FHWA Asphalt Mixture and Construction Expert Task Group

Mixture & Construction ETG Purpose
The primary objective of the FHWA Expert Task Group is to provide a forum for the discussion of ongoing asphalt mixture technology and to provide technical input related to asphalt mixtures design, production and construction.

A total of 51 individuals attended the meeting (17 members, 32 visitors, and 2 contract personnel). Attachment A is the meeting Agenda, Attachment B includes a listing of the ETG members, and Attachment C is a listing of the Mixture ETG working task group members. Members of the FHWA Asphalt Mixture and Construction ETG that were in attendance at the March 2011 meeting included:

Frank Fee, NuStar Asphalt (Chairman)
Ray Bonaquist, Advanced Asphalt Technologies (Co-chairman)
John Bukowski, FHWA (Secretary)
Mike Anderson (Liaison), Asphalt Institute
Haleh Azari (Liaison), AASHTO-ARML
Ervin L. Dukatz, Jr., Mathy Construction Company
John Haddock, Purdue University
Kevin D. Hall, University of Arkansas
F. M. Rick Harvey, Wyoming DOT/AASHTO SOM liaison
Gerry Huber, Hertiage Research Group
Reid Kaiser, Nevada DOT
Richard Kim, North Carolina State University
Julie Kliewer, Arizona DOT
Louay Mohammad, LTRC/Lousiana State Univeristy
James Musselman, Florida DOT
Judie Ryan, Wisconsin DOT
Randy West (Liaison), NCAT

Meeting Coordinator: Lori Dalton (SME, Inc.)
Meeting Notes: Harold L. Von Quintus, (ARA, Inc.)

"Friends" of the ETG that were in attendance included:

Chris Abadie, Louisiana DOT
Hussain Bahia, University of Wisconsin at Madison
Mark Belshe, Rubber Pavements Assoc.
Szabolos Biro, Ecopath
Mark Blow, Asphalt Institute
Ken Brown, Troxler Labs
Mike Farrar, WRI
Lee Gallivan, FHWA
Nelson Gibson, FHWA
Beth Griffin, DuPont – Elvaloy
Katherine Petros, FHWA
Jean-Pasal Planche, WRI
Roger Pyle, Pine Instruments
Gerald Reinke, Mathy Construction
Shakir Shatnawi, Shatec Engineering
James Smith, Advance Testing Co.
Mena Souliman, Arizona State University
Richard Steger, Road Science, LLC
Anne Stonex, MACTEC
Kevin VanFrank, Utah DOT

Ellie Hajj, University of Nevada at Reno
Doug Hanson, Amec. Earth & Environmental
Mike Harnsberger, WRI
Emad Kassem, Texas A&M University
Mike Mamlouk, Arizona State University
Mihai Marasteanu, Univ. of Minnesota
Ala Mohseni, Pave Systems
Scott Veglahn, MTE
George Way, Consultant
Eric Weaver, FHWA
Jeff Withee, FHWA
Walud Zeiada, Arizona State University

DAY 1: Thursday, March 17, 2011

1. Call to Order—Chairman Frank Fee (NuStar) called the meeting to order at 8:20 AM.

Welcome and Introduction – Chairman Frank Fee welcomed the group to the meeting.

Frank Fee requested all in attendance at the ETG to introduce themselves, and asked Lori Dalton to distribute the sign in sheet. All members should check their contact information and make any appropriate corrections, if needed.

Secretary John Bukowski (FHWA) reported that copies of the meeting agenda were distributed prior to the meeting.

2. Review Agenda/Minutes Approval & Action Items—John Bukowski (FHWA)
Secretary Bukowski reported the minutes from the last ETG meeting were sent out via e-mail prior to this meeting. Any revisions or corrections to the meeting minutes should be sent to him. No corrections or revisions were identified during the meeting.

Bukowski noted the meeting is again being webcast. He requested all participants use the microphones during questions and discussions so that individuals attending over the internet can hear the discussion. In addition, he requested all microphones be muted because of the online participants.

Secretary Bukowski reviewed the Action Items from the September 2010 Mix and Construction ETG meeting. The following is a listing and status from the last meeting.

1. Bonaquist will develop and distribute for ETG an appendix (1-2 pages) to be added to TP79 on explanation of the Franken Model.
   UPDATE: Action item is on the agenda.

2. Bukowski will send to ETG members the web link to FHWA Technical Briefs (Previously intended as TRB E-Circulars) on the SGC and Specific Gravity Determination/Issues. Also sent to all SOM members or their agencies.
   UPDATE: These are now published as technical briefs. Bukowski reported he sent everyone the link. He thanked the team for putting these together. Bukowski reported he received a number of comments – all were very complimentary of these documents.

3. Bonaquist will develop and distribute to ETG members wording to be added to TP 79 section 8.2.1 on equipment calibration recommendations.
   UPDATE: Action item is on agenda.

4. Task Group (Mike Anderson – lead) will review T320, 321 and 322 for any necessary updates and recommendations to the SOM. Volunteers to assist in this Task Group should contact Mike Anderson.
   UPDATE: Action item is on agenda. These are now full standards, as reported by Rick Harvey.

5. Bukowski will distribute to ETG members NCHRP 9-33 information related to proposed new procedures and commentary for review and discussion at next meeting, prior to forwarding a final recommendation to the SOM.
   UPDATE: Action item is on agenda.

6. A Task Group on WMA (Corrigan – lead) will review and coordinate comments with the WMA TWG on the proposed changes to R35 as a result of the 9-43 project, and report at the next ETG meeting.
   UPDATE: Action item is on agenda.

7. Corrigan will prepare and distribute to ETG members an Appendix to T312 dealing with comparison of different Superpave Gyratory Compactors.
   UPDATE: Action item is on the agenda. There is an AASHTO standard on this, but it has expired, so we are looking at adding this as an Appendix.

8. ETG members are requested to review and send any final comments to D'Angelo, prior to October 15 on the draft Technical Brief on adjusting Ndesign levels.
   UPDATE: Action item is on the agenda. This item is now a Technical Brief on N-design. If an agency decides to change N-design, this Technical Brief provides guidance in making those revisions.

9. Task Group on Construction (LeFleur – lead) will prepare a research needs statement related to in-place density, how it is specified and measured among the various agencies. One issue to determine is whether there has been an actual change in the amount of in-place density prior to and after Superpave.
   UPDATE: Action item is on the agenda. Discussion will focus on in place density criteria and overall issues, and next step. LeFleur is not attending but a member of the Task Group will make the report.

10. Task Group on Construction (LeFleur – lead) will compile a list of critical construction topics, distribute to ETG members and discuss at the next ETG meeting.
    UPDATE: Action item is on the agenda.

11. For the MIST procedure; Erv Dukatz will try to obtain material from the mixtures that were used in NCHRP 9-24 and attempt to replicate those test results using the MIST tester. Report the results from this effort at the next ETG meeting.
    UPDATE: Action item is on agenda.

12. Mihai Marasteanu will provide to Fee the final recommended procedure for the mixture low temperature testing using the BBR.
    UPDATE: Action item is on the agenda. Frank Fee believes the procedure is ready but not sure if it has been submitted. Bukowski asked whether this should come under the Binder or Mixture ETG. Frank Fee commented there is a lot of uncertainty on this item and it needs to be coordinated with both ETGs before it goes forward to the SOM.

13. Frank Fee to report on the status of the Flow Number experiment, available test results, and any comparisons completed to date at the next meeting.
    UPDATE: Action item is on agenda.

14. West will prepare and distribute to ETG members for comment a draft standard for a 4.75 mm mix.
    UPDATE: Action item is on agenda. Bukowski sent this for review.

15. Azari will distribute to ETG members for comment/review the P& B statement for T166 and final discussion at the next ETG meeting. The statement, after review will be forwarded to the SOM.
    UPDATE: Action item is on agenda. Haleh Azari will report on the on-going activities and future plans.

16. Requested that the ARC submit the revised draft recommended practice for the image analysis to the ETG for review/comment.
    UPDATE: Action item is on agenda.

A comment was made about the ARC survey on products and activities. All ETG participants were asked to rate/rank the priority of each potential product. Bukowski asked everyone who has yet to do so, to give their input and send the evaluation to Eric Weaver.

Before starting the next presentation, Bukowski gave the location on the FHWA website of the three technical briefs regarding the Superpave Gyratory compaction and its operation and Specific Gravity.

These are:

- SGC Compaction – http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=703
- SGC Operation – http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=704
- Specific Gravity – http://www.fhwa.dot/gov/pavemetn/pub_details.cfm?id=705

3. Subcommittee on Materials: AASHTO Standards Update Report

Presentation/Report Title: ***AASHTO Standards Update—***Rick Harvey (Wyoming DOT); Liaison for the AASHTO Subcommittee on Materials

Summary of Presentation/Report:
Rick Harvey noted he will update on the last Subcommittee on Materials (SOM) meeting held August 9-13, 2010 in Madison, Wisconsin. In addition, he overviewed the comments and negatives received on the 2010 SOM ballot items and report on their status. He will also identify new items included in the 2011 Technical Section 2d ballot. In summary, the 2010 SOM ballot was sent out in November 2010 and the ballot is complete. AASHTO is in the process of preparing ballot items for publication.

R 30; Mixture Conditioning of HMA:
There was a comment from the AMRL regarding section 7.3, Long-Term Conditioning for Mixture Mechanical Property Testing, under section 7.3.2.1.1 – Compact the specimens in accordance with T 312. The ARML comment was to make the note mandatory, so it was included as text in the standard. [Note 3 – Extrude the specimen from the compaction mold after cooling for 2 to 3 hours.] This revision/change received several negatives. The comments on the ballot were that text should remain as a note. Harvey reported the negatives were found to be persuasive, and it was recommended to leave as a note. Harvey requested comments and opinions from the ETG on this item.

Mike Anderson opinion is it should remain as a note. Frank Fee commented that unsure what other impact that might have in making it mandatory regarding the AMPT use. He suggested leaving it as a note, as a minimum. Randy West mentioned NCAT is doing as standard practice – they measure the volumetric properties after coring, and suggested the note may need to be removed. Huber comment/question; are we starting to confuse things? There was some confusion about this note being in R 30, and is this long term aging of HMA. Harvey commented that he intends to leave as a note and not make it mandatory.

TP 62; Determining Dynamic Modulus of HMA:
Harvey reported this standard will expire as a provisional standard. And was adopted as AASHTO T 342, for the 2011 publication. Thus, the provisional standard was withdrawn without any objection. He also reported the uniformity coefficient for strain measurements in Table 7 was changed from 20 to 35 percent without objection.

TP 79; Determining the Dynamic Modulus and Flow Number for Hot Mix Asphalt (HMA) Using the Asphalt Mixture Performance Tester:
Harvey overviewed the changes and revisions made to the standard included in the ballot: Section 8 – STANDARDIZATION was modified to require weekly verification and annual calibration; and ANNEX A2 – Procedures for Calibrating the AMPT was added. Harvey reported no negative or technical comments were received on this ballot item. This test standard will also be included in the 2011 publication.

T 312; SGC Mold Wear Recommendations:
Harvey reported this item had involved a lot of work by the ETG. It was issued in July 2010 Technical Section Ballot and discussed at the August SOM meeting. There were five negatives and eight pages of comments received. All negatives were discussed, which resulted in changes to this ballot after the ETG meeting last year. Harvey identified and overviewed the changes made under section 4.2 and included on the ballot. He also noted the annex in the standard was also prepared by this ETG.

