TOPIC 9

Implementation and Strategic Plan

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Moisture sensitivity of hot-mix asphalt (HMA) paving mixtures is one of the leading pavement performance-related issues facing highway agencies. Most agree that the current test protocols for identifying moisture sensitive mixtures do not accurately predict actual field performance. It appears desirable to assemble a group of knowledgeable and experienced personnel from highway agencies, academia, and industry, and to conduct a workshop to develop a strategic plan to address this issue.

Clearly, one of the most important aspects of any study or effort is disseminating the results to practitioners. The objective of this seminar is no different. A number of different agencies will be represented at the seminar, and the goals of disseminating the findings are to

1. Emerge from the meeting with an understanding of the best practices for identifying moisture sensitive asphalt mixtures currently being used in the United States,
2. Understand the barriers that exist in eliminating the moisture damage problem,
3. Identify relevant research needs so that knowledge gaps can be studied and conquered, and
4. Develop a strategic plan for administering the required research and implementing the findings.

BEST PRACTICES

A survey dated August 2002 (*1*) of 50 state departments of transportation, 3 FHWA federal lands offices, the Washington, D.C., Department of Transportation, and 1 Canadian province indicates that 45 of these agencies have identified a potential moisture damage problem with their flexible pavements and specify some type of treatment to mitigate the problem. More than one-half use a liquid antistrip material, 30% use lime, and the remainder use one or the other.

Forty-eight of the 55 agencies responded that they perform tests on the mix at some point in the mix design and construction process to determine the need for and suitability of the antistrip material. The types of testing include tensile test (AASHTO T283, ASTM D4867, or similar), compressive test (AASHTO T165 or similar), retained stability, and wheel tracking in combination with tensile testing. Sixty-two percent test for moisture damage during the mix design phase only, whereas 38% test during the mix design and during construction.

This review indicates that considerable effort is expended in attempting to control or eliminate moisture damage, but it also illustrates the number of different approaches to solving the problem. One might ask this question: Has any agency solved the problem with the approach it has taken? The identification of procedures and processes that are successful, so that others may implement them, is an essential outcome of this meeting and the first goal of the seminar. Specific test methods, specifications, and protocols that work need to be identified and documented so that the final report contains this information. Also, the Asphalt Institute is developing a document on best practices to help deal with the problem of moisture sensitivity.

IDENTIFY GAPS IN KNOWLEDGE: BARRIERS

Although 45 agencies perform some type of testing during the mix design and production processes, 11 agencies are performing some type of research to better understand the phenomenon of moisture damage. Specific projects target

- Understanding the chemical nature of the problem,
- Refining existing procedures,
- Developing an improved procedure, and
- Correlating laboratory testing to field performance.

This finding suggests that there are agencies that acknowledge that existing procedures have not been successful or do not meet the agencies' expectations. This is also true at the national level, where both FHWA and NCHRP are sponsoring work to better understand the important design and construction issues as well as methods for eliminating the problem.

Are these gaps in knowledge the result of a lack of understanding of the phenomena, or the result of inability to actually accomplish the process or procedure? The second goal of the workshop is to identify gaps in knowledge of moisture damage and to prepare plans to fill in these gaps with studies that will help us better understand the process and develop and implement procedures to solve the problem. The activity should be done by using or developing proven test methods that identify those factors that lead to moisture damage.

IDENTIFY RESEARCH NEEDS

In June 2001, a number of practitioners representing state highway agencies, academia, and industry met in Sacramento, California, to discuss research needs in the area of pavement preservation (*2*). Although not specifically identified as a research need, moisture damage was considered as part of the overall performance of pavement preservation treatments.

TRB committees A2D03, Characteristics of Bituminous-Aggregate Combinations to Meet Surface Requirements, and A2D05, General Issues in Asphalt Technology, have solicited problem statements from committee members and others, and they currently have statements dealing with moisture damage in the queue to obtain some type of funding.

The third goal of the seminar is recognizing that there are gaps in the knowledge of moisture damage that exist and to identify research required to understand the problems and provide solutions.

In the approach to research needs, consideration should be given to new, promising methods, such as surface energy measurements. Some of these new methods may be quicker and less variable than some of the current tests being used. Further evaluation of torture tests may hold some promise. Performance-based tests that are repeatable and reliable are needed.

