January 7, 2003

Mr. John C. Horsley
Executive Director
AASHTO
444 North Capitol Street, N.W.
Suite 225
Washington, DC 20001

Ms. Mary Peters, Administrator
Federal Highway Administration
U.S. Dept. of Transportation
400 Seventh Street, S.W.
Room 4218
Washington, DC 20590

Dear Mr. Horsley and Ms. Peters:

This is the ninth letter report of the Transportation Research Board's Superpave Committee. The Superpave® system of asphalt paving materials selection and mixture design was initially an outcome of the Strategic Highway Research Program (SHRP). The American Association of State Highway and Transportation Officials and the Federal Highway Administration are engaged in a joint effort to further develop and deploy the Superpave system among transportation agencies. Throughout its existence, the SHRP was guided by a tripartite arrangement among the FHWA, AASHTO, and the National Research Council (NRC). By mutual agreement of the three parties, the NRC, through its TRB Superpave Committee, continues to provide advice and assistance on the conduct of the Superpave deployment and development program.

The ninth meeting of our committee was held on October 24 and 25, 2002. This meeting was primarily devoted to status reporting on activities currently in progress at the FHWA, AASHTO and as part of the National Cooperative Highway Research Program. Those members in attendance at this meeting are shown in bold type on the appended committee roster (Appendix). In this letter, I will relate the committee members' general sense of the health of the current program; describe some of the activities the committee has planned in the near future; and offer several consensus recommendations for actions that your organizations should consider to further advance deployment of the Superpave system.

CURRENT STATUS

Perhaps the most significant item that we have to report is that, with one exception, all of the research and development work necessary to reach the 2005 deployment goals for Superpave is now completed or is in progress. The exception is the planned NCHRP Project 9-33 for the development of a "Mix Design Manual for Hot-Mix Asphalt." Commencement of this last project has to await the completion of other research currently in progress including NCHRP Project 1-37A on the development of a new guide for the design of pavement structures and NCHRP Project 9-19 which seeks to develop "simple" performance tests for use with the Superpave system. This current work has progressed sufficiently far for us to anticipate that Project 9-33 will commence by mid-2003 and should be completed by the end of 2005.

At our first meeting in 2003, we will ratify our Annual Report for 2002 which will include a detailed status report and a statement of progress made toward the long-range goals we established in 1999.

While progress against these goals seems to indicate steady progress in the development and deployment of Superpave, a more certain measure of progress is how widely Superpave is used among highway agencies. At our meeting, the committee members heard a presentation from FHWA staff on the preliminary findings of another research project in progress at the University of Texas at El Paso. This project, which is outside the purview of the committee, seeks to determine the implementation status and assessment of Superpave among the state departments of transportation (DOTs). The researchers reported that in the 2002 construction season, 4,726 scheduled projects were designed using the Superpave procedures. This is approximately triple the number of Superpave projects built in 1998 and about 60% of the state asphalt paving projects scheduled for letting in 2002. While this is an impressive number, room for progress still remains, even among the state DOTs. Local highway agencies remain relatively uninformed about the Superpave system.

AASHTO STANDARDS DEVELOPMENT

Dr. Haleem Tahir, of the AASHTO staff, reported on the current status of the development of Superpave-related standard test methods and specifications by the AASHTO Highway Subcommittee on Materials (HSOM). The concentrated effort put forth by the HSOM since 1993 has contributed significantly to the rapid deployment of Superpave. Often, standards and specifications are viewed as barriers to innovation in highway engineering. In this instance, standards development has been a boon to innovation. The close relationship between the HSOM and the Superpave researchers that was facilitated by our committee's Expert Task Groups (ETGs), kept the R&D focused on resolving issues of standard practice. Dr. Tahir reported that since 1993, HSOM has adopted 33 provisional Superpave standards and the state DOTS have accumulated enough experience with the standards to convert 12, soon to be 16, of these to permanent status. While action still remains on some additional standards, AASHTO and the HSOM are to be congratulated on this record, all the more remarkable as service on and for the HSOM is voluntary.