Harvey reported and explained some of the negatives received on the ballot. These included: Section A1.5 (Section f in ETG recommendations) for the "Procedure for Evaluating the Internal Angle of a Superpave Gyratory Mold" was believed to be unnecessary on a routine basis. This negative was found to be persuasive. In response to the negatives and additional ETG comments, supporting documentation was added to the last ballot, which included: T 312 recommendations paper from the ETG, a commentary paper prepared by the ETG Task Force, and the ETG discussion paper explaining the need for a three-point bore gauge and the precision requirements of the gauge. With that supporting documentation, this item then received only one negative on the SOM ballot, but without recommending any other changes. Several comments were received relative to the 2 versus 3 point gauge. Harvey commented that information prepared from the ETG cleared up a lot of confusion and was helpful to get the 3 point gauge measurement into the standard and through the SOM. This test standard will now also be included in the 2011 publication cycle.

T 166; Specific Gravity Task Force Recommendations:
Harvey reported the ETG recommendations on this item were forwarded to Technical Section 2c (Tom Baker - Chair). A SOM task force was formed in August to look at the ETG recommendations for changes regarding percent absorption, and to prepare the ballot item. The standard was balloted to allow over 2.0 percent absorption under T 331.

This item passed with one negative. Harvey will meet with the SOM task force to see what action is being taken. Kevin Hall asked about the wording to allow T 331. Harvey replied that is correct, and explained there is a difference between T 331 and T 356. He commented this is a standard that still needs work. Harvey will contact the 2c Tech Section Chair.

NCHRP Problem Statement, Develop an Approach for Lab Mix Short-Term Aging that Correlates to Various HMA Plant Processing and Warm Mix Asphalts:
Harvey was unsure about the status of this item. He explained and noted the activities completed since the last meeting. Harvey noted this research statement was supported by the SOM, but several revised problem statements including long term aging issues were combined by the SOM research advisory group. He reported the statement did receive a high priority recommendation and the meeting to prioritize all statements is scheduled for next week.

Harvey reported on new items that he quickly reviewed, because they are on the agenda for this meeting, and will be on the 2011 Technical Section ballot.

- Reconfirmation is required for T 320 (SST), T 321 (Fatigue), and T 322 (IDT).

- Refinement of 4.75 mm mix design criteria – this is the NCAT pooled fund study and recommended modifications to the current AASHTO specifications.
- M 323, Specification for Superpave Mix Design and R 35, Practice for Superpave Mix Design; A task group was appointed on these issues to clarify selected terms – percent RAP and percent RAP binder. Audrey Copeland was appointed as the task group chairperson, and she reported on this at the last RAP ETG meeting. Copeland announced that Lee Gallivan will provide an update to this issue later in the meeting. Harvey commented he wanted to bring this up and ask if any ETG members had been asked or assigned to the task group. Copeland noted Jim Pappas is on the RAP ETG group. Gallivan noted all task group members have been invited to the RAP ETG meeting.

Harvey discussed the 2012 publication cycle and noted the following important dates: all ETG recommendations need to be received by May 2011; the Technical Section Ballots will be from May to June 2011; the 2011 SOM meeting is scheduled for July 31 to August 5, 2011 in Burlington, Vermont; the SOM ballot items are due by September 15, 2011; the SOM ballot will be issued in November 2011; and all revisions will be published in July 2012.

4. Task Group Superpave Test Standard Review Update—Mike Anderson (Asphalt Institute)

Report Title: ***Update on Status of AASHTO T 320 (SST), T 321 (Beam Fatigue), and T 322 (IDT) Test Standards***

Summary of Report:
Mike Anderson reported there were substantial changes to the fatigue testing standard T321. He also explained Geoff Rowe's position that fatigue failure is being determined differently between agencies, even though they use the same procedure. For example, many individuals do not capture the number of load cycles at 50 percent stiffness reduction – they run the test past the 50 percent level; to 40 or even 20 percent reduction in stiffness and use all of the data. This changes the shape of the curve and changes the 50 percent point, so it changes the definition. Anderson noted he will ask the task group to investigate this issue and determine how to resolve the variation in failure criteria.

Anderson asked for volunteers to review and identify any changes needed for AASHTO T 320, T 321, and T 322. The following members volunteered at the meeting or were suggested from individuals attending the ETG meeting.

- T 320 (SST): Louay Mohammad, Tom Bennert, Becky McDaniel, and Richard Steger. It was suggested any agency or firm with a simple shear testing device also be asked to participate in this group. It was noted Becky McDaniel sent a comment over the internet related to this item – Becky McDaniel's comment; she revised this standard for ASTM.
- T 321 (Beam Fatigue): Geoff Rowe, Louay Mohammad, Richard Steger, Richard Willis, and Tom Bennert.

- T 322 (IDT): Jo Daniels, Richard Steger, Rey Roque, and Issah Shaw (works for Becky McDaniel).

Gerry Huber asked if the compaction method issue for the beam fatigue test was resolved for preparing test specimens. Different compaction devices are being used – it does not appear there is one method being used for preparing test specimens. Asked if this make a difference? ETG agree that it does, so issue is how to proceed. Richard Steger commented that we need a standard to consistently prepare test specimens for fatigue testing. D'Angelo agreed with that suggestion, but noted it will take years to prepare a compaction standard. Fee commented that the approach was to develop a standard, but not to eliminate any device – define the precision and bias of the volumetric properties for the preparing test specimens. Frank Fee reported this item should be addressed by the task group.

Rick Harvey requested Mike Anderson keep him informed on any controversial issues from the review of these three test standards, so he can exclude those items from discussion at the SOM until the ETG has taken a position and prepared appropriate documents to support the position, as done in the past.

ACTION ITEM #1: Mike Anderson will lead the task groups to review and prepare any suggested changes to AASHTO T 320 (SST), T 321 (Bending Beam Fatigue) and T 322 (IDT). Suggested changes will be distributed to the ETG prior to the next meeting. The individuals assigned to each standard were listed above.

5. Update Related NCHRP Project—Edward Harrigan (NCHRP)
Ed Harrigan was not in attendance, John Bukowski gave the report.

Summary of Report/Presentation: ***NCHRP Update*** – John Bukowski (FHWA)
The presentation provides an update on NCHRP projects in five areas related to this ETG: (1) Warm Mix Asphalt, (2) Materials and Mix Design, (3) HMA Quality Assurance, (4) MEPDG, and (5) Other Tests and Procedures.

Warm Mix Asphalt

NCHRP 9-43; Mix Design Practices for Warm Mix Asphalt:

This project was completed by Advanced Asphalt Technologies, LLC. Bukowski reported the draft appendix to AASHTO R 35 and included in NCHRP Report 691 will be published in 2011. Other important findings from the work briefly noted. The volumetric properties of properly designed warm mix asphalt (WMA) and HMA mixes are similar when produced with aggregates having asphalt absorption less than 1 percent. The same performance grade of binder should be used in WMA and HMA mixes designed for the same location. RAP and new asphalt mix can be at WMA process temperatures, provided the mix is held at elevated temperature for a certain length of time.

NCHRP 9-47A: Properties and Performance of WMA Technologies:

This project is being conducted by NCAT and is expected to be complete in January 2012. Bukowski included a listing of the project deliverables. WMA properties that influence short-term (less than 4 years) pavement performance of new projects constructed in seven states in 2010 and one state in 2011; revisions to WMA mix design and analysis method; WMA production and construction guidelines; and updated emissions measurement protocol. Randy West noted they are looking for one additional project in the Southwest (Arizona, Nevada, etc.). Judy Kliewer (Arizona DOT) mentioned Paul Birch is the person to contact for projects in Arizona. She noted one potential project in her district.

NCHRP 9-49; Performance of WMA Technologies: Stage I – Moisture Susceptibility:

The project is being conducted by the Texas Transportation Institute and is due to be completed in 2013. Bukowski overviewed the objectives from this project: assess whether WMA technologies adversely affect the moisture susceptibility of flexible pavements; and develop guidelines for identifying and limiting moisture susceptibility in WMA pavements.

NCHRP 9-49A; Performance of WMA Technologies: Stage II – Long-Term Field Performance:

The contractor for this project is still pending. Bukowski noted the project objectives: identify the material and engineering properties of WMA pavements that are significant determinants of their long-term (greater than 4 years) field performance; and to evaluate field projects from NCHRP projects 9-47A and 9-49, projects (constructed before 2010) with the FHWA mobile lab on site, projects constructed in 2010 and 2011 but not included in the above NCHRP projects, and APT experiments.

NCHRP 20-07(311); Development of a Warm Mix Asphalt Technology Evaluation Program:

Bukowski reported this project was recently awarded to Myers McCarthy Consulting Engineers through the SCORE program. The project scheduled completion date in March 2012. The objective of the project is to develop a standardized evaluation program for WMA technologies that is compatible with AASHTO NTPEP's centralized system of testing, evaluation, and data reporting of engineering materials for the state DOTs. Gerry Huber asked; is the purpose of the project to evaluate the methodology or to evaluate the material? Corrigan replied; the purpose is to put together a program for a centralized database so that agencies can use for information. He also stated NTPEP is on board with the project which is to formulate the details of a program that they can move forward with. Bukowski reported that Ed Harrigan will keep the ETG up to date on what is happening under this project.

Materials and Mix Design

NCHRP 9-33; A Mix Design Manual for Hot Mix Asphalt:

The project was completed by Advanced Asphalt Technologies, LLC. Bukowski identified some of the products and deliverables from this project, which included: NCHRP Report 673 to be published in 2011; performance test; new volumetric criteria; mix design procedure with RAP; integration of mix and structural design; and chapters on design of WMA, gap-graded, and open-graded mixtures.

NCHRP 9-46; Improved Mix Design for HMA with High RAP Content:

Bukowski mentioned this project is central to the RAP ETG and is being completed by NCAT. The scheduled completion date is December 2011. He identified some of the objectives or deliverables from the project, including: adapt AASHTO R 35, Superpave Volumetric Design for HMA for High RAP Content Mix Designs; include performance-related tests and specification criteria as well as a measure of durability; and develop practical guidelines for RAP material management and processing in a format similar to NAPA QIS 124.

NCHRP 9-48; Field versus Laboratory Volumetric and Mechanical Properties:

This project is being completed by Louisianan Transportation Research Center and is scheduled to be completed in January 2012. Bukowski briefly noted the objective of this project is to determine sources of variability for volumetric and mechanical properties of design-graded HMA between lab mixed and compacted, plant mixed and lab compacted, and plant mixed and field compacted samples. Analyses of extensive data sets from literature are inconclusive on the difference between these three samples, so a controlled laboratory experiment is underway to determine the difference.

Louay Mohammad noted they are trying to meet the reported schedule. He also mentioned this is a field project, and asked agency personnel attending the ETG meeting for assistance in identifying and providing projects to track mix properties – design, production, and placement. Gerry Huber asked for more specifics on project needs. Mohammad replied; trying to find out or determine the variability and sources of variability between three sample types – design, production, and installation. The question is: do you expect similar property values or is there a systematic difference (bias) between the three, and if so, what are the factors or sources that affect the difference. They are trying to identify some numerical value representative of any difference (difference plus a standard deviation) between the different samples. Bukowski noted this underscores the importance to use specific sample types regarding design, production, placement, etc. Huber commented; that was the reason he asked for more information. For example, dynamic modulus has become more important, and is being measured on samples prepared using varying mix conditions. He referred to Mike Anderson's conclusion during the Superpave project in measuring E* on numerous mixtures – E* is different between the lab and field compacted specimens, even when all volumetric properties are the same. The E* value is higher from field compacted specimens in comparison to lab prepared specimens, and that difference can have a significant impact. Mohammad agreed with that conclusion and noted that is exactly the objective of the project. He also noted other mechanical properties are included in the controlled lab experiment (repeated load constant height shear tests, strength tests, etc.).