The effects of design, production, and construction practices, including quality control, may be a practical issue to address at the seminar. Many pavements are constructed and accepted with air void levels that significantly exceed specified limiting values. Moisture may weaken the asphalt aggregate bond in these pavement layers and expose them to successive damage by moisture, even though they are subsequently compacted to acceptable air void levels by traffic. With the advent of vibratory rollers, many have abandoned the use of pneumatic rollers, which may do a better job of sealing the surface of a compacted HMA mat.

The fourth goal of the seminar is, once these items have been identified, to ask participants to prepare problem statements in standard TRB format (*3*) for each issue and include them in each breakout session strategic plan.

CHALLENGES AND EXPECTATIONS

Challenges for Seminar Participants

There are several challenges to the seminar participants. They include the following:

- Is it reasonable to expect that the moisture damage problem can be solved? Since the late 1970s, a number of studies have been carried out in an attempt to define, understand, evaluate, and mitigate moisture damage. Two of the most notable studies were carried out under the sponsorship of NCHRP and resulted in the publication of NCHRP Reports 192, 246, 274, and 373 (*4–7*). In Report 246, the author recommended the use of a test procedure that is currently known as AASHTO T283. As noted, at least four different test methods are currently being used by agencies to aid them in predicting moisture damage. This indicates that there is no universally accepted method for the determination of moisture damage.
- Can a strategic plan be developed to solve the problem? Like any focused endeavor, a strategic plan for solutions of the moisture damage problem appears to be the most effective approach. Developing a plan that concentrates on the desired outcome, incorporates all the known variables, and attracts the most talented people to undertake the effort seems advisable. A well-designed experimental plan should be part of any plan, so that it will have a successful outcome.
- If the answer is yes to the two foregoing questions, then what is expected from the breakout sessions? After pondering those two important questions, and presuming that the answer is "yes," the breakout groups will be challenged to discuss the issues relating to specific moisture damage topics, debate the pros and cons of various approaches, and prepare a strategic plan on how best to evaluate and solve the moisture damage problem.

Charges to Breakout Session Participants

Specific charges to the breakout participants include the following:

- Be proactive and participate in the discussions. To attack and solve the moisture damage problem, the best ideas are necessary. Come prepared to discuss the pertinent problems and offer your opinions on how best to solve them.
- Think "outside the box" for solutions. Using strategies from other industries or experiences can be very helpful in taking a nontraditional approach to problem solving.

- Respect others' opinions even though you do not agree with them. This is an essential component of the democratic process. Synthesizing the best ideas can happen only when all ideas are on the table.
- Begin with an objective and establish goals. Most effective plans begin with an objective that provides a beacon to direct our undertaking. Goals provide the mileposts during the planning process to keep us on target and permit us to measure our accomplishments. A fundamental research approach is required to understand the physical and chemical phenomena that contribute to moisture damage and to lead to a viable solution to the problem. If the fundamental test protocols require expensive test equipment and highly specialized experts to interpret resulting data, they may be unsuitable for routine specification testing. But gaining a fundamental understanding of the problem is essential for developing a practical specification test and acceptance criteria.
- Prepare an action plan to accomplish goals and objectives. The overall objective of the breakout sessions is to provide the contract team with sufficient information to prioritize problem statements and research areas. The ultimate goal is to obtain funding to complete the necessary studies to solve the HMA moisture damage problem.

FRAMEWORK FOR CONDUCT OF THE BREAKOUT SESSIONS

Four concurrent breakout sessions will be held. They are Fundamentals, Testing and Treatments, Design and Specifications, and Construction and Field Performance. Each session will have a facilitator and note takers, whose challenge will be to direct and focus the discussion and prepare a record of the salient discussions.

Expectations from the Breakout Sessions

Each facilitator should encourage discussions that address the following deliverables of the seminar:

- Identify best practices.
- Identify gaps in knowledge and barriers to progress.
- Identify research needs.
- Prepare a strategic plan for the future.

Adequate facilities and aids will be provided to assist the facilitator and note takers. It is expected that each breakout session will be somewhat different in style but the final outcome of the discussions will be in the same format to facilitate the preparation of a final summary of the seminar.

Specific Questions

Specific questions that need to be discussed at each session were noted earlier in the "Introduction and Seminar Objectives" presentation, but they are repeated here for convenience. These questions are meant to help focus discussion and are not intended to be all-inclusive. It is critical that the facilitators set the boundaries, or scope, of each session. With limited time, it is important to minimize overlap and use the time available most efficiently.

