Conference Summary

CONFERENCE SUMMARY

National Seminar on Moisture Sensitivity of Asphalt Pavements

February 4–6, 2003

LARRY SANTUCCI
University of California, Berkeley

I am honored to have the opportunity to give a brief summary of this seminar on moisture sensitivity. It has been exciting to see the seminar unfold. I applaud Caltrans for hosting this effort along with the enthusiastic participation of industry and the support and encouragement of the Transportation Research Board and the Federal Highway Administration.

Although I have been away from a direct involvement in asphalt research for a few years, this subject has always been dear to my heart. I believe that the detrimental effects of moisture on pavement performance are underestimated. I feel that by instituting sound engineering judgment in the selection of materials, design considerations, and construction practices, we can significantly extend pavement life once we understand and address these moisture-related effects.

Let's take a moment and briefly review what was covered earlier this week. On Tuesday morning, you heard a series of lectures that started out with an introduction by Gary Hicks that identified the extent of the moisture sensitivity problem throughout the nation. Gary defined the purpose of the seminar and provided some examples and definitions of moisture-related problems. He challenged the group to come up with implementable solutions to help mitigate moisture-related distress in asphalt pavements.

Dallas Little provided valuable information on the chemical and mechanical processes associated with moisture-related distress. Dallas, in his presentation, captured the numerous theories that have evolved over the years to help explain the problem. He pointed out that not only the nature of the aggregate and the asphalt binder is important, but also the manner and environment in which these materials are combined are also critical. He noted that surface energy measurements can serve as a tool for screening asphalt–aggregate compatibility. In addition, asphalt must be able to wet the aggregate and penetrate surface voids, to provide a strong mechanical bond. Dallas also pointed out that moisture resistance is derived not only from bond strength but also from mastic strength. This paper provides an excellent resource for researchers and practitioners who continue to seek ways to minimize the detrimental effects of moisture on pavement performance.

Mansour Solaimanian reviewed the historical development of test methods, dating back to the 1930s, that have been proposed to predict moisture sensitivity of asphalt pavements. In all, approximately 25 tests on loose mixtures or compacted specimens have evolved. The link between predictions from laboratory tests and actual field performance has been somewhat elusive. The most widely used test to predict moisture sensitivity seems to be some form of retained strength test, such as AASHTO T283, with a growing interest in some version of a wheel-tracking test. Mansour identified the key elements of a successful test as one that is repeatable and reproducible; feasible, practical, and economical; serves as a good discriminator; and simulates field mechanisms.

On Tuesday afternoon, Jon Epps, Jim Anagnos, and Eric Berger informed us of the various types of treatments available to reduce the moisture sensitivity of asphalt mixtures. We learned that the most widely used treatments are amine-based liquid additives applied to the asphalt binder and lime applied in various ways to primarily the aggregate. The benefits and effectiveness of each additive type were presented. It was pointed out that the effectiveness of any treatment is dependent on such factors as the asphalt binder type, the aggregate used, the concentration level, the age of the mix, and the test method used to evaluate moisture resistance.

John D'Angelo focused on material production issues, including different crude oil sources, crude oil refining, and asphalt binder modification. He identified certain acids present in asphalt binders that may be susceptible to moisture damage. He pointed out that the practice of caustic treating asphalt to increase stiffness can create soluble salts that may emulsify in the presence of water. The chemical nature of aggregates and aggregate production concerns such as the presence of clay and dirty aggregate that affect the adhesion of the binder to the aggregate were discussed. Mix design and pavement design considerations, including the selection of mix types (dense versus coarse versus gap graded mixes) for specific applications, aggregate size relative to lift thickness, and the potential of trapping moisture in lower pavement layers, were covered in John's presentation.