Although we were unaware of it at the time, Dr. Tahir's presentation proved to be his valedictory address. He announced his retirement from AASHTO the following week. In a note to the TRB staff, Dr. Tahir indicated that his work was done. The committee has worked closely with Dr. Tahir over the past four years and we must disagree with his assessment. In our view, his work was very well done, indeed. Please extend our heartfelt thanks and congratulations to Dr. Tahir. We will miss him at our committee table.

HOT-MIX ASPHALT PAVEMENT CONSTRUCTION AND SUPERPAVE

Performance related specifications and QC/QA are the only construction elements that will be included in the Superpave system. The techniques of delivery, lay down and compaction of hot-mix asphalt (HMA) are not addressed. However, construction related issues surfaced early in the Superpave implementation process – tender mixes, compaction temperature requirements,

handling of coarser mixes, and segregation, among them. From time to time, these issues reappear. It is not entirely clear, however, if these problems are systemic to Superpave or related to HMA paving in general. Because poor construction can bring the best designs to naught, the committee must be cognizant of these issues and, where useful, recommend actions to FHWA and AASHTO that aid in resolving these issues.

At our meeting, we began an examination of mutual relationship of the Superpave system and HMA construction. Five prominent invited guests addressed our meeting on this. From the discussion it was evident that contractors and materials suppliers have encountered very real problems dealing with Superpave designed asphalt mixes. In the great majority of instances, these problems have been satisfactorily resolved. While some of the problems relate to construction technique and the need to adapt techniques to Superpave mixes and other new materials, most seem related to construction quality control and apply generally to modern HMA paving. We have reached no conclusions as yet on this topic but plan to continue our examination.

The guest speakers were:

Mr. Larry Michael, Regional Engineer, Maryland State Highway Administration
Mr. Jeff Graff, President, Maryland Paving Co.
Mr. Chuck Deahl, National Accounts Manager, Compaction America, Inc.
Mr. Brian Prowell, Civil Engineer, National Center for Asphalt Technology
Dr. David Newcomb, Vice President, National Asphalt Pavement Assoc.

Several of our members from state departments of transportation suggested that a repetition of this panel discussion would be appropriate for the summer meeting of the AASHTO Highway Subcommittee on Construction and/or the technical program of the AASHTO Annual Meeting. If AASHTO wishes to pursue this suggestion, the TRB Superpave Committee will be happy to assist in whatever way we can.

SIMPLE PERFORMANCE TESTS

NCHRP Project 9-19, Superpave Support and Performance Models Management, Task C. *Develop simple performance tests for permanent deformation and fatigue cracking for incorporation in the Superpave volumetric mix design method.*

NCHRP Project 9-29, *Simple Performance Tester for Superpave Mix Design*

In conception, the Superpave system is a stepwise materials selection and design process. The performance of the final asphalt pavement is a function of more or less mechanistically based tests and design procedures applied at each step. No final "proof" test was included in the system. Many state departments of transportation and HMA suppliers saw the absence of such a test as a barrier to deployment. A survey of state DOT materials engineers conducted by our Mixture and Aggregate Expert Task Group assigned the highest priority to the development of simple performance tests for evaluating the resistance of Superpave-designed HMA to

permanent deformation and fatigue cracking during mix design and, possibly, in field quality control.

As a result of previous recommendations of the committee, the development of this test is being pursued through two NCHRP projects. Dr. Ramon Bonaquist of Advanced Asphalt Technologies (AAT), Inc, and the principal investigator for Project 9-29, briefed the committee on progress.

NCHRP Project 9-19 identified three likely candidates for a permanent deformation test and one for fatigue cracking. The Project 9-19 research team based its recommendations on correlation of test properties measured on specimens prepared from original materials obtained from the MnRoad, FHWA ALF, and WesTrack experiments with the actual field performance of the mixes. An extensive field validation experiment is now underway to support a final selection of one or more of these tests. A test protocol has been drafted for each test by the Project 9-19 research team. One of the recommended simple performance tests, dynamic modulus, is also a procedure selected 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 II."