- Session 1: Fundamentals
  - What are the mechanisms causing moisture-related distress?

  - Are there procedures available for identifying moisture sensitive aggregates and asphalts?
  - What are the major gaps in the knowledge?
  - What fundamental issues still need to be addressed?
- Session 2: Testing and Treatments
  - What test method is best for identifying moisture-related problems? What relates to field performance?
  - Are improvements still needed to existing test methods?
  - How effective are the various additives, and processes for adding them, in minimizing the effects of moisture?
  - Is there documented evidence on how they affect pavement life? If not, why not?
  - What issues still need to be addressed?
- Session 3: Design (mix and pavement) and Specifications
  - What mix design procedures and properties are most effective for controlling moisture-related problems?
  - What items in the specifications should be controlled to minimize problems?
  - Are we considering all the major factors in design and specifications? If not, what additional factors need to be considered to minimize the effects of water on the asphalt pavement?
- Session 4: Construction and Field Performance
  - How do we distinguish moisture-related distress from distress related to construction problems?
  - What construction issues need to be controlled to reduce moisture problems?
  - What has worked and what has not worked in the field?
  - What information is needed to make better decisions when it comes to preventing moisture-related distress?
  - Should permeability be a consideration?

CONCLUSIONS AND RECOMMENDATIONS

Summary of Breakout Sessions

At the conclusion of the seminar, each of the facilitators will make a presentation summarizing the discussions of each workshop using the format presented in the attachments section at the end of this paper.

Strategic Plan for the Future

As a result of the seminar, a strategic plan will be developed by the project team and will consist of the following essential elements. It is envisioned that this plan will be directed to FHWA, TRB, NCHRP, and AASHTO for consideration for future research and development funding. Elements of the plan are as follows:

- Introduction
- Objectives and goals of the national seminar
- Organization of the seminar and breakout sessions
- Summaries of the breakout sessions

  - Best practices
  - Knowledge gaps and barriers to progress
  - Research needs
- Identification and prioritization of significant needs from each breakout session
- Discussion of resources needed to address these needs, along with research problem statements that can be readily used in the research community
- Time line with milestones to track the progress of solving these needs
- Conclusions