HMA Quality Assurance

NCHRP 9-22; Performance Related Specification for HMA:

This project was completed by Fugro Consultants, Inc. Bukowski identified some specific products from the project and its status: Quality Related Specification Software (QRSS) that calculates pay factors from differences in predicted service life of as-designed and as-built pavement properties; performance predictions derived from pre-solved solutions of the MEPDG for rutting, fatigue and thermal cracking, and IRI; includes a Monte-Carlo simulation to develop

probabilistic solutions that account for sources of variability; and draft final report and software is under review.

NCHRP 9-22A Facilitating Implementation of the QRSS:

This project is being completed by Fugro Consultants, Inc. and is scheduled to be completed in December 2011. Bukowski identified some of the objectives or activities completed under this project, including a shadow specification on recently completed projects which include RAP and HMA overlays; proof of concept testing on new construction in Rhode Island, Texas, and Utah; maintain QRSS for public evaluation on NCHRP website and provide support and error resolution; and test direct input of E* test results as an alternative to E* calculated with the Witczak equation.

Bukowski noted the product from this study is a quality related specification software package. He reminded the ETG the software was demonstrated at the ETG meeting last year in Irvine, California. He also mentioned a webinar on the software package was held last year. John D'Angelo mentioned this is simplified software for the MEPDG that provides an evaluation and comparison of the predicted and as-built properties.

MEPDG

NCHRP 9-30A; Rutting Performance Model for HMA Mixture and Structural Design:

This project is being completed by Applied Research Associates, Inc. and the completion date is September 2011. Bukowski noted some of the products and software being delivered from this project, include; MEPDG rutting prediction model recalibration from field experiments and test tracks; an MEPDG version 9-30A that includes four transfer functions for predicting the rutting behavior of a flexible pavement design; and final report to be published in 2011.

NCHRP 9-44A; Validating an HMA Endurance Limit: Laboratory Experiment and Algorithm Development:

This project is being completed by Arizona State University and is scheduled to be completed by February 2012. Bukowski identified the two objectives from the project: identify mixture and pavement layer design features related to the endurance limit for bottom-initiated fatigue cracking of HMA, and develop an algorithm to incorporate this endurance limit into the MEPDG and other pavement design methods.

Other Tests and Procedures

NCHRP 9-39; Determining the Mixing and Compaction Temperatures of Superpave Asphalt Binders in HMA:

This project was completed by NCAT. Bukowski noted the final report is available as NCHRP Report #648. He also reported the purpose was to have a product that is reliable, contains user-friendly methods applicable to modified and unmodified binders for determining the mixing and compaction temperatures using: the Casola dynamic shear method and the steady shear flow method.

Frank Fee provided some additional comments on the results from this project and what is being done to move the product forward. Harvey had asked about the purpose of the project and how it

relates to current AASHTO test standards and specifications. Fee noted moving the product into existing standards is a long way off right now. Randy West commented he did not have anything else to add, but suggested getting the results into practice be initiated with the binder ETG. Frank Fee noted the importance of this project in terms of trying to get away from using the manufacturer's recommendation for mixing and compacting temperatures. Harvey agreed with the comments, but noted eventually we need to move forward with a standard in order for that to happen. The Binder ETG will make any final recommendations.

NCHRP 9-45; Development of Specification Criteria for Mineral Fines Used in HMA:
This project is being completed by the University of Wisconsin at Madison. Bukowski commented the final report is to be published in 2011 and summarized results from the project. Four primary filler characteristics were identified as critical for defining the influence of fillers on mix performance indicators – Rigden voids, size distribution, content of calcium compounds, and content of active clay.

Bukowski reported the NCHRP Problem statements can be submitted through September 15 by State DOTs, AASHTO committees, and FHWA. Projects are reviewed by the AASHTO Standing Committee on Research (SCOR) and approved by AASHTO Board of Directions (which requires 2/3 vote on each problem statement). He encouraged all to prepare and submit problem statements applicable to the Mix ETG through one of the above mentioned agencies.

ETG Comments and Discussion:
Louay Mohammad mentioned NCHRP 9-36 on short-term aging to replace the RTFO test which was just completed. Frank Fee identified the purpose of this project which was to replace the RTFO. He also noted the project team decided to go with the modified flask method, which is going to be recommended from the project and NCHRP.

Rick Harvey wanted to add a comment about the NCHRP problem submittal process – if a TRB or AASHTO subcommittee approves or recommends a problem statement it carries more weight. So, if there are problem statements submitted to the subcommittee in August, the subcommittee can recommend them to SCOR. There is a cycle or delay of about 2 years from the problem statements being submitted to becoming an actual project. So we need to be thinking each year about future work that needs to be done.

Fee commented on NCHRP 9-33, that it took a long time to complete this project because it was decided to add the results from NCHRP project 9-43 to the product from NCHRP 9-33. He noted the project will be closed shortly and encouraged members to start thinking about what needs to be done to move forward with implementation.

Suggested that the implementation of NCHRP 9-33 be put on the agenda for the next ETG meeting.

6. Report on AMPT Flow Number Round Robin

Presentation Title #1: ***FHWA Mix ETG – Flow Number (Fn) Study*** – Frank Fee (NuStar Asphalt)

Summary of Presentation/Report:
Fee stated the purpose of the study; to perform an evaluation of the five promising flow number approaches and to recommend one test protocol for flow number testing that could be used in mixture design to characterize rutting potential. Fee presented the flow number experiment and the seven to nine mixtures that have been identified. He discussed the mixtures that have been received to date and those that have yet to be received. Fee summarized the experiment was designed to identify the factors related to rutting and determine which one of the methods should be eventually recommend to the SOM.

Kevin Hall asked if all of the mixtures have good rutting performance. Fee replied yes, which was one of the criteria in selecting the mixtures for the experiment. Ramon Bonaquist explained the idea was to take a first cut based on good performance. The way the experiment was designed was to look at different ranges in traffic and the ranges in traffic should discriminate between different mixture rutting characteristics. Kevin Hall disagreed with that approach; flow number may not differentiate between all traffic levels. Bonaquist noted; there are criteria that have been developed, the purpose will be to develop or confirm the criteria for different traffic levels.

Presentation Title #2: ***ETG Flow Number (Fn) Task Group – UNR/ARML Testing Progress*** – Elie Hajj (University of Nevada at Reno)

Summary of Presentation/Report:
Elie Hajj discussed the mixtures that have been received (seven mixtures) and the one that is being shipped. The ninth mixture has yet to be identified from the central region. Gerry Huber noted it appears we have a bias relative to the low volume mixtures.

Hajj presented and compared the gradations for some of the mixtures that have been received. He reported; the first step was to redo the mixture design and/or confirm the volumetric properties to ensure the target asphalt content satisfies the volumetric requirements. He showed results for verifying the mix design results for four of the mixtures. Randy West comment; there appears to be something wrong between the effective asphalt content and water absorption for the NCAT mix. Jim Musselman also noted a concern for the Florida mix. He suggested that Hajj check on the computations. Hajj will verify the computations and results for both of these mixtures in question.

Frank Fee suggested; if anything changes through the mixture design verification process than was provided, to send the properties back to the supplier to ensure they concur with those changes. He understands that some changes may be needed, but wants to ensure that the suppliers have reviewed and agree with any changes made.

Hajj reported on the testing in progress which includes dynamic modulus and flow number. The University of Nevada at Reno (UNR) is performing both the flow number and dynamic modulus tests, while AMRL is performing flow number tests. Hajj illustrated some of the dynamic modulus test data. Hajj discussed the projected completion date. He expects all testing to be completed in 2011. In concluding his report, Hajj thanked everyone that submitted materials for this effort, and acknowledged the material suppliers. Erv Dukatz asked if mixtures from Wisconsin and Minnesota had been received. Hajj replied; no, mixtures only from Wisconsin were received. Dukatz requested all materials be noted from Wisconsin.

Presentation Title #3: ***Status of Evaluation of Flow Number Test*** – Haleh Azari (ARML/AASHTO)

Summary of Presentation/Report:
Haleh Azari gave her status report on the evaluation of the flow number test experiment. She provided an overview of the experiment, similar to Hajj's report. She reported six promising repeated load permanent deformation test protocols selected by the ETG Flow Number Task Force and are being evaluated. Azari also noted that one of the six test protocols was proposed for use by UNR and is being evaluated by the UNR research group.

Azari overviewed the process planned for use to evaluate the protocols. In summary, the evaluation process includes: preparation and testing of three replicates from each mixture, analyzing the test results from each replicate, and ranking the nine mixtures from the test results. The mixtures selected represent different traffic levels and climatic conditions.

She reported on the status of the materials processing effort, but noted Hajj had already covered this topic. Azari noted the materials for seven of the nine mixtures have been received, four of the seven materials have been processed (sieving the aggregates), and the mixture verification process had been completed for three of the mixtures. She also reported that the stress level for all of the test protocols have been finalized and selected, but noted some of the test temperatures are still be determined.

Azari overviewed the test conditions for each flow number or repeated load permanent deformation test protocol. She noted the sixth test protocol was the one from UNR, which is being performed by UNR research staff.

1. NCHRP 9-33 protocol – Test temperature is determined based on the project location using 50 percent reliability performance grade temperature from LTPPBind. The repeated load test is performed unconfined with a vertical stress of 87 psi.
2. MTE Protocol – Test temperature is determined as for NCHRP 9-33 (50 percent reliability PG temperature from LTPPBind). The MTE protocol requires confined test with 10 psi confinement and three different stress levels – 58, 87, and 116 psi.
3. NCAT Protocol – Test temperature is determined based on project location using 50 percent reliability performance grade temperature from LTPPBind minus 6°C. The NCAT protocol also required confined testing with a confinement of 10 psi and a deviator stress of 70 psi.

4. NCHRP 9-30A Protocol – The stress levels required for this protocol are the same as for the NCAT protocol (10 psi confinement and 70 psi deviator stress). The test temperature, however, is the effective pavement temperature determined in accordance with the MEPDG.
5. NCHRP 10-87 – The AAPRL protocol requires 3 test temperatures based on high temperature PG, which is independent from the project location; PG-12°C, PG-6°C, and PG. This protocol also required confined tests using 10 psi confinement, but two deviator stress levels – 58 and 87 psi.

Azari showed the flow number test chart and timeline for all planned tests. The flow number test chart summarized the different test protocols and mixtures included in the experiment and their status. The timeline projects the planned completion month for each of the mixtures.

ACTION ITEM #2: Frank Fee will report on the status of the Flow Number experiment, available test results, and any comparisons completed to date at the next meeting.

