The meeting was called to order at 8:00am. The meeting opened with self-introductions by everyone present.

**Matt Wictzak** presented the NCHRP 1-37A 2002 Design Guide and the Future Superpave Models. He discussed the basic with some emphasis on the fatigue model (number of repetitions to failure) and the Shell-oil fatigue relationship (the constant strain and constant stress relationship), which will be used in the AASHTO design guide. The shell oil relationship was used primarily to include proper material and binder implications. Two types of practices will be used in the design, which will relate to the structure of the pavement (Thin and Thick Pavements) and the load. He briefly talked about the views & direction in which the Models Task Group is going to proceed relative to the binder characterization in the AASHTO 2002 design guide. A viscosity and temperature model related to G* and phase angle will be used to characterize the binders for the 2002 system. In summary, the dynamic complex modulus will be used as main way to characterize the mixture modulus. The hierarchical system has been developed using the complex modulus in three levels, in which the accuracy and reliability are related to the levels:

1. Level 1 – Utilize Required Mixture specific test data
2. Level 2 – Utilize the predictive equation, binder G* data
3. Level 3 - Utilize the predictive equation, AC penetration grade/Viscosity grade or PG grade

Finally, he requested that the group provide any input/comments or suggestions on the above issues discussed. Details of his presentation are on separate disk.

Discussion of the 2002 system centered on if the complex modulus E* will accurately describe high temperature characteristics of the pavement. Examples of low modulus mixes with good high temperature

**John Bukowski** summarized the activities of Mix & Aggregate Expert Task Group from their April meeting. He briefly explained the issues that were discussed in the meeting. Important issues that were focused on:

1. Review of FHWA/NCHRP projects
2. Improvement of Gyratory compactors
3. Relating mixture characteristics to performance related specifications to mix verification in the field
4. Compaction mixture tenderness issue
5. Specific Gravity
Also discussed were the following:

1. Dynamic Angle Measuring device – more work is needed.
2. Characterize Aggregate gradation – proposed Bailey’s method to analyze the packing of aggregates.
3. Administrative activity – move the provisional standards to full standards
4. New standards – the new nominal maximum size mix with 4.75 mm nominal maximum aggregate size will be proposed to be incorporated in the Superpave procedures.
5. Field validation and verification - A standard for field verification of Superpave Asphalt-aggregate Mixtures is being evaluated by AASHTO

The next Asphalt-aggregate mixture meeting is on August 28th and 29th in Washington D.C.

Ted Ferragut presented the update on Superpave Long Range Plan for 2005 developed as a requirement of AASHTO resolution AR-5-98. The plan calls for the Superpave mix design system to be fully implemented by the year 2005. He reviewed the goals of Superpave Long Range Plan for 2005 as follows:

1. Superpave will be a fully integrated asphalt mix design and construction system that recommends binder type (including modified binders) and mixture proportions based on anticipated environmental and loading conditions and layer location – he listed a number of on-going projects conducted by FHWA and NCHRP to meet this goal
2. Superpave will be a fully integrated asphalt mix design and construction system that predicts the ability of a mix to withstand rutting, fatigue, thermal cracking, and moisture damage through a series of laboratory tests and mechanistic models. He listed a number of on-going projects conducted by FHWA and NCHRP to meet this goal.
3. Superpave will be a fully integrated asphalt mix design and construction system that integrates the binder and mix requirements into a performance-based quality control specification system during Field Validation of the Binder and Mix design he listed a number of on-going projects conducted by FHWA and NCHRP to meet this goal.
4. Superpave will be clearly understood by Public, Private Sector and Engineers – He discussed briefly the related issues.

He requested the group to submit any future research topics and comments or suggestions to him before the next AASHTO committee meeting. A detailed list of on-going projects and new projects are on separate disk.
Technical Discussion Topics

Binder Equipment

DTT Sample Preparation, review of improved test procedure to reduce variability and expanded testing of modified systems. Improvement in the Low-Temp grade for PMA’s

DTT Ruggedness – review of experimental plan.

Low temperature Testing – What data is really needed. Use of DT to collect all the data needed to determine the low critical cracking temperature.