Allen Cooley gave the presentation on construction issues and focused on minimizing segregation, both thermal and mechanically induced, during loading of the mix, transportation of the mix to the job site, and charging of the paver. Relative to compaction, Allen suggested the use of permeability measurements as a way to achieve proper field densities. He emphasized that all air voids are not created equal and showed variations in the permeability–air voids relationship with changes in nominal maximum size aggregate. Allen also covered improved techniques to construct longitudinal joints to help reduce the permeability at this potentially sensitive area in the pavement to water infiltration.

Amy Epps Martin led a tag team of presenters who provided a historical perspective of their experiences with moisture sensitivity in the states of California, Nevada, Texas, and Virginia. Summarizing these efforts, Amy identified the need for an improved test or tests and criteria to predict moisture sensitivity. She also suggested that testing needs to be done on the combination of materials coupled with other design considerations such as proper drainage of the entire pavement structure. Amy's recommendations included a plea to better understand the mechanisms contributing to moisture sensitivity, and she encouraged all present to continue to share experiences to reach a common goal of moisture-resistant pavements.

On Wednesday morning, Rita Leahy (in a presentation not included in this proceedings) identified a number of factors that need to be considered in specifications to mitigate the effects of moisture sensitivity. Some factors we can control, whereas others we need to accommodate. We control fairly well the design, materials, and construction factors. However, we must accommodate factors such as traffic, the environment, and sometimes materials. Rita proposed that specification possibilities may be either fundamental or mechanical. She suggested that by implementing what we know now, by using sound design methods, good mix production and construction practices, and proper selection of materials, we could go a long way toward minimizing moisture-related damage.

Jim Moulthrop closed the lecture series by outlining the challenges and expectations of the breakout sessions. Jim pointed out that the primary goal of the seminar was to identify, in regard to best practices, what works now and can be used immediately to mitigate moisture sensitivity problems. He also requested that participants identify what we do not know in terms

of knowledge gaps and what we need to address with additional research. Another goal of the breakout sessions was to develop strategic plans or a road map for the future. Jim concluded by providing templates for the facilitators to use as a guide in the various breakout sessions.

Some of the recurring themes that surfaced over the course of the lecture presentations included the fact that chemical and physical properties of both the aggregate and the asphalt binder are very important in obtaining good adhesion. We heard about the importance of good compaction practices to reduce the air voids or permeability of the pavement and hence its susceptibility to moisture. We also heard about the need for a test or series of tests that relate to field performance. The concept of refining and enforcing existing specifications and good practices to minimize moisture sensitivity was presented.

Armed with this information, each participant attended one or more of the breakout sessions: Fundamentals, Testing and Treatments, Design and Specifications, and Construction and Field Performance. The results of participants' hard work was reported earlier by the facilitators assigned to the sessions. I commend all participants for their efforts and I was especially pleased to see that the major part of their deliberations focused on developing best practices that could be used now to help reduce moisture sensitivity problems.

When we examine possible accomplishments of this $2^1/_2$-day seminar, several items come to mind. Certainly, one major accomplishment was bringing together the vast array of talent from around the country that is in this room, and I give that credit to our seminar leader, Gary Hicks. Other accomplishments include the dissemination of knowledge in the lecture presentations and the exchange and sharing of ideas in the breakout sessions. From these activities, action plans were developed that identified best practices, gaps in knowledge, and research needs. And finally, a future accomplishment will be the documentation of these seminar findings in a Transportation Research Board publication.

How might we measure the success of our efforts over the past few days? One measure might be how well we transfer the technology through training of the people on the front lines dealing with the issue of moisture sensitivity. Plans are being made by Caltrans to conduct 1-day training sessions this fall throughout the districts, using the information that comes out of this seminar and the results from ongoing joint industry–Caltrans task forces. Implementation of task force recommendations is expected to follow in early 2004. Another measure of success could be a systematic documentation of field results that demonstrates the benefits of using certain best practices to reduce moisture sensitivity. Changes in state practices as a result of efforts here in the form of improved specifications, tests, or protocols would be a measure of success. Of course, the ultimate goal would be to realize a significant drop-off in moisture-related problems. Over the longer term, a measure of success would be funded research that originated from recommendations of this seminar.