7. AMPT Test Development

Presentation/Report Title #1: ***Some Recommended Changes to AMPT Standards*** – Ramon Bonaquist (AAT)

Summary of Presentation/Report:
Ramon Bonaquist provided an update to the Asphalt Mixture Performance Test (AMPT) development, and some issues they have observed which may need to be considered in future updates to the test standard. He listed and noted the three standards that apply to the AMPT: AASHTO PP 60, Preparation of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor; AASHTO PP 61, Developing Dynamic Modulus Master Curves for HMA Using the AMPT; and AASHTO TP 79, Determining the Dynamic Modulus and flow Number for HMA Using the AMPT.

Bonaquist explained some potential changes to the standards and the reasons why they may be needed.

AASHTO PP 60 Specimen Fabrication:

- Suggested change is to widen the tolerance on specimen diameter from 100-104 mm to 97 -104 mm, because the new 100 mm diameter core barrels produce 98 mm diameter specimens.
- The method for measuring end flatness and end parallelism remains sufficient.
- Potentially may need to widen air void tolerance to +/- 1.0 percent, because this higher value appears to be supported by data from the ILS study. He showed data comparing air voids and dynamic modulus and air voids and flow number for different size mixtures that included test results from 8 labs for 3 different materials.

AASHTO PP 61 Master Curve

- Update testing error with the ILS value, because it is a better estimate of testing error from 8 labs and 3 materials.
- Update air void tolerance to match whatever change in AASHTO PP60 and in PP 61.

AASHTO PP 79 Testing

- Update section 8 "Standardization" to include verification and calibration, because currently included in equipment specification and SOM requested it be added to testing standard.
- Add commentary on Francken Model because this was requested by Rick Harvey. Harvey noted this was requested as a comment from last SOM ballot. Bonaquist noted he put together a 2 to 3 page summary that explains where this came from. Two methods have been used; first method was looking at the incremental differences, while the second approach was the one recommended by ASU using the Francken model. Bonaquist asked Harvey to look at it to ensure it is adequate.
- Update the testing error with the ILS value, because it represents a larger database, as mentioned earlier in the presentation.
- Update air voids tolerance to match AASHTO PP 60 because air void tolerances are specified also in TP 79.
- Add precision statements from ILS study because ILS study has been completed and represents a larger database.
- Edit text so that terminology matches that in AMPT software because it eliminates confusion; for example, repeated deviator stress.

ETG Comments and Discussion:
Frank Fee and Richard Kim discussed the effect of air void tolerance on the results. Bonaquist explained; a change in air void tolerance, in his opinion, from +/- 0.5% to +/- 1.0% would not make a difference. The difference in E* on the Master Curve is 5 to 10 percent on the stiff end, but on the soft end the variation is much greater. Thus small air void differences do not explain the variation in the E* data.

John D'Angelo commented about the different compactors that have been used and maybe we need to relook at the data to see how specimens were compacted and then again compare the results. Frank Fee agreed with looking into the sample preparation issue. Ala Mohseni noted comparing the variability related to different procedural steps may need to examined. For example, how the cell was placed in the chamber, etc. Bonaquist commented the data tell him not to look at the machine, but to look at how the specimens were prepared to make it more precise. We have never done ruggedness testing on sample preparation for these specimens. The ruggedness factors should include height of specimen, how you load the mold, short term aging procedures, etc. Bonaquist's opinion is if we are going to decrease variability of the flow number and E* it is in these areas of sample preparation that we need to focus.

D'Angelo asked about specimen preparation in terms of ruggedness and if these values were first recommended from ruggedness testing. Bonaquist noted they did not look at air void variation as a factor because the results from ASU implied air void was important so they left it as initially

recommended from ASU. They did look at this issue from the interlaboratory study and found slight variations in air voids were not that important. Another question – Is the target air voids important relative to the air void tolerance? It was stated that the tolerance should be dependent on the target air void level; in other words check the standard deviation of air voids based on the target air voids. There was continued discussion under this topic without resolution.

Harvey asked that the Francken model write up be forwarded to him. Bonaquist noted that the calibration section has already been forwarded to Harvey, and the Francken model was forwarded this morning. Bonaquist agreed, to also send the other items or revisions, but not a change in the air void tolerance to Harvey.

ACTION ITEM #3: Bonaquist will forward to SOM (Harvey) discussed changes to TP60/61/79 (exclusive of air void specimen tolerance).

Presentation/Report Title #2: ***Specimen Fabrication – Major Source of Between Lab Variability*** – Ramon Bonaquist (AAT)

Summary of Presentation/Report:
Bonaquist reported on the issue of specimen fabrication. He reviewed the NCHRP 9-20 Interlaboratory Study (ILS) results from 8 labs with 3 materials. Bonaquist presented the data from that study in terms of coefficient of variation versus dynamic modulus. He noted that scatter in the data suggests that variability between labs for dynamic modulus testing is larger and the 0.5% variance in air voids can be increased.

ETG Comments and Discussion:
Matt Corrigan asked about the air void variations. Bonaquist suggested based on the interlaboratory study, $\pm$0.5 % is too restrictive and suggests that value be increased to $\pm$1.0 % to make it more practical. Corrigan asked him to comment on the experience level of the labs included in interlaboratory study. Bonaquist noted they ranged from those with a lot of experience to a moderate level of experience. All labs included in the study had the AMPT and all were accredited with AMRL. Corrigan and Chuck Paugh found requiring $\pm$0.5% air void level is not that difficult to achieve. Bonaquist replied this tight air void tolerance is not making a significant difference in the dynamic modulus values, based on the data he has collected. Bonaquist commented that other tests also have a $\pm$1.0% air void tolerance. Corrigan disagreed with this direction and noted that some agencies are finding $\pm$1.0% air void variability for the Hamburg is too high.

Richard Kim commented based on his experience, the higher air void tolerance would make a significant change in dynamic modulus values using the IDT. Mike Anderson agreed with Kim's comment – referring back to some of the shear testing originally done for the shear frequency tests, found the higher range in air voids affected the results. When they separated out the temperature effects from the air voids effect, they saw a distinct effect from the air voids.

Randy West asked how the bulk specific gravities in the ILS were determined. Bonaquist replied they probably violated the absorption requirements for the larger mixtures, but for the smaller sizes it was probably acceptable. He noted all labs were directed to use T 166. D'Angelo commented you still have limited data in the ILS, but he recommends we examine this larger air variability to see if it makes a difference.

ACTION ITEM #4: Task Group will evaluate any needed additional changes to TP60 regarding specimen preparation, to include air void tolerance (+/- 0.5% or +/-1.0%) and discuss at next ETG meeting. Members include Corrigan, Reinke, Kim, Azari, Steiger, West, and Bonaquist.

Presentation/Report Title #3: ***AMPT Pooled Fund Study – TPF-5(178), Implementation of the Asphalt Mixture Performance Tester for Superpave Validation*** – Jeff Withee (FHWA)

Summary of Presentation/Report:
Jeff Withee provided an overview of the objectives of the pooled fund study. This pooled fund is to procure the AMPT for interested highway agencies, provide support in training technicians to use the AMPT to perform the proposed standard practices for measuring dynamic modulus, flow number and flow time of HMA mixes compacted using the SGC; and provide assistance for the nation-wide implementation and use of the AMPT for assessing performance of HMA mixes over a wide range of climate conditions, and materials.

Withee listed the participating agencies in the pooled fund study. Currently 23 state agencies are participating, with FHWA taking the lead. He overviewed NHI Course #131118 ("Asphalt Mixture Performance Tester") that was developed to train the AMPT operators. The course includes classroom instruction on the theory and data evaluation, a video on sample preparation, and hands on experience related to the sample evaluation, test procedures, and equipment operation.

Withee reported the equipment procurement includes two vendors under the current contract. Four units have been delivered and installed to date (Georgia, FHWA, New Hampshire, and Wyoming). He also noted additional AMPT's are now being ordered. Withee discussed the implementation support, which includes: sharing implementation plans and experiences, identifying and addressing implementation issues or challenges, and coordinating an effort to evaluate the test results from the pooled fund study. Withee noted that more information can be found at the website: www.pooledfund.org, or to contact him directly.

Frank Fee asked about the timeline for delivery of remaining units. Bukowski noted they are planning to complete procurements by the end of 2012 for the pooled fund participants.

8. Low Temperature Mixture Tests—Mihai Marasteanu (University of Minnesota)

Presentation Title: ***Update on Asphalt Mixture Low Temperature Fracture Tests: Disk Compact Tension DC(T) Test and Semi-Circular Bend (SCB) Test***

Summary of Presentation/Report:
Mihai Marasteanu reported this effort is part of the pooled fund study to develop a low temperature specification for asphalt mixtures. He noted this presentation is grouped into four basic parts: an introduction to the tests, an overview of the experiment used to answer specific questions about the test procedures, results from the experiment, and a summary of the findings.

Marasteanu noted the three activities of this subtask: (1) refine and simplify the SCB and DCT fracture tests used in phase I of the study; (2) propose a standard fracture test method based on SCB configuration for HMA mixes; and (3) develop a standard fracture test method. Marasteanu noted that the DCT test has been already approved as an ASTM test, D7313-06. He also noted; at the end of this work the research team will recommend one fracture test, but provide correlations between the results from both methods.

Marasteanu discussed both mixture tests, which are used to measure low temperature mixture fracture properties, and provided an illustration of the output (load versus displacement) from the tests. He explained some of the issues with the test methods, that include: size effects for SCB (1 inch thick) and verification of this thickness; SCB stress intensity factor calculations based on linear elastic fracture mechanics (is this valid for heterogeneous HMA mixes, is the fracture process zone significant, should stress intensity factor be used as an index parameter); SCB has a slow loading rate which results in creep effects; the loading head geometry of the SCB; and sample preparation procedure for the DCT test. Marasteanu showed photos of the test method set up and sensors/strain gauges location on the test specimens.

Marasteanu listed and discussed the experimental design parameters included in the testing plan and the different materials that were being used in the experiment. He also discussed the procedures of both tests, typical results from both tests, and explained how the low temperature properties are determined from the test results. The HMA low temperature properties include: DCT fracture energy, SCB fracture energy, SCB fracture toughness. Marasteanu also noted that the IDT strength was measured on all of the test specimens in comparison to the DCT and SCB fracture properties.

Marasteanu summarized the results from the experiment to determine if selected experimental parameters were found to be significant. He used an analysis of variance (ANOVA) to do a statistical grouping and ranking of the parameters. The factors and comparisons evaluated included: effect of mixture type, air void content, and temperature on the fracture properties – data analysis for unconditioned laboratory compacted specimens (ranking of HMA mixtures included in the experiment); effect of mixture conditioning – data analysis for conditioned laboratory compacted specimens (conditioned versus unconditioned specimens); testing of field cores (ranking of HMA mixtures); correlation of field cores to laboratory compacted specimens; and a comparison of experimental results.

Marasteanu gave a summary of the findings from the data analyses of the experiment.