Specifications

Binder Grading – Update on data needed for 8 hour grading system

Pavement Temperature Algorithms – Work to improve the pavement temperature determination based on ICM

Grade Bumping – ETG guidance on grade bumping

High Temperature Task Group – Review of latest models being considered

Fatigue task force update – review of the task force experimental plan

FHWA polymer asphalt program

FHWA Polymer Mix Validation Program data to support the High Temperature and Fatigue Task groups

Binder aging and possible WRI roll – Review of Binder Aging procedures

Susanna Ho presented the results from a continuation study on Direct Tension Sample preparation procedures conducted by University of Calgary, Canada. The objective of this experiment was to determine the sources of errors and to establish a sample preparation method that will allow the asphalt materials to maintain a fluid state for a short period after being poured into the molds. The procedure is to have molds distributed evenly on heated ceramic tiles. The steps in pouring asphalt into the molds are shown in the attached list. She discussed the test results using this procedure on the eight SHRP core asphalts. The results indicate that, the lower the test temperature the higher the failure stress values and the variation of the direct tension failure stress with the test temperature is a linear fit in most cases. In addition, the comparison of BBR and Tsar critical cracking temperature showed that the low temperature from Tsar is lower or very close to low temperature obtained from BBR.

She also discussed the Direct Tension test results of polymer modified asphalts made with increasing modification. In summary, she said that the direct tension test results with Tsar analysis allows us to appreciate the improvement in the low temperature property of asphalt binders especially modified binders that otherwise would have been missed if only the BBR test was used. Direct Tension can be used as a useful tool for polymer evaluation. Raj Dongre presented the sand bath method which allows asphalt materials to maintain a fluid state for a short period when poured into the molds. See the separate disk for details.

Raj Dongre presented the experimental design for the DTT ruggedness testing. He briefly discussed the ruggedness variables considered and the number of repetitions. The ruggedness variables considered are as follows:

1. Test Temperature, °C
2. Elongation Rate, mm/min
3. Time in Bath, min
4. Specimen Age, h
5. Chilling (yes/no)

Asphalts to be used in the ruggedness testing are as follows:

1. Husky (PG 58-28, Lloyd Minster)
2. Citgo (PG 70-22 or 70-28, Venezuelan)
3. PMA (PG 64-34 Utah-SBS)
4. PMA (PG 64-34 Utah-Styrelf)

Initially, as a dry run only one laboratory will be used for the ruggedness testing. ASTM E1169-89 will be used as a reference. The initial experimental design is attached. Eight replicates will be tested for each condition. Based on the results of this ruggedness testing, a more detailed experimental design will be developed which will involve three laboratories as recommended by ASTM E1169-89. John D’Angelo suggested including sample preparation as the ruggedness variable. Some members suggested including a PG 52-xx asphalt binder instead of two PMA (PG 64-34) asphalt for the testing.

Action: Ruggedness experimental design will be finalized after all the recommendations/suggestions are received from the ETG members and will be discussed in the next meeting.

Geoff Rowe presented the development of thermal stress calculations and determination of $T_{crit}$ from only using direct tension test results. The objectives of proposed work is:

1. To develop a procedure that removes the requirement to conduct BBR tests.
2. DTT test yield relaxation modulus, $E(t)$ directly
3. Use $E(t)$ from tests at different temperatures to construct master curves
4. Compute thermal stress and compare to failure stress in Tsar Pro Software.

He discussed the work plan, which includes the review of data from DTT, development of software tools to inspect data, implementation of changes to Tsar software, and validation of new procedures compared to MP1A, development of a final report and documentation. The possible benefits from the above exercise are as follows:

1. Lowers testing costs
2. Increased use of apparatus
3. Improved understanding of binder behavior

He said that the relaxation modulus could be obtained from the tangent slope of the Stress-Strain curve obtained from the Direct Tension Test. He showed the results of current work conducted. In summary, he said the procedures are available for performing calculations with only DTT data, but data from round-robin study is needed to further verify the procedure. Finally, he had the following questions for the ETG members:
1. Does the ETG recommend the development of this alternate procedure for MP1A?
2. Are the members of the ETG willing to pool data for a round robin study?