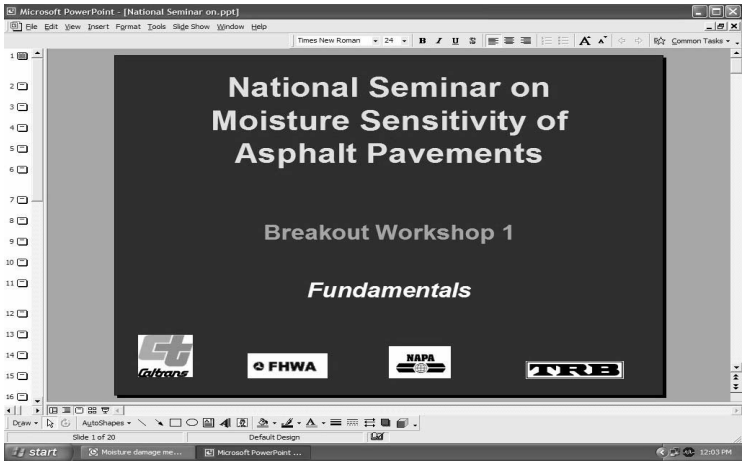
REFERENCES

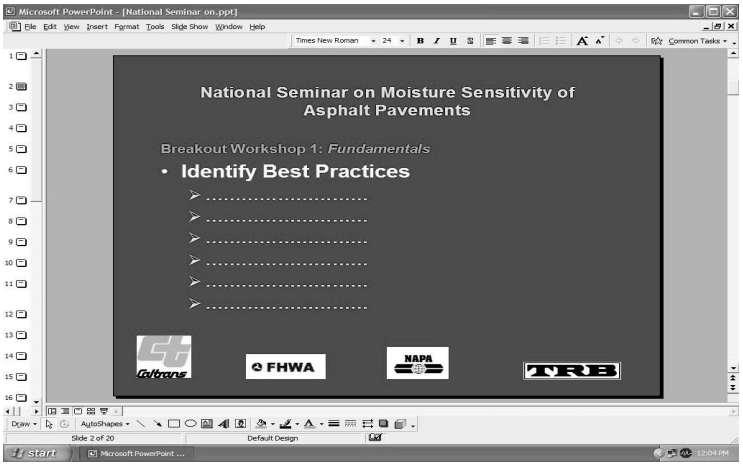
1. Aschenbrener, T. *Results of Survey on Moisture Damage of Hot Mix Asphalt Pavements*. Colorado Department of Transportation, Denver, Aug. 2002.
2. *Pavement Preservation Research Problem Statements*. FHWA and the Foundation for Pavement Preservation, Research Problem Statement Workshop, Sacramento, Calif., June 21–22, 2001.
3. TRB Division A Leadership Guide, 2002. www4.trb.org/trb/activities.nsf. Accessed Dec. 20, 2002.
4. Lottman, R. P. *NCHRP Report 192: Predicting Moisture-Induced Damage to Asphaltic Concrete*. TRB, National Research Council, Washington, D.C., 1978.
5. Lottman, R. P. *NCHRP Report 246: Predicting Moisture-Induced Damage to Asphaltic Concrete: Field Evaluation*. TRB, National Research Council, Washington, D.C., 1982.
6. Tunnicliff, D. G., and R. E. Root. *NCHRP Report 274: Use of Antistripping Additives in Asphaltic Concrete Mixtures*. TRB, National Research Council, Washington, D.C., 1984.
7. Tunnicliff, D. G., and R. E. Root. *NCHRP Report 373: Use of Antistripping Additives in Asphaltic Concrete Mixtures: Field Evaluation*. TRB, National Research Council, Washington, D.C., 1995.

ATTACHMENTS

Presentation Format

The following PowerPoint slide formats will be used during the final seminar session so that the presentations will be easier to follow and the development of the strategic plan will be more uniform.

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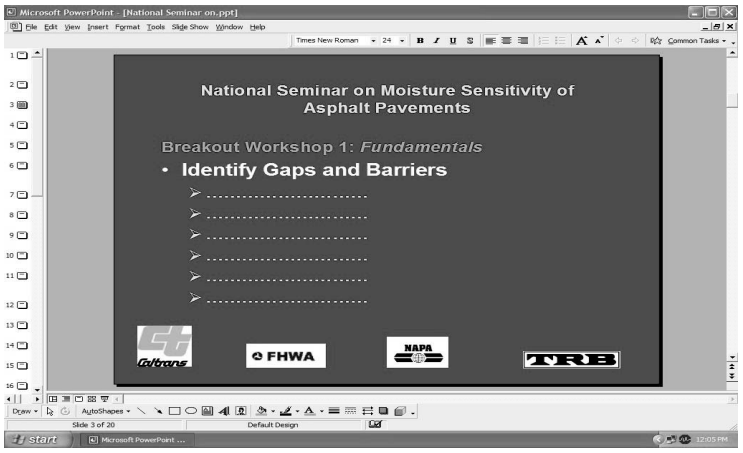
• Identify Best Practices
FHWA
NAPA
TRB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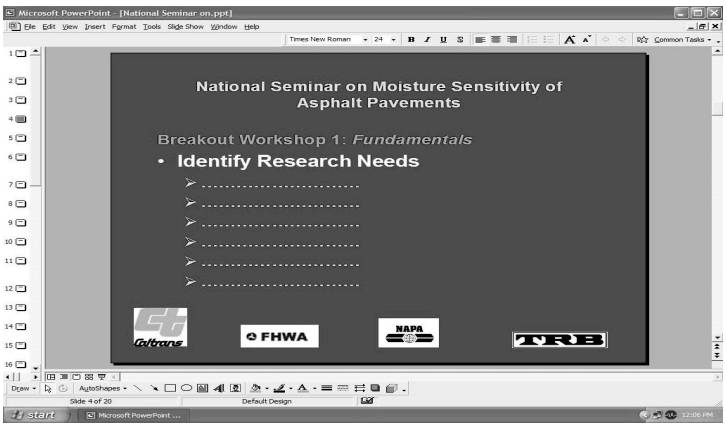
• Identify Gaps and Barriers
FHWA
NAPA
TRB


Microsoft PowerPoint - [National Seminar on.ppt]
National Seminar on Moisture Sensitivity of Asphalt Pavements
Breakout Workshop 1: Fundamentals
• Identify Research Needs
FHWA
NAPA
TRB

Problem Statement Format
Problem statements that are developed by the workshop participants should use the following format followed by TRB standing committees.