- Unconditioned laboratory compacted mixtures:
  - Mix type was found to be a significant parameter for all four properties (SCB, DCT, and IDT).
  - Properties measured at the PG low temperature plus 10^{o}C were always higher than for those at the PG low temperature for the DCT, SCB, and IDT tests.
  - Overall the effect of the air void content on the DCT fracture energy was found to be minimal, while it was significant for the other three properties. The fracture energy decreases as the air void increases.
  - Some differences were observed for the conditioned lab samples; the SCB fracture toughness was found to be insignificant between the mixes.
- Field Cores Versus Lab Prepared Specimens
  - Mixtures statistically the same except for the SCB fracture energy. The SCB fracture energy was significantly lower for the field cores in comparison to the laboratory samples.
  - Best match between lab prepared mixes and field cores was for the DCT fracture energy.
- Factor Effects
  - Asphalt modification has a significant effect on the fracture property of laboratory mixes. The SBS modified mix ranked the best overall. For the field cores, asphalt modification was found to be significant only for the SCB fracture energy, but the SBS modified mix again had the highest fracture energy.
  - Field cores were weaker than the lab-compacted samples for the SCB test. This difference was caused by the loading rates used between the DCT and SCB – the DCT is very fast relative to the SCB.
- Comparison between laboratories
  - Significant difference in results between the two laboratories.

In summary, Marasteanu noted for the same test (SCB and DCT) the results between labs in the study were significantly different. Marasteanu requested other agencies to run these tests and would appreciate their help in expanding the number of labs to determine the reason for this difference.

ETG Comments, Questions, and Discussion:

Frank Fee asked if any kind of ruggedness procedure has been conducted to try and explain what is causing the differences between the two labs. Marasteanu replied not at this time.

Louay Mohammad commented they have done a lot of investigative work in the fracture testing area and Marasteanu may want to look at the dimensions for the notch; the 57 mm they are using between the supports. Mohammad noted they have found good correlations between the lab and field. Marasteanu requested Mohammad to assist them in doing some of the testing.

9. ARML P&B Updates/SOM Recommendations—Haleh Azari (ARML/AASHTO)

Presentation Title: ***Precision Estimates TP 70-5 (MSCR)***

Summary of Report:
Haleh Azari overviewed what was presented at last year's meeting relative to the precision estimates for the MSCR (TP 70-5). She reported they have collected the second set of data which was sample data set 221 to 222 collected from participants in the performance graded asphalt binder PSP program and will report on the additional precision estimates that have been collected since the last report.

Azari presented a graph of the data showing the precision estimates for the Jnr0.1 – samples 221 to 222 data pairs. She calculated the precision estimate from the Jnr3.2 and Jnr-diff. There were 128 lab results, 107 lab results were used in the analysis. She reported and showed the single-operator and multi-laboratory precision statements or data from the PSP 217-218 in comparison to the estimates from the Asphalt Institute.

She reported the D2s reproducibility in terms of the Jnr01 and Jnr3.2, as well as for the percent recovery. Azari compared the current findings with the results from the original Asphalt Institute study for precision and bias. She noted from the test results you can see that as labs become more familiar with this test procedure and method, the variability is decreasing and the precision is improving from the original values reported by the Asphalt Institute. Azari presented and reported similar results for the precision estimates of Jn3.2. Percent recovery tests results regarding the precision estimates on some set of samples showed a significant improvement.

Azari's overall summary is that there has been improvement in the precision of the MSCR and indicates that laboratories are gaining more experience in conducting the test. She also noted a joint NCHRP-Asphalt Institute research report will be prepared this year.

10. Status IDT E* Ruggedness Testing—Richard Kim (North Carolina State University), Haleh Azari (ARML/AASHTO), and Nelson Gibson (FHWA)

Richard Kim asked Haleh Azari to do the presentation on sample preparation and Nelson Gibson will report on what has done at the FHWA Turner Fairbank lab.

Presentation/Report Title #1: ***Ruggedness Testing for IDT E* Specification*** – Richard Kim (NCSU) and Haleh Azari (AMRL/AASTHO)

Summary of Presentation/Report:
IDT dynamic modulus (E*) is the subject of a ruggedness testing effort. Analytical solutions for the dynamic modulus by indirect tension (IDT) mode have been developed by the research team at North Carolina State University (NCSU). A draft specification for specimen fabrication, test procedures, and analysis procedures has been developed at NSCU. For the specifications to take

full effect, however, a laboratory investigation into ruggedness of the test parameters needs to be conducted and that is the purpose of this work element.

Haleh Azari acknowledged the five laboratories participating in this effort, including: NCSU which is responsible for the statistical analysis; AASHTO Advanced Pavement Research Laboratory (AAPRL) which is doing the specimen fabrication and some testing; and three other labs that are doing most of the testing – FHWA TFHRC, NCAT, and Rutgers. Azari also reviewed the ruggedness protocol which is based on ASTM C1067, Standard Practice for Conducting a Ruggedness or Screening Program for Test Methods. She showed the experimental design for the ruggedness testing effort, and briefly discussed all of the parameters included in the ruggedness experimental plan. Azari included a listing of the number of specimens (volumetric properties) that will be prepared and tested.

Azari outlined how these specimens are being prepared using NCHRP project 9-29 – "Ruggedness Testing of the Dynamic Modulus and Flow Number Tests with the Simple Performance Tester." She showed the type of aggregate and gradation and asphalt that constituted each mixture. She also discussed the specimen fabrication procedure and identified important points of the preparation procedure. Azari discussed and showed the test set up and equipment for preparing and testing the IDT tests. She also showed the specimen instrumentation and how the LVDTs are attached to each side of the specimen.

Azari presented and discussed the timeline for the specimen fabrication and the total number of specimens that are being prepared and how the specimens are being used in the test program. She showed the testing and analysis plan, a 3 month time period is anticipated.

In summary, specimen fabrication should be completed by the end of May, the ruggedness should be complete by the end of July, and the analysis of the data should be completed by the end of August. Azari hoped to present the results from the ruggedness experiment at the next ETG meeting.

<u>ETG Comments, Questions, and Discussion:</u>
Frank Fee suggested that the location of the cores be noted and identified that are used in the test program. Azari agreed, but are trying to stay away from the edges. Kevin VanFrank noted they have seen significant density variations in the slab specimens. They have used this compactor for preparing their Hamburg test specimens, and noted he also provided the specimen preparation protocol for this work.

Kevin Hall asked if using the top and bottom of the core, and if so, there may be a density gradient that would result in a bias. Azari replied that if there is a density gradient, they will cut only one specimen from the middle. Hall also asked if they were randomizing the cores from all 3 slabs. Gerry Huber asked if this randomization could also be used between the top and bottom of the cored sample. Richard Kim replied this was not discussed with Azari, but they will get the gradient from the cores. He emphasized this is a preliminary plan and it will be updated and revised.

Presentation/Report Title #2: ***Findings after Implementing Indirect Tension (IDT) Dynamic Modulus (E*) in the Laboratory*** – Nelson Gibson (FHWA)

Summary of Presentation/Report:
Nelson Gibson noted the applicability of this procedure for forensic investigations and measuring the in place properties of the HMA from field cores. He reported their preliminary findings, which included: IDT deformations are not as uniform as with compression test deformations; the phase angle is highly sensitive to both the test geometry and loading configuration; IDT and compression modulus match fairly well; and there are differences in the phase angle. He graphically compared the dynamic modulus and phase angle measured using the IDT and AMPT devices.

Gibson showed photos of the test equipment and how gauges are attached to the specimen. He reported this was a learning curve, and noted they used a nylon dummy specimen to make sure the test set up and method was correct. He also reported the horizontal LVDTs were well behaved but the vertical LVDTs on two faces were variable and decided a separate study using nylon specimens is needed. Gibson illustrated the test results from the nylon specimen with the LVDTs being mounted on both sides. Concluded one face is different from the other and thus needed to test more specimens.

For the phase angle, noted about a 10 degree difference between the vertical and horizontal LVDTs. He mentioned that Richard Kim had recommended using a material that has no phase angle to ensure the equipment and instrumentation were working well. Gibson showed results for different conditions or equipment (IDT – AMPT).

ETG Comments, Questions, and Discussion:
Mike Mamlouk noted appears the two loading modes that are different (IDT and AMPT), so it is not surprising that the results are different. Richard Kim replied that his opinion is that you get statistically the same modulus value for compression and tension. Once you start mobilizing the aggregate structure through the use of larger strain levels, you start to see a difference – but as long as you have low strains the results are the same between horizontal and vertical directions. You must stay within the viscoelastic strain levels. If you get outside that range (100+ microstrains), outside the viscoelastic strain level, you do see differences. Mamlouk noted and asked about the difference between lab and field strain levels. Richard Kim replied he understood that, but this is just to capture the materials response. The structural model should capture the different levels in strain between the lab and field. Frank Fee reminded Kim the reason for doing this work is for use in measuring field dynamic modulus.

Noted when using large aggregate, probably need to increase the gauge length which will reduce the amount of variability in results. Nelson Gibson noted that can be done. Richard Kim noted the effect of the shear plane and where it occurs – it is a balance between where we are measuring the deformations in trying to stay away from the shear plane. Kim noted with the larger aggregate mixtures, you do need to increase the gauge length – there is an optimum gauge length for different size mixtures. So they decided to use 50 mm and just use more specimens because of the increased variability. D'Angelo suggested building of Roque's study and data

rather than recreate the previous study. Kim noted they are fine tuning the test specification and will consider that suggestion.

11. Simplified Fatigue Testing—Nelson Gibson (FHWA)

Presentation Title: ***Simplified HMA Fatigue Characterization Activities***

Summary of Presentation/Report:
Nelson Gibson overviewed the similarities and differences between the two protocols that are typically used to define the fatigue strength or properties of HMA mixtures, defined as: reduced cycles and S-VECD. Both use cyclic loading in the AMPT and glued platens and use the same specimen fabrication as the AMPT. He compared the S-VECD and the protocol developed by Christiansen for AAT. The Christiansen (reduced cycles) is a push-pull test, while S-VECD is a pull-pull test. Gibson noted S-VECD removes the compression response because it is assumed that no damage occurs in compression.

Gibson went through a comparison of the two protocols, and the two current AMPT devices that are on the market today. He explained the different items between both tests. The first was the type of controls for the test. The reduced cycles or Christiansen test uses stress controlled while the S-VECD uses displacement or is a strain controlled type test. He also noted strains are measured – one is measured over a gauge length on the specimen while the other over includes the total specimen and is external to the specimen. He showed an example of force versus cycles for the cross head push-pull test – a stress controlled push-pull type of test. In the S-VECD for displacement control, it is a pull-pull test. Both tests measure or determine the specimen softening which is assumed to be the damage in the specimen. He also noted the importance of the first load cycle.

Gibson provided an overview of the S-VECD protocol that he uses. He showed a schematic that illustrated the different parts of the protocol, preparation of specimens, cyclic fatigue, dynamic modulus, relaxation modulus and alpha coefficient. Gibson discussed the preprogrammed software used in the study, and showed some actual results to demonstrate what goes on in the process. The first step is to measure dynamic modulus. He illustrated some of the fatigue test results, and noted the critical item to monitor is the drop in dynamic modulus with number of cycles. Gibson explained the assumption in the S-VECD – the pseudo stiffness versus damage parameter is a material property curve, so no matter what temperature or strain level that you start with, you should end up with the same relationship because that is the assumption. He showed data that does demonstrate the assumption although there is variability in the data.

Gibson noted the MEPDG transfer function can be easily fitted to laboratory measured data. He defined failure and noted the definition can have a large impact on the fatigue life curves. The typical definition of failure is a 50% stiffness reduction, but pointed out that the condition at which maximum phase angle occurs should be the definition. He also referred to the NCHRP 9-38 definition for the endurance limit – that being 50 million load cycles.

Gibson also overviewed the polymer modification mixture test results between two labs using different procedures. The polymer mixture was placed at the NCAT test track. He presented the test results for the same mix but using two laboratories. The relationship is pseudo stiffness versus the damage parameter.