A series of discussions followed the presentation on the above issue. John D’Angelo asked the ETG group to decide on the following DTT related issues:

1. What modifications should we make in the DTT specifications with respect sample handling procedure?
2. Should we develop a procedure for MP1-A based on Jeff Rowe’s work?

Dave Anderson offered to share the DTT data from Northeast round robin study with Jeff Rowe to further verify the procedure.

Action: Jeff Rowe will continue to work with FHWA and others to further verify his procedure. Susana Ho, Raj Dongre and Dave Anderson will continue to work on improving the DTT test procedure using the tiles/sand bath method.

Dave Jones presented his continuation work on the 8-hour binder classification system. The objective of this system is to reduce the current 26-hours PG grading to 8-hours, by using the relationship between PAV and RTFOT on binders and the microwave aging procedure. The microwave aging method will yield an equivalent of RTFO+PAV aged residue within 4 ½ hours. He presented additional test data on the BBR and DTT testing conducted using the RTFO residue and compared to the PAV. He requested that the group provide additional data to develop master curves on the microwave residue to compare it with the conventional RTFOT+PAV aged residue. Details of his presentation are on separate disk.

Action: Dave Jones will collect additional data from the ETG attendees to conduct the analysis. A written document will be submitted to John D’Angelo detailing the proposed 8-hour binder classification procedure.

Ala Moheseni presented the proposed development of a new model for determining the high pavement temperature for rutting from detailed climatic data included in the Integrated Climatic Effects Model (ICEM). The original high temperature algorithms developed during SHRP were based on many assumptions to simplify the algorithms in the ICEM. Both the existing SHRP and the LTPP High temperature algorithm were developed with limited climatic data. There is existing data from NOAA on detail climatic information that can be used to better predict pavement temperatures from air temperatures.

Rutting is a function of three primary conditions

1. Maximum Load level
2. Critical Temperature and
3. Loading time
The maximum load is determined from tire pressure and weight. The loading time is the function of traffic speed and number of repetitions at high temperatures. The number of repetitions is a function of number of axles & location and number of days of critical temperatures. The number of days of critical temperature is an important factor for prediction of rutting, but it is missing from most existing models.

Detailed climatic data for 240 weather stations around the country is now available. This data includes hourly temperatures for over twenty years including the wind speed and moisture. This data can be used to refine the LTPPBind software. Data from the LTPP weather stations will be used to validate the high pavement temperature prediction model.

Action: Ala Moheseni will continue to refine the LTPPBind Software. An update will be discussed in the next meeting.

Gayle King presented information on grade bumping practices. He discussed issues related to adjusting the asphalt binder grade to account for higher ESAL’s and/or slower traffic. He mentioned that there are two official AASHTO documents; MP1 covers the Binder specifications and MP2 covering the Mixture specifications. MP1 references the LTPPBind software for binder grade selection and MP2 references Superpave software, which has a grade selection procedure for traffic. He briefly discussed the current grade bumping procedure practiced by State Agencies. He said that, based on the survey the States are using both AASHTO software and the new LTPPBind software to bump the grades.

He discussed the comparisons of French wheel tracking test, SST-RSCH and ALF Rutting vs. Binder grade. From the test data the effect of increased traffic loading to temperature were as follows:

<table>
<thead>
<tr>
<th>Tests</th>
<th>°C/traffic decade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. French PRT</td>
<td>7°</td>
</tr>
<tr>
<td>2. SST-RSCH</td>
<td>10°</td>
</tr>
<tr>
<td>3. ALF</td>
<td></td>
</tr>
<tr>
<td>- AC Layer</td>
<td>8°</td>
</tr>
<tr>
<td>- Total Rut</td>
<td>15°</td>
</tr>
</tbody>
</table>

For the various grade bumping methods LTPPBind bumps at 3 million and 30 M ESALs or 6°C per traffic decade, starting at 300 k ESALs. The SHRP algorithm only bumps 3°C per traffic decade results in insufficient bumping based on the observation. He recommended that based on the ALF study, 300 K ESALs may be used as the starting point. On the other hand, for the low volume traffic roads reduced reliability can be used if the binder economics dictate. Finally, he recommended the following:

1. Official recommendations to AASHTO is to continue use the LTPPBind for grade bumping procedure.
2. Change MP-2 and the AASHTO Superpave accordingly
3. Need more work on how to select the Low Temperature grade for cracking
Action: John D’Angelo asked the group to submit their comments/suggestions on grade bumping procedure. A final document will be prepared by Gayle King with all the recommendations. The finalized document on grade bumping procedure will be forwarded to the State Agencies.