Dr. Bonaquist described the progress his team has made in developing first-article equipment units for rapid, practical conduct of the simple performance tests in routine mix design and quality control/quality assurance operations. Equipment of two competing designs was procured from Shedworks/IPC and Interlaken. These units are undergoing evaluation by AAT and the Federal Highway Administration. The unit that best meets the equipment specification requirements of reliability, reproducibility, and practicality will be more extensively tested during 2003 on field projects as part of the FHWA Mobile Laboratory operation. In addition, there are funds available in Project 9-29 for procuring several production units of the successful design to equip the first state DOT laboratories with the simple performance tester. The first-article units have the capability to conduct all three of the candidate simple performance tests as well as the dynamic modulus protocol selected for HMA materials characterization in the 2002 Pavement Design Guide. The cost of production units is estimated at $35,000 to $45,000 for the multi-functional equipment, less if the results of Project 9-19 indicate that some capabilities in the first-article units are not needed.

Final adoption of the simple performance test for routine use in the Superpave mix design method will further require ruggedness evaluation and final procedure verification with commercial SPT equipment -- all leading toward a national procurement for the state DOTs and eventual widespread adoption and use in the HMA industry. These steps were successfully used by the Federal Highway Administration throughout the Superpave implementation process to bring many new test devices into routine use. Plans for this larger future procurement should now be drawn. We intend to invite selected FHWA and state DOT staff members familiar with the mechanisms of the pooled fund arrangements used for these earlier procurements to attend our next meeting to share with us the benefits of their experience and help us initiate the planning for this new procurement.

ADVANCED PERFORMANCE MODELS

A goal of the original research that led to the Superpave mix design method was to include a long-term performance analysis and prediction module in the system. The models available at the time were inadequate for this task. Beginning in 1995, the FHWA initiated research in advanced materials characterization and performance modeling to fill this gap. This work has been continued as part of NCHRP Project 9-19, Tasks F and G. Specifically these tasks charge the research team to 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.

Dr. Charles Schwartz of the University of Maryland research team briefed us on progress under this task at our meeting. Dr. Schwartz reported that the team has successfully developed an enhanced model formulation that shows great promise in that it incorporates performance mechanisms neglected in earlier models and employs improved data analysis techniques. Dr. Schwartz indicated, however, that much work remains and the current work will only provide a foundation for the next generation of mechanistic pavement performance modeling.

Because the development of new, more sophisticated mechanistic performance models is not crucial to the deployment of the Superpave system in its current form, the committee has not recommended additional model development as part of the Superpave deployment effort. However, the committee does see benefit to the development of calibrated, valid, fully mechanistic HMA performance models. Except in special cases, models of this complexity will probably not be used directly in pavement design. However, information derived from these models will lead to improved design procedures. This work will also lead to the identification of critical factors that can be controlled or influenced by materials suppliers and construction forces. This information will fill in the blanks needed for improved construction quality control and dependable long-term performance warranties. The pavement performance modules incorporated into asset management systems will also be influenced. Asphalt pavement performance models in use today still contain many empirically based components. Such models can not adjust to new materials or conditions. When applied outside their inference space, these models can yield undependable or even nonsensical predictions.

For these reasons, the committee recommends that FHWA continue the development of fully mechanistic performance prediction methods as an element of its long-range infrastructure research program.

LOOKING TO THE FUTURE

It seems evident to the committee that, if the current Superpave-related R&D projects are successfully concluded and communications and technology transfer mechanisms now in place remain at work, the committee's goal of full Superpave deployment by 2005 will be met. Both of your organizations merit congratulations for staying the course despite some major setbacks. If the projections of benefits made by others are even half realized, the highway users of the nation will see significant improvements in service. We have known, however, that success in

the practical deployment of the Superpave system would not end the need for research and development to continuously improve the performance of HMA pavements.

At this recent meeting, we observed the need to improve HMA construction techniques and technology and the need to develop fundamental, fully mechanistic performance models. We have observed other needs in the course of our work. In the last several years, we have accumulated a "parking lot" full of research needs and good ideas. At our meeting, we debated how best to convey these thoughts to you before we finally conclude our work. As the debate progressed, it became evident that the best use of our parking lot of ideas and the expertise available to us was to craft a vision of where asphalt pavement technology could and should be ten years beyond Superpave. This vision can contribute to the efforts of your organizations to build strategic research plans. In the absence of well-conceived strategies, we believe that the coherence that the Superpave deployment effort has brought to asphalt R&D will once again fragment. We will keep you apprised of our progress.