Gibson concluded his presentation with the interpretation of data collected. Those identified by Gibson for the future evaluation. One critical research area is the establishing adequate failure criteria. The maximum phase angle currently is the best definition, while the failure criteria is not universal and mixture dependent. He intends to evaluate the reduced cycles protocol, phase-out the universal MTS and use the AMPT. The S-VECD protocol draft standard needs evaluated.

ETG Comments, Questions, and Discussion:
Mike Mamlouk commented about the linear viscoelastic assumption. It may not be that correct, especially when the mixture starts to exhibit damage. Richard Kim noted this test goes much higher than 100 microstrain. He found that linear viscoelastic and continuum damage theory are sufficient to capture and predict fatigue cracking. Kim noted this has been presented before for predicting fatigue cracking in pavements. He developed this more simplistic test method and evaluation process to be similar to the VECD procedure, but to be easier to use and implement by practicing engineers.

12. Update on Moisture Induced Sensitivity Test (MIST) —Erv Dukatz (Mathy Construction)

Presentation Title: ***Moisture Induced Sensitivity Tester - Update***

Summary of Presentation/Report:
Erv Dukatz started his report with an explanation of the MIST device. He included a photo of the MIST tester and explained how it operates, noting the column or chamber of the MIST. He explained this is the same type of system for the air meter. Dukatz also noted the MIST tester uses hydrostatic loading and evaluates the binder in terms of adhesion (binder to aggregate) and cohesion (binder to binder).

Dukatz noted he uses the MIST tester device for testing their standard designs by preparing samples during their HMA mixture design process. He summarized the test conditions and times in the MIST. He emphasized a total test time of 3 hours. Dukatz reported the MIST can be used as a screening test to indicate whether there might be a problem with a specific asphalt and aggregate combination.

Dukatz presented some of their wet strength results and noted there was reasonable correlation with AASHTO T 283. He showed the tensile strength ratio in comparing to the MIST and T 283 results.

Dukatz reported he received data from Tom Bennert on dynamic modulus and reviewed the test conditions and materials. He presented a summary of the data in terms of a comparison of mixes

between the MIST conditioned and TSR conditioned specimens. Dukatz noted in some cases the MIST was more severe in some cases and less in severe in other cases relative to the TSR values. He also showed a comparison of MIST data versus TSR results (104 mix designs).

Dukatz presented results for air voids before and after conditioning, and noted there were some outliers in the data. Based on that data, Dukatz asked the ETG for future direction. He presented some options, as possibilities. Need to define standard test conditions of temperature, pressure, confinement; and define failure or trigger point to do additional testing – beyond a screening tool. He noted the need to be able to use this test for all materials or set acceptance based on the material.

ETG Comments, Questions, and Discussion:
Louay Mohammada asked if there is any saturation prior to placing the specimen in the MIST. Dukatz replied the MIST does the saturation, so he did not need to do any pre-saturation. Mohammad noted they have a MIST and they were told to saturate the specimens prior to putting them in the MIST device. Dukatz replied that there are two different approaches in terms of saturating: before or within the MIST device – it will make a difference in the test results.

Mohammad noted he will share his data with the ETG. Dukatz noted they will need more time up to the next ETG meeting to resolve some of the issues noted in the presentation.

Richard Kim asked; were there MIST values over 100? Dukatz replied; yes, they had numbers above or about 100 on a few mixtures. He noted there obviously is an aging effect simply from hardening of the asphalt. Kim asked; what was the condition of the samples for the dynamic modulus tests performed by Bennert? Dukatz answered; these were new samples, but after MIST conditioning – the procedure was the same, whether the testing was with the TSR or MIST.

ACTION ITEM #5: For the MIST procedure; Erv Dukatz will provide an update at the next ETG meeting. Louay Mohammad will provide him additional data on this procedure.

13. RAP ETG Update on M323 Revision—Lee Gallivan (FHWA)

Presentation Title: ***AASHTO M 323 Modification for Percent Binder Replacement***

Presentation Summary:
Lee Gallivan reported that binder replacement was identified as a key issue at the AASHTO Subcommittee on Materials. This issue came from Tech Section 2d – task force to re-evaluate AASHTO M 323 for including a procedure for binder replacement for use with RAP and RAS. Members of the AASTHO task force include: Audrey Copeland (Chair), Merrill Zwanka (SCDOT), Jim Pappas (DelDOT), and Jeff Miles (IDDOT). Gallivan also identified members of the RAP ETG task group on binder replacement: Gallivan (Chair), Audrey Copeland, Gerry Huber, Randy West, Becky McDanield, Matt Corrigan, Jim Pappas, and John D'Angelo. Gallivan overviewed the RAP ETG and explained the background for this activity.

Gallivan presented the AASHTO M 323 potential addition. A new Note 6 is proposed to be added to the standard: "*Research has shown that agencies could standardize binder replacement percentages as an alternative to using Table 2. RAP samples should be taken from typical stockpiles from various geographical locations. The samples should be large enough so that sufficient binder can be extracted for a full PG binder classification. The samples can be taken from RAP stockpiles at plants or roadway cores from pavements.*" He requested discussion from the ETG on this issue and the proposed new note that could be added to the standard.

ETG Comments, Questions, and Discussion:
Frank Fee commented there is an issue with blending and a significant factor is the amount of asphalt available for mixing. We need a better understanding of what is happening in the mix.

Kevin VanFrank commented on what Utah is doing – now fractionating the RAP and including it in the mixture design process. Julie Kliewer commented that ADOT is also concerned with this issue, so their specification limits the amount of RAP being put into the mix. There was additional discussion and debate on this item and the values included in the table 2, currently in the standard.

14. Reports on Construction Related Topics

Presentation Title #1: ***Report Construction Task Group; Asphalt Mixture Construction Issues – A Task Group Update***

Summary of Presentation/Report:
Judie Ryan (Wisconsin DOT) provided the update from the Task Group. She reported the Task Group has been working on two activities: in-place density and critical construction topics. Ryan explained the status of each.

- *Task 1:In-Place Density*. The current goal of this activity was to prepare a synthesis or research needs statement. Lee Gallivan offered write a draft to discuss and debate for next conference call. Their next conference call was scheduled for the Spring of 2011.

- *Task 2 is Critical Construction Issues*. Ryan overviewed the discussion from the previous ETG meeting. There are multiple issues and need to narrow the focus. This was to identify the states concerns, review SHA specifications, become aware of current of research efforts, and develop an action plan. Ryan presented the issues related to critical construction issues. Ryan noted that this list will be distributed to the ETG for review and comment.

Ryan identified specific areas that need to be monitored and tracked relative to construction issues and topics. These included: identify areas of impact or concern; seek technical advice from data measurements or other experience; evaluate current practice; define the risks; estimate costs to implement as well as not implementing; suggest adjustments to current rules; and follow-up with performance assessments.

Ryan concluded they have more states practices to review and get additional information final recommendations.

ETG Comments, Questions, and Discussion:
Kevin Hall commented that when the MEPDG was being developed there was a focus on tying construction, materials and design together. It is not just about measuring a property, but trying to tie mixture properties to performance at the time of measurement. We are all trying to answer the question – how long a pavement perform. Hall did not see that type of question in the list, but maybe this is something that you could think about or build into the list.

ACTION ITEM #6: Task Group on Construction (LeFleur/Ryan – lead) will prepare a Synthesis Needs Statement on "Methods to Measure and Specify In-place density of Asphalt Pavements". Prioritization of other items in this area will be sent to the ETG for comment.

Presentation Title #2: ***Tack Coats; NCHRP 9-40, Optimization of Tack Coat Materials*** – Louay Mohammad (LTRC and Louisiana State University)

Summary of Presentation/Report:
Louay Mohammad gave an overview of NCHRP project 9-40. He presented the project objectives: (1) determine the optimum application methods, equipment type and calibration procedures, application rates, and asphalt binder materials for various uses of tack coat; and (2) recommend revisions to relevant AASHTO methods and practices related to tack coats. He also listed and described the tasks for each of the two phases of the project.

Mohammad emphasized the method they will use to characterize tack coat quality. A test was developed that measures the required force to pull or separate the tack coat. The test is referred to as the Louisiana Tack Coat Quality Tester (LTCQT). Mohammad provided a description of the test and provided an illustration of what it measures and how that data will be used in the project. This is a pull-off test that measures the bond strength of tack coat materials. He gave a reference for the development of this device – Transportation Research Record #2126, 2009.

The other device that will be used in the study is a direct shear test referred to as the Louisiana Interlayer Shear Strength Tester (LISST). This is a direct shear test for measuring the force to shear to layers. Mohammad reported they started with the SST device and made modifications to measure the interface shear strength of the two layers and the tack coat. The test method was prepared in an AASHTO format.

ETG Comments, Questions, and Discussion:
Jim Musselman asked will there be recommendations on the residual ranges of tack coat to be used in different applications. Mohammad answered that was their intent. Most of the work was related to field activities, but some lab testing was planned. Jim Musselman noted this appears to tie in with what Judie Ryan just presented. Musselman's opinion is we can have a good design, but construction activities can negate the design and materials assumptions. He believes we are

starting to see more and more construction related issues and not many design and material issues.

Kevin Hall asked and Mohammad agreed that the tack coat rate was going to be measured in the field. Fee asked about whether milled versus un-milled surfaces were included in the field evaluation plan. Mohammad replied yes, and noted the application rate has a lower effect on a milled surface in terms of shear strength between the two layers.

Mohammad commented that modified and unmodified tack coats, were evaluated, and the materials were different and some materials did better at different application rates.

ACTION ITEM #7: Louay Mohammad will send the protocol for measuring tack coat strength to the ETG for review and potential future submission to the SOM.

Presentation Title #3: ***NCHRP 9-48, Field Versus Laboratory Volumetric and Mechanical Properties*** – Louay Mohammad (LTRC and Louisiana State University)

Summary of Presentation/Report:
Louay Mohammad gave an overview of NCHRP project 9-48. The project objectives included: (1) assess the cause and magnitude of the difference and variances (volumetric and mechanical properties within and between three types of specimens; and (2) prepare a recommended practice for state DOTs to incorporate these results in specifications and criteria for quality assurance, mix design verification, and structural design and forensic studies. He also listed and described the methodology being used in the project to complete the project objectives: quantify the differences and quantify levels of variability. Mohammad also listed and discussed the experimental factorial design and process-based factors, which included: baghouse fines, mixture re-heating, aggregate absorption, aggregate degradation, and aggregate moisture. Mohammad noted that there are levels within each process-based factor.

Report Title #4: ***Recommendations for Revisions to Criteria for the Design of 4.75 mm Mixtures*** – Randy West (NCAT)

Summary of Report:
Randy West noted this document has been e-mailed to the ETG. West noted, as part of the background on the topic, this was not a part of the original Superpave mix options. He reported the design procedure was based on work initially done at NCAT and by a few states that had used these small mix sizes. All of the NCAT work was completed in the laboratory. After the initial design criteria came out, more states started using the criteria and mixes and even some contractors started looking into using these mixes. The contractors, however, thought these mixtures were over asphalted and that is where this project started.

West reported they have gathered data from additional mixtures that have been constructed, and based on all data collected to date are recommending revisions to the design criteria for the 4.75

mm mixes. West reviewed the 5 changes proposed for M 323, which were discussed and shown on the screen for discussion by the ETG.

