.**
- **Suggested changes to MP1 and supporting test methods.**

Asphalt Institute (Completed)

Use of RAP

Is RAP use compatible with the Superpave mix design method?

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

- **Confirmed Superpave Mixture ETG's interim guidelines for RAP use.**
- **RAP is not a black rock.**
- **Published engineer's guidelines and technician's manual for RAP use.**

NCSC - Purdue University (Completed)

HMA Moisture Susceptibility

Develop a practical, more accurate, more repeatable test method than the present AASHTO T283 for evaluating HMA moisture susceptibility.

9-13: *Evaluation of Moisture Sensitivity Tests*

- **Revised AASHTO T283 for compatibility with the Superpave mix design method.**
- **Confirmed test's poor accuracy for predicting field behavior.**

University of Nevada - Reno (Completed)

9-34: *Improved Conditioning Procedure for Predicting Moisture Susceptibility*

Develop an improved conditioning procedure based on the environmental conditioning system (ECS) for evaluating the moisture susceptibility of compacted HMA in combination with the validated SPT.

(For FY 2002 award)

Quality Control/
Quality Acceptance

Identify QC/QA procedures and equipment for ensuring compliance with Superpave specifications and mix designs during HMA production and construction.

9-7: *Field Procedures and Equipment to Implement SHRP Specifications*

- **Prototype field shear test device for QC/QA applications.**
- **Recommended AASHTO practice, "QC/QA Plan for HMA Production and Lay Down."**

Fugro-BRE, Inc. (Completed)

9-18: *Field Shear Test for Hot Mix Asphalt*

- **Conducted further evaluation and refinement of the field shear test device developed in Project 9-7.**
- **Additional work not warranted at this time.**

Penn State U. (Completed)

9-22: *Beta-Testing and Validation of HMA PRS*

Evaluating WesTrack-developed HMA guide specification and PRS incorporating key elements of the QC/QA practice from Project 9-7.

Fugro-BRE, Inc. (December '03)

Precision and Bias

Develop precision and bias statements for AASHTO test methods supporting Superpave specifications and mix design.

9-26: *Precision Statement for AASHTO T312*

- **Carry out "round robins" to develop precision and bias statements.**
- **Begin with T312; update T166 and T209.**

AASHTO AMRL (Open-ended)

Simple Performance Test

Test that confirms a volumetric mix design provides adequate resistance to permanent deformation and fatigue cracking.

9-19: *Superpave Support and Performance Models Management, Task C*

Initial SPT selection on the basis of correlation with performance measured at MnRoad, WesTrack, and FHWA ALF sections.

9-19: *Superpave Support and Performance Models Management, Task C*

- **Dynamic modulus: E*/sin Ø (PD/FC).**
- **Static creep: flow time (PD).**
- **Triaxial repeated load permanent deformation: flow number (PD).**

University of Maryland (April 2002)

9-19: *Superpave Support and Performance Models Management, Task C*

Final validation through correlation with performance of SPS-1, SPS-5, SPS-9, NCAT Track, Nevada I-80, and Mississippi modified binder experiment pavement sections.

9-29: *Simple Performance Tester for Superpave Mix Design*

- **Users' Workshop -- 30 May**
- **Manufacturers' Workshop -- 30 July**
- **1st-Article RFP -- November 2001**
- **1st-Article Delivery -- June 2002**

Advanced Asphalt Technologies (April 2003)

Performance Models

Mix analysis requires performance prediction models to confirm the adequacy of Superpave volumetric mix designs for the pavement structure, traffic, and climate found at the project.

SHRP Superpave Software

What was wrong?

- **Inefficient, ineffective program code.**
- **Problems with predictive capabilities of rutting and fatigue cracking models.**
- **Testing methods for load-related distresses not well-matched to models.**

2002 Design Guide 🕓 Superpave

- Build new Superpave mix analysis method around the use of HMA performance models and integrated climatic model in the 2002 pavement design guide.
- Potential savings: 3 years and $6 million.

2002 Design Guide 🕓 Superpave

- Provide a common “toolbox” for HMA mix design, structural design, and performance-related specification.
- Reduce need for new equipment.
- Simplify technician training.

Mix Design and Analysis

***The 2005 HMA Mix Design Guide*: update the original Superpave method with the products of 12 years of research to fill gaps, solve shortcomings, and validate results.**

9-9: *Refinement of the Superpave Gyratory Compaction Procedure*

Reduced the number of possible design gyration values in AASHTO PP28 to 4 from the original 28.

NCAT (Completed)

9-9(1): *Verification of Gyration Levels in the N_{design} Table*

How well does densification at the N_{design} levels in AASHTO PP28 match that in the field under traffic?

NCAT (August 2003)

9-9(1): *Verification of Gyration Levels in the N_{design} Table*

- **40 field projects observed for 24 months.**
- **Average “as-constructed” air voids = 8.6%.**
- **At 6 months, average air voids = 6.7%.**

9-33: 2005 Superpave Mix Design Method and Manual

Update the original Superpave mix design method to incorporate the SPT, the material tests and performance models in the 2002 pavement design guide, and other research products.

(For FY 2002 award)

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