I. PROBLEM TITLE

A suggested title, in as few words as possible.

II. RESEARCH PROBLEM STATEMENT

A statement of general problem or need—one or more paragraphs explaining the reason for research. Be explicit about how the intended research product will be used and by whom.

Note: A TRIS online literature search (ntl.bts.gov/tris) is encouraged to avoid duplication with existing or past research. If a literature search is performed, general comments on the results should be provided.

III. RESEARCH OBJECTIVE

A statement of the specific research objective, defined in regard to the expected final product, that relates to the general problem statement. Define specific tasks necessary to achieve the objective.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding
An estimate of the funds necessary to accomplish the objectives. As a general guideline, the present cost for research usually averages between $150,000 and $200,000 for 100% of a professional employee's time per year. Such an amount represents a fully loaded professional rate that would include an individual's direct salary and benefits and an agency's overhead or indirect costs. Average rates for supporting staff might be approximately one-half those of professionals. Depending on the type of research, the estimate should be modified for any unique expenses, such as the purchase of materials, extensive physical testing or computer time, and extraordinary travel.

Research Period
An estimate of the number of months of research effort, including 3 months for preparation of a draft final report, necessary to the accomplishment of the objectives as mentioned.

V. URGENCY, PAYOFF POTENTIAL, AND IMPLEMENTATION

Statements concerning the urgency of this particular research in relation to highway transportation needs in general and the potential for payoff (couched in benefit/cost terms if at all possible) from achievement of project objectives should be given.

A statement should be included that further describes the anticipated products from the research (e.g., recommended specification language, new instrumentation, or recommended test methods). The anticipated steps necessary for implementation of the research product should also be delineated.

Will an industry group have to adopt a new test method or revise its current practices or equipment? This information should be as specific as possible, noting particular documents that may be affected or techniques or equipment that may be made obsolete. Any institutional or political barriers to implementation of the anticipated research products should also be identified.

Example Problem Statement

I. PROBLEM TITLE

Minimizing Transportation Agencies' Liability Associated with Use of Contaminated Property

II. RESEARCH PROBLEM STATEMENT

Historically, transportation agencies have avoided using contaminated properties for project construction. Major concerns have been (*a*) increased costs and delays due to regulatory compliance requirements and, more significantly, (*b*) uncertainty about future liability. Recently, the federal government and state governments have initiated legal or administrative changes, or both, to encourage the cleanup and redevelopment of contaminated property (brownfield redevelopment). As the private and public sectors remediate abandoned, polluted properties and restore them to the economic mainstream, transportation agencies will be expected to play a cooperative role in providing access to these revitalized areas. The use of contaminated sites may offer transportation agencies the opportunity to acquire property at reduced costs. Technological advances and lesser remediation requirements reduce cleanup costs. However, despite changes in the regulatory climate and potential decreases in costs of cleanup, transportation agencies remain wary about the uncertainties of liability for future cleanup, for third-party suits, or for deposition of excavated construction materials. Guidance will help planners and design engineers determine the risk and opportunities of using brownfields.

III. RESEARCH OBJECTIVE

The objectives of this research project are to (*a*) define the degree of protection available to public transportation agencies under federal and state laws; (*b*) assess responsibility and defenses to third-party liability; (*c*) identify procedures to minimize liability when using contaminated property, such as engineering, land use, or other institutional controls; and (*d*) prepare a findings report that includes detailed examples of the most feasible methods for state departments of transportation and recommendations for transportation agency staff, including both legal and design professionals.

The following tasks will be performed:

1. Literature search. A review of current literature on these topics will be conducted with the awareness that changes in law are happening quickly enough that juried academic journals are likely to be somewhat behind the development of new government policies on such issues as natural attenuation of contaminated media.
2. Survey of agencies. A survey will be conducted, using written forms and interviews, to identify examples of current and anticipated lawsuits, policy development, and guidance documents that describe issues related to the use of contaminated property. Included in the survey will be questions on how agencies are handling the construction of utility trenches or other structures through contaminated media that may create preferential pathways for migration of contamination onto other properties.
3. Identification of methods to assess and minimize liability. Methods that are determined to be potentially successful, as revealed in the literature search and survey, will be identified. Steps will be evaluated and described, including (*a*) engineering controls, (*b*) land use restrictions or other institutional controls, and (*c*) risk assessment methods for evaluation of alternatives.
4. Preparation of report. A summary of findings will be prepared for the use of public transportation agency professionals. The report will include an assessment of the degree of variability of different states' laws that affect the usefulness of the information gathered.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Cost: $225,000. Duration: 18 months.