Sincerely,

Joseph A. Mickes
Chairman, TRB Superpave Committee

Appendix: Committee Roster

Appendix

TRANSPORTATION RESEARCH BOARD
E1006 – TRB Superpave Committee
(Members present at meeting of February 25, 2002 indicated in **bold**)

Chairman

Joseph A. Mickes
Consultant
Energy Absorption Systems, Inc.
925 Schumate Chapel Road
Jefferson City, MO 65109
Tel: 573/893-3431 Fax: 573/893-3431
mickej@socket.net

Members

David A. Anderson
Professor of Civil Engineering
Pennsylvania State University
Penn Transportation Institute
201 Transportation Research Board
University Park, PA 16802-4710
Tel: 814/863-1912
Fax: 814/865-3039
daa@psu.edu

Martin F. Barker
Pavement & Materials Engineer
City of Albuquerque
Public Works Department
P.O. Box 1293
Albuquerque, NM 87103
Tel: 505/243-0783
Fax: 505/764-1587
mbarker@cabq.gov

Jed S. Billings
President and Chief Executive Officer
FNF Construction, Inc.
115 S. 48th Street
Tempe, AZ 85281
Tel: 480/784-2910
Fax: 480/517-1840
jbillings@fnfinc.com

Frank L. Danchetz
Chief Engineer
Georgia Dept. of Transportation
No. 2 Capitol Square
Atlanta, GA 30334
Tel: 404/656-5277
Fax: 404/463-7991
frank.danchetz@dot.state.ga.us

Fred M. Fehsenfeld, Sr.
Chairman of Executive Committee
The Heritage Group
P.O. Box 68123
5400 West 86th Street
Indianapolis, IN 46268
Tel: 317/228-8300
Fax: 317/879-8145 or 843/842-3843
Fehsie1@aol.com

John E. Haddock
Assistant Professor of Civil Engineering
Purdue University
1284 Civil Engineering Bldg.
West Lafayette, IN 47907
Tel: 765/496-3996
Fax: 765/496-1364
jhaddock@ecn.purdue.edu

Eric E. Harm
Engineer of Materials and Physical Research
Illinois Dept. of Transportation
126 East Ash Street
Springfield, IL 62704-4766
Tel: 217/782-7202
Fax: 217/782-2572
HarmEE@nt.dot.state.il.us

Paul J. Mack
201 Stanford Drive
Schenectady, NY
Tel: 518/356-0256
martylou@covad.net

Charles R. Marek
Principal Materials Engineer
Vulcan Materials Company
13001 Liberty Parkway
Birmingham, AL 35242
Tel: 205/298-3217
Fax: 205/298-2979
marekc@VMCMAIL.com

John B. Metcalf
Freeport-McMoRan Professor of Engineering
Louisiana State University
Dept. of Civil Engineering and Environmental Engineering, 3508 CEBA
Baton Rouge, LA 70803
Tel: 225/578-4911
Fax: 225/578-4945
johnbm@eng.lsu.edu

Gale C. Page
State Bituminous Materials Engineer
Florida Dept. of Transportation
State Materials Office
2006 Northeast Waldo Road
Gainesville, FL 32609-8901
Tel: 352/337-3208
Fax: 352/334-1648
gale.page@dot.state.fl.us

Douglas R. Rose
Deputy Administrator/Chief Engineer for Operations
Maryland State Highway Administration
707 N. Calvert Street, #C-402
Baltimore, MD 21202
Tel: 410/545-0360
Fax: 410/209-5010
drose@sha.state.md.us

Byron E. Ruth
Professor, Emeritus
University of Florida
Dept. of Civil Engineering
345 Weil Hall Box 116580
Gainesville, FL 32611-6580
Tel: 352/352-1775
Fax: 352/392-3394
Gemsbok@ufl.edu
Mailing Address: 2221 NW 97th Street
Gainesville, FL 32606

Dean C. Weitzel
Chief Materials Engineer
Nevada Dept. of Transportation
1263 S. Stewart Street
Carson City, NV 89712
Tel: 775/888-7520
Fax: 775/888-7501
dweitzel@dot.state.nv.us

J.T. Yarnell
Senior Associate
Wilbur Smith Associates
1626 Northport Drive
Jefferson City, MO 65109
Tel: 573/634-4150
Fax: 573/554-8072
jyarnell@wibursmith.com