1. Reduction of the maximum percent passing the 1.18 mm sieve and increase the maximum percent passing the #200 sieve.
2. Adding a fine aggregate angularity requirement for the lowest traffic category, and increasing the requirement for 0.1 to 3.0 million ESALs.
3. Allow a design air void range of 4 to 6 percent.
4. Adjusting the VFA criteria.
5. Increasing the minimum dust-to-binder ratio.

The report for the project is on the NCAT web site.

Randy West believes a density requirement should not be used for this mixture because measuring density on thin layers is inappropriate or inaccurate. West noted that many of the mixes observed are performing well. Some have an air void level of 12 to 14 percent, and are still impermeable and are performing well.

West cautioned regarding skid resistance, because they have not done any work related to skid values. These mixes are smooth, but they do not have surface texture or macrotexture and is concerned about using these mixes on high volume roadways.

ETG Comments, Questions, and Discussion:
A question was asked regarding the rationale for the low void content, why not higher values – say 7 percent. West agreed maybe we should move the design air void higher because these mixes are generally impermeable. Kevin Hall asked about the maximum VMA being no more than 2 percent than the minimum VMA. Hall asked if that violates the 2 percent maximum requirement, and if it would result in more than 18 percent.

West noted if you have comments, please give them to him, and asked for suggestions related to providing comments to Harvey on what should be done. Bukowski noted we have discussion and debate on the issues, and if ETG concurs and is agreeable, West needs to send onto Rick Harvey/SOM Tech Section 2d. West requested after you have had a chance to review the recommended changes and if there are no further comments, he then would send to SOM.

Harvey commented he was unsure about the urgency of these changes. West believes the changes are urgent. Kevin Hall suggested that wait for any ETG comments, then after May 1 send to SOM. Harvey noted if you have a summary of the changes this would make the balloting process easier. West noted the report is about 100 pages but the summary does not go into that level of detail.

ACTION ITEM #8: West will prepare and distribute to ETG members for comment a draft standard for a 4.75 mm mix. Revisions to M323 for 4.75 mm mixes, as presented by West will be reviewed by the ETG and comments sent back to West and Bukowski by May. The proposed revisions will be then forwarded to SOM (Harvey) for consideration.

DAY 2: Friday, March 18, 2011

Chairman Fee called the meeting to order at 8:05 AM.

15. Prediction Skid Resistance AIMS/Micro Duval—Emad Kassem, Arash Rezaei, and Eyad Masad (Texas A&M University)

Presentation Title: ***Development of a Prediction Model for Skid Resistance of Asphalt Pavements*** – Emad Kassem (TTI)

Summary of Presentation/Report:
Emad Kassem presented on the importance of surface characteristics of the pavement. He noted friction is a function of two parameters relative to the surface layer – microtexture and macrotexture; and both are dependent on aggregate gradation.

Kassem listed and discussed the two project objectives: (1) to develop a model for the International Friction Index (IFI) and skid number (SN) of asphalt pavements as functions of traffic level, aggregate characteristics, and aggregate gradation; and (2) use the models to classify road sections based on their skid resistance. He overviewed the five tasks they are completing in this effort to achieve the objectives. Kassem noted they are measuring surface texture using the CTMeter and DFT, and explained the relationships being used to determine the IFI. He also explained and overviewed the laboratory and field experiments for this project. Kassem reported they are using the British pendulum and other equipment in the lab experiment.

Kassem showed some data from the experiment – IFI versus polishing cycles. They found aggregate texture and gradation were important factors in the experiment in predicting IFI and SN.

- Aggregate texture – Kassem explained how aggregate texture was measured using the Micro-Deval test. He overviewed the measurement of texture before and after Micro-Deval polishing. He presented some example results in terms of AIMS Texture and time in the Micro-Deval test for three aggregates – quartzite, sandstone, and siliceous gravel. He showed the AIMS texture versus percent of particles for before (BMD) and after (AMD) Micro-Deval test.
- Aggregate gradation – Kassem reported they found the aggregate gradation fits a Weibull distribution function very well and identified specific parameters of the Weibull distribution function that were used in the friction model.

Kassem explained the parameters included in the friction model and described how they were considering traffic and determining a traffic related parameter for the IFI prediction equation. Kassem overviewed the Skid Analysis of Asphalt Pavements (SAAP), which is excel based-software that was developed for predicting field skid resistance and for the pavement classification. He presented examples of the influence of traffic and gradation on skid resistance for a range of mixture types and highway traffic volumes.

Kassem summarized some of the benefits of the program, the more important one being – replacement of the current time consuming method to measure the friction value of the specimens using the British pendulum tester. They also found the British pendulum tester did not accurately distinguish aggregates with known skid values very well. He reported they drafted a couple of AASHTO test standards as part of this effort, AASHTO TP 81, Determining Aggregate Shape Properties by Means of Digital Image Analysis; and AASHTO MP xx-xx, Determining Aggregate Shape Properties for Superpave Volumetric Mix Design. Kassem described use of the associated software and test procedure in a step-by-step process.

ETG Comments, Questions, and Discussion:
Gale Page commented that lab testing is over a short time period, so the Micro-Deval test may not be a good predictor of long term values. Kassem replied they found the Micro-Deval is in good agreement with long term skid values.

Louay Mohammad asked if other methods were used to measure skid resistance, like the sand patch and pendulum. Kassem replied they used the sand patch and other methods, but the Micro-Deval was found to result in better correlations. This represents 4 years of work in evaluating and analyzing the micro and macro-texture of different mixtures and how they change in terms of skid values over time and traffic.

Corrigan asked, relative to the software, what is needed to use the software and if it was sponsored by the Texas DOT. Kassem replied; the aggregate gradation, aggregate texture, and a few other variables of the mix are needed to predict the skid resistance values over time. He noted it was sponsored by the TXDOT and they were very receptive. Corrigan asked if you have monitored other roadways to see how the model fits the field data. Kassem replied it was calibrated with lab data and many field measurements. It covers different mix designs, conditions, and traffic levels. Kassem noted the reports of this effort are ready for review on-line.

Some members noted they were confused about the inputs needed; data from AIMS, the Micro-Deval, and CTMeter. Kassem replied yes, but those properties can be estimated using standard properties of the aggregate (gradation and texture). Harvey noted the CTMeter is after construction, so you have no choice about changing anything to the mix after it has been placed.

Randy West commented the results and data from NCAT test sections will be released shortly. They have found some good results. Fee commented the PennDOT skid data has been collected over many years but has not been extensively used. West noted that with these types of tools we can get an estimate fairly quickly on whether skid is going to be a problem. He also noted the web site where the documents can be downloaded.

16. Potential Appendix for T 312 Comparing SGCs—Matthew Corrigan (FHWA)

Summary of Report:

Matt Corrigan gave the report concerning deletion of T47 concerning SGC comparisons and potential ways to include as an Appendix to T312. The Technical Brief on SGC analysis now provides the basis for going forward for additional SGC guidance. This SGC related item previously discussed is very important to compare different devices and would be included in the proposed Appendix to T312. The AASHTO SOM is very receptive to this additional information.

ETG Comments, Questions, and Discussion:
Rick Harvey commented there was a lot of other information that needed to be included relative to the internal angle, the precision and bias changes, and other data because none of that was in TP47.

ACTION ITEM #9: Corrigan will prepare and distribute to ETG members, prior to the next meeting, a draft Appendix to T312 dealing with comparison of different Superpave Gyratory Compactors.

17. Report Task Group on WMA (NCHRP 9-43/R35 Changes) —Matthew Corrigan (FHWA)

Summary of Report:
Corrigan reported from the last ETG meeting action item was to distribute the products from NCHRP 9-43 which has been completed. The primary products were the draft appendix and the changes that were needed relative to NCHRP 9-43. The commentary was prepared that explained the changes. It was distributed to the NCHRP committee and WMA TWG, and it received positive comments.

Corrigan noted the plan for the FHWA mobile lab this construction season is based on the design recommendations from 9-43. This information is available to others that might want to do the same thing. Corrigan noted that Gerald Reinke and Louay Mohammad intended doing similar testing. Corrigan requested information on potential sites for the mobile lab resting and if anyone is interested in participating this construction season.

ETG Comments, Questions, and Discussion:
Corrigan asked if the report has been posted by NCHRP. Bonaquist replied he has the NCHRP editor comments, and it should be out shortly or posted by NCHRP. Corrigan noted it will be good to get it out, so others can start to use the product. Corrigan agreed his Task Group would organize data and comments on these evaluations and potential recommendations to the SOM.

Harvey noted that this information as an Appendix would be optional procedure (an Annex is a requirement) in AASHTO standards. Harvey noted there needs to be a flow for HMA and WMA, and commented that more input is needed whether this needs to be a requirement relative to AASHTO standards. Agreed with the appendix approach, gets into the user hands. Corrigan noted that originally this was planned as a standalone procedure but later realized there was not that much of a change and could be incorporated into R35. Some still believe it should be a

separate standard. Harvey noted that including together is better because the definition and difference between HMA and WMA is vague, so which one would you use. D'Angelo noted this needs to be a mixture design, you do not just swap things out or around. You do a mix design for both HMA and WMA. Corrigan noted as part of the discussion the issue relative to foaming and the need to have more of this type equipment available. Fee suggested the Task Group get feedback/data on the procedures use and any concerns.

ACTION ITEM #10:A Task Group on WMA (Corrigan – lead) will review and coordinate comments with the WMA TWG on the proposed changes to R35 as a result of the NCHRP 9-43 project. Frank Fee will solicit agency and industry members to do "shadow" mix designs with these procedures and to provide comments and data on these. Task Group will also determine whether these should be a requirement (Annex) or an option (Appendix), and report at the next ETG meeting.

18. Asphalt Research Consortium – Pavement Loading Frequencies—Ellie Hajj (University of Nevada at Reno)

Presentation Title #1: ***Equivalent Loading Frequencies to Simulate Asphalt Layer Pavement Responses Under Dynamic Traffic Loading***

Summary of Presentation/Report:
Elie Hajj commented that dynamic response of HMA pavements under moving loads is a key component for accurate prediction of flexible pavement performance. He also noted we must have reliable pavement responses to moving wheel loads for a mechanistic design procedure to be successful, and time and temperature dependency of asphalt must be considered in the mechanistic analysis response model. He reviewed the MEPDG approach included in the software, and went through the sublayering process of the MEPDG in terms of temperature and frequency – which he maintains violate the above factors. He overviewed the MEPDG process in determining the equivalent frequency and temperature, and how they are used to determine the dynamic modulus of each HMA layer. Hajj showed a sampling of the literature related to this item. Most of this work has been based on the vertical stress-strain distribution from loads of the MEPDG. Hajj's opinion is that the consensus in the literature is the MEPDG is not that good in terms of computed layer responses. Hajj specifically referred to Richard Kim's approach and his conclusion was the MEPDG is biased and resulted in too high modulus values. Kim and Underwood recommended a different method for determining the modulus of each sublayer.

Hajj defined the research objective of this project, investigate the existence of one or more predominate frequencies associated with the HMA layer that controls the dynamic response of pavements. The critical HMA responses include longitudinal and transverse tensile strains and vertical compressive strains.