V. URGENCY, PAYOFF POTENTIAL, AND IMPLEMENTATION

Recent change in federal policy and in some states' policies encouraging use of brownfield contaminated properties makes it important that this study of liability be initiated immediately so that appropriate measures can be undertaken before contaminated properties are acquired or construction is initiated on them. Although it is difficult to estimate dollar savings, new policies would make it important that risks be defined and accounted for to avoid losses in the future.

TOPIC 9

Questions and Answers

JAMES MOULTHROP
Fugro-BRE, Speaker

Q1—Gayle King, Koch Pavement Solutions
One might perceive a division here into pro-Hamburg and pro-T283 camps. I hope everyone will read Tim Aschenbrener's CDOT reports and remember how he has used both tests in tandem. Tim has made great use of the Hamburg as a research tool to understand materials, as a forensic tool to evaluate premature stripping failures, and as a performance tool to award project bonuses. However, he has adapted T283 for daily specification control and relies on methylene blue to control clay. Of course, Dale Rand has taken the very big step of adopting Hamburg for all hot-mix specifications, but only after testing some 1,500 mixes to set performance limits and understand local materials. Let's put their findings and actions into perspective as it relates to Caltrans. The key decisions: $4.00 a ton to slurry lime, $2.00 a ton to use dry lime, $0.50 a ton for liquid antistrip or no additive for moisture resistance. That's up to $10 million to be spent on somewhat arbitrary decisions lacking best available information. If clay is the bad actor, methylene blue and Hamburg should be part of the decision process as to best practice, as Aschenbrener so clearly demonstrated when he used both to locate clay seams in a problem aggregate pit. If high clay content is the only reason to slurry lime, then methylene blue could serve as the single specification control to make that decision once relative damage risk is understood in the Hamburg. One other valuable reason to bring a Hamburg into Caltrans labs may be more political than scientific. Categorize this idea as a picture worth a thousand words. When a contractor is required to employ a more expensive alternative than a competitor's, serious heartburn ensues. Watching his favorite mix fall apart under the Hamburg wheel leaves an image that causes him not only to understand the problem, but makes him want to do better. Most important, he now has a tool, which enables him to isolate and resolve his own quality problems. There are many things that Caltrans can learn from the Hamburg that don't require changing specifications. Let's try not to divide into two camps, but recognize where both T283 and wet wheel-tracking tests can provide best value.

Q2—Tim Aschenbrener, Colorado Department of Transportation
A couple of comments. One, it would be a value to me, very soon if possible, if I could get a copy of the presentations that were done this morning. I don't know if that's something you can e-mail out to all the participants, because that is something I can start taking a look at and sharing with the folks back in Colorado right away.

A—Gary Hicks, MACTEC
I've instructed Dr. Leahy to get those out so they'll be out either tomorrow or early next week, depending on what else she has to do.

Q3—Tim Aschenbrener, Colorado Department of Transportation
A second thing: you mentioned a survey. I am wondering who the target audience for that survey would be. One audience might be all the states in the country 6 to 8 months from now. I'm not sure if that would really be the right audience. I might be curious if we surveyed all the people here, not just the people from Caltrans, but everybody here 1 year from now. Have you done anything differently? Changed a specification? Written a research problem statement? What have you done differently in the last year as a result of this? It wouldn't have to be a meeting. It could be a simple survey, and I'd be interested in one or two paragraphs or one or two pages written up about some of the things that happened as a result.

A—Jim Moulthrop
That is very doable and I think it is a very good idea.

Q4—Carl Monismith, University of California, Berkeley
I would like to just make a comment about Gayle King's comment. I don't believe that the discussions that took place will lead people to select this camp or that. If they have the information, they will make their own judgments. For example, the discussions we had yesterday in the session on tests and treatments were very healthy, particularly those related to tests. I would hope that Eric Berger, the cochairman of the session, would agree with me on this assessment.