Hajj compared the viscoelastic versus pseudo analysis between dynamic and static conditions. He noted his bench mark is the viscoelastic analysis in comparison to the pseudo-dynamic and pseudo-static analyses. As part of the viscoelastic analysis he presented the 3D-Move analysis

software, and noted this software package is available over the web. Hajj noted the 3D-Move software was compared to ViscoRoute – 2010 using measured pavement responses from multiple sources in determining its accuracy. He compared and explained the differences between ViscoRoute (2010) and 3D-Move. The sources of measured pavement response data were from the test roads. This comparison to measured data to validate the 3D-Move software was the focus of his presentation and report.

Multiple test sections from multiple sites were used in comparing the predicted to measured pavement responses. Hajj overviewed the proposed approach to determine the predominant frequency (f_p) for a specific HMA layer. He noted they determined the predominant frequency for different pavement responses and conditions or pavements, but is only presenting results for one selected condition. He presented a comparison of the results in a tabular manner. Hajj noted the predominant frequency changed for some responses and cases, but was constant for most of the examples used to validate the model and approach. In addition, he pointed out the highest frequency switched from top to bottom in different cases. Hajj reported when the f_p starts to change is when the HMA mixture starts to become less stiff.

Hajj also reviewed the pseudo-dynamic analysis for the same problems. For the same cases, he presented and discussed the results and comparison graphical form of maximum tensile strain versus depth. The two examples were for a 4 and 8 inch HMA layer. Hajj explained the comparison of the viscoelastic versus pseudo-dynamic analysis, and how it was done in terms of transforming time to frequency for the 4-inch HMA pavement. Pavement responses were compared at the colder temperatures the results found to be similar, but at the higher temperatures or softer conditions, the results start to diverge. The same was true for the 8 inch pavement.

Hajj discussed some of the overall findings from the validation work. In summary: use of one single set of predominant frequencies, f_p, cannot be assigned to an HMA layer for all responses; pavement responses can be successfully predicted, within 10 percent, using the pseudo-dynamic equivalent approach; and the MEPDG approach derives comparable pavement responses, but only when the HMA layer is stiff and here are no multiple predominant frequencies within the HMA layer.

Based on these findings, Hajj identified some additional work activities they are looking into, which include: investigate the influence of axle load, response location and axle configuration on f_p; investigate the influence of CTB on f_p; and evaluate different time-frequency conversions. In conclusion, Hajj acknowledged the sponsor for the work and others involved in the study. He noted a more detailed description of the work can be found in the Asphalt Research Consortium work element E2d on the ARC website – www.arc.unr.edu.

ETG Comments, Questions, and Discussion:
Ala Mohseni commented that when the MEPDG came out, he was concerned about the high modulus values generated from the software. These results, however, are acting systematically and not individually. He is expected to see one frequency for one layer and not frequency independent. He noted deflections measured on LTPP test sections clearly show the basins go

beyond 8 feet. If you take the average to be 8 feet and using normal highway speeds, this relates to about 80 feet per second. For the deflection basins with a radius of about 8 feet, you get about 1 second per loading. His concern with the MEPDG is using only vertical deformations for rutting. Mohseni also noted some researchers have found the frequencies were a lot lower by publication, but the FWD show about 0.1 second – he noted we are talking about 10 to 20 Hz and not 100 Hz. Hajj agreed with the comment – it reacts like a unit rather than individual units. Hajj also noted deflection basins measured at higher temperatures will have a shorter basin. Mohseni disagreed with that statement and noted even for the thinner sections you have a deflection basin of about 8 feet. Hajj and Mohseni disagreed on this item. Hajj also agreed we should base our decision more than on just vertical responses. It should also include horizontal responses.

Does the software take into account roughness in terms of dynamic analysis. Hajj replied that roughness is taken into account by considering the mean and standard deviation from the mean to account for dynamic loading by applying a DNC value. If you chose to run the analysis with the DNC, you will see some difference in the strain versus time. It is not direct, but the software does consider roughness indirectly. Hall commented; in looking to the future, can you envision making this probabilistic in terms of the responses. Hajj agreed with the suggestion, and noted they treat roughness in a probabilistic manner. They look at the peaks to provide the variation in response results. The response can be divided into the mean and standard deviation of the responses.

19. Overview of Action Items

The action items from this meeting are:

1. Mike Anderson will lead the task groups to review and prepare any suggested changes to AASHTO T 320 (SST), T 321 (Bending Beam Fatigue) and T 322 (IDT). Suggested changes will be distributed to the ETG prior to the next meeting.

2. Frank Fee will report on the status of the Flow Number experiment, available test results, and any comparisons completed to date at the next meeting.

3. Bonaquist will forward to SOM (Harvey) discussed changes to TP60/61/79 (exclusive of air void specimen tolerance).

4. Task Group will evaluate needed additional changes to TP60 regarding specimen preparation, to include air void tolerance (+/- 0.5% or +/-1.0%) and discuss at next ETG meeting. Members include Corrigan, Reinke, Kim, Azari, Steiger, West, and Bonaquist.

5. For the MIST procedure; Erv Dukatz will provide an update at the next ETG meeting. Louay Mohammad will provide him additional data on this procedure

6. Task Group on Construction (LeFleur/Ryan – lead) will prepare a Synthesis Needs Statement on "Methods to Measure and Specify In-place density of Asphalt Pavements". Prioritization of other items in this area will be sent to the ETG for comment.

7. Louay Mohammad will send the protocol for measuring tack coat strength to the ETG for review and potential future submission to the SOM.

8. West will prepare and distribute to ETG members for comment a draft standard for a 4.75 mm mix. Revisions to M323 for 4.75 mm mixes, as presented by West will be reviewed by the ETG and comments sent back to West and Bukowski by May 1. The proposed revisions will be then forwarded to SOM (Harvey) for consideration.

9. Corrigan will prepare and distribute to ETG members, prior to the next meeting, a draft Appendix to T312 dealing with comparison of different Superpave Gyratory Compactors.

10. A Task Group on WMA (Corrigan – lead) will review and coordinate comments with the WMA TWG on the proposed changes to R35 as a result of the NCHRP 9-43 project. Frank Fee will solicit agency and industry members to do "shadow" mix designs with these procedures and to provide comments and data on these. Task Group will also determine whether these should be a requirement (Annex) or an option (Appendix), and report at the next ETG meeting.

20. Additional Topics Related to Next ETG Meeting

Others noted selected activities that may be included as discussion items at the next ETG meeting.

- Prediction model for skid resistance: Fee asked if access to the final reports and other information on the software could be supplied or sent to the ETG. Kassem will provide the location to the on-line reports, and will determine if the software could be provided to the ETG for review.

- Mihai Marasteanu will provide to Fee the final recommended procedure for the mixture Low Temperature Testing using the BBR.

- Azari will distribute to ETG members for comment/review the P& B statement for T166 and final discussion at the next ETG meeting. The statement, after review will be forwarded to the SOM.

- Requested that the ARC submit the revised draft recommended practice for the image analysis to the ETG for review/comment.

- Nelson Gibson will send his report on the evaluation of the comparison of IDT vs. Axial configuration for the E* test to Fee and Bukowski for distribution and review by the ETG.

21. Next Meeting Location and Date

Chairman Fee/Bukowski reported that the next ETG meeting is scheduled for the week of September 19 2011. Models, Mix and Binder ETGs will be the sequence for the next meetings. Bukowski noted that the location will be somewhere on the east coast.

22. Meeting Adjournment

Secretary John Bukowski and Chairman Frank Fee thanked everyone for attending the meeting. Fee adjourned the meeting at 10:30 PM.

ATTACHMENT A

Asphalt Mixture & Construction Expert Task Group

Phoenix, Arizona
March 17 & 18, 2011

Meeting Agenda- Draft

Day 1— March 17, 2011

8:00 am	Welcome and Introductions	**Fee**
8:15 am	Review Agenda/Minutes Approval & Action Items September, 2010 Meeting	**Bukowski**
8:30 am	Subcommittee on Materials Updates/Comments	**Harvey**
9:00 am	Update Related NCHRP Projects	**Harrigan**
9:30 am	Report on AMPT Flow Number Round Robin	**Fee**
10:00 am	Break	

10:30 am	AMPT Test Development
	• TP-79 Recommendations for SOM
	  o Commentary Franken Model
	  o Section 8.2.1 on Equipment Calibration
	• TP-60 Sample Preparation
	• Status AMPT Pooled Fund TPF-5(178)
		Bonaquist
		
		Withee

11:30 am	Low temperature Mixture Tests DC(T)	**Marasteanu**
Noon	Lunch	
1:00 pm	AMRL P&B Updates/ SOM Recommendations	**Azari**
1:30 pm	Status IDT E* Ruggedness testing	**Kim/Azari**
2:30 pm	Simplified Fatigue Testing	**Gibson**
3:00 pm	Break	
3:30 pm	Update on Moisture Induced Sensitivity Test	**Dukatz**

4:00 pm	RAP ETG Update on M323 Revision	**Gallivan**
4:30 pm	Report Construction Task Group • Research Needs Statement on In-Place Density • Critical Construction Topics	**LeFleur**
5:00 pm	**Adjourn for the Day**	

Day 2— March 18, 2011

8:00 am	Prediction Skid Resistance AIMS/Micro Duval	**Kassem**
8:30 am	Recommendations on Standard for 4.75 mm Mix	**West**
9:00 am	Task Group Review Update T-320 (SST) T-321 (Beam Fatigue) T-322 (IDT)	**Anderson**
9:30 am	Potential Appendix for T 312 Comparing SGCs	**Corrigan**.
10:00 am	Break	
10:30 am	Report Task Group WMA (NCHRP 9-43/R35 Changes)	**Corrigan**
11:00 am	ARC - Pavement Loading Frequencies	**Haij**
11:30 am	Action Items and Next Meeting Planning	**Fee/Bukowski**

Noon Adjourn

ATTACHMENT B

FHWA Asphalt Mixture & Construction Expert Task Group Members

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ATTACHMENT C

Task Group Members and Assignments
FHWA Asphalt Mixture & Construction ETG

Task Group Identification:		Members Assigned to Group:
1	Guidance for Flow Number Testing	Ray Bonaquist (Lead); Richard Kim, Ellie Hajj, Haleh Azari, Audrey Copeland, Kevin Van Frank, Phil Blankenship, Nam Tran, Raj Dongre, Nelson Gibson, Harold Von Quintus
2	Superpave Performance Test Review	Mike Anderson (Lead)
	T 320; Simple Shear Test	Louay Mohammad, Tom Bennert, Richard Steger, Becky McDaniel
	T 321; Bending Beam Fatigue	Geoff Rowe, Richard Steger, Louay Mohammad, Richard Willis
	T 322; Indirect Tension	Jo Daniels, Becky McDaniels, Rey Roque, Richard Steger
3	WMA Mixture Design/9-43 Comments	Matt Corrigan (Lead)
4	HMA In Place Density Practices & Specifications	Cindy LaFleur (Lead); Erv Dukatz, Julie Kliewer, Todd Lynn, Jim Musselman, Judy Ryan, Chris Euler
5	S-VECD Alpha/Beta Testers	Richard Kim and Shane Underwood (Leaders); Tom Bennert, Jo Daniels, Geoff Rowe, Tom Scarpas, Harold Von Quintus
6	AMPT, TP 60: Air Void Tolerance and Sample Preparation Issues	Ramon Bonaquist (Lead); Haleh Azari, Matt Corrigan, Richard Kim, Gerald Reinke, Richard Steger, and Randy West