Ludo Zanzatto presented the results from a study entitled “Modeling of Repeated Creep-Recovery Test of Asphalt Binders by Data from Dynamic Mechanical Tests”. The goal of this study was to model repeated creep and recovery curves from creep tests on asphalt binders with data obtained from dynamic mechanical tests. He briefly discussed the modeling process for creep and recovery data. He showed actual creep data and modeled data for Cariphalt, Nevada PG 64-22 and Nevada AC 20. The creep recovery test data was obtained from the Federal Highway Administration Highway Infrastructures and Pavement Technology (HIPT) asphalt binder laboratory. In conclusion, he said that it is possible to model the repeated creep and recovery curves using data from dynamic mechanical experiments. Details are included under separate disk.

Raj Dongre presented the correlations between the creep recovery tests done on asphalt binders versus creep recovery tests done in asphalt mixtures. He showed the comparisons of PG 64-22, Nevada AC20-P and asphalts from the new FHWA polymer study. The binder creep recovery data showed good correlations with mixture data of repeated shear at constant height. He proposed a simplifying scheme for the modeling of creep recovery data, which would otherwise be computational intensive as demonstrated by Ludo Zanzatto. Dave Anderson shared the data from the creep recovery testing conducted at Pennsylvania State University. Gerry Reinke presented the data on repeated creep test on the binders and fatigue test on the asphalt mixtures. He showed the data from Minnesota Roads and Citgo asphalts from Georgia. He briefly discussed comparisons of accumulated strain versus the number of cycles to failure for asphalts PG 58-40, PG 58-34, PG 58-28 (Minnesota Roads) tested at 58°C and asphalt with different modifiers tested at 67°C on RTFO residue at 300 Pa stress. Test results showed relatively no difference in the strain levels for the different modified asphalts. He showed the data for asphalt mixtures tested as well.

Action: John D’Angelo asked the group that there is lots of work being conducted by the High Temperature Task Group in determining the best way to conduct the creep recovery test. The HTTG will continue to work on this issue and the discussions will continue in the next meeting.

John D’Angelo presented the activities of the Fatigue Task Group (FTG). He said that, the major issues we have had in pavement distress for last ten years has been rutting. However, when Superpave was introduced the State Agencies complained about low asphalt content in the asphalt mixtures. Most state agencies may experience more fatigue distress in the next few years. The ETG must address the fatigue related issues in asphalt binders. The Fatigue Task Group was formed to expand on the ideas from NCHRP 9-10 fatigue study, validate the findings, and make it applicable to the binder specifications. NCHRP 9-10 came up with a fatigue test, where the asphalt binder is repeatedly sheared over an extended period. The Fatigue Task Group’s intent is to continue the work started under NCHRP 9-10, to refine the test procedure and develop specification criteria for the test. An experiment was planned at their last meeting to use 4 binders, 4 different test temperatures, and different 2 strain levels to conduct the fatigue study. Three of the
binders selected have actual roadway performance data and the fourth binder is not determined yet. Four-point bending testing will be conducted on the mixtures with one mix design, two asphalt binders and four temperatures. In their second meeting at AAPT, some questions were raised about the compliance problems with the equipment. An experiment was developed to determine the response of the rheometers to loading times temperatures and load. Dave Anderson presented some preliminary data obtained from his Rheometrics DSR. He said that, more data has to be collected to include other manufactured equipment and no conclusions were drawn at this point.

Action: Dave Anderson will continue to collect more data to include other Rheometers to examine the compliance problems. Results will be presented at the next meeting.

Jack Youtcheff reported on the research being conducted under NCHRP 90-04 project entitled Understanding the Performance of Modified Asphalt Binders in Mixes carried out by FHWA R&D. The objective of this research is to understand how modified binders work in asphalt binder Mixtures. He listed the ten modified binders used in this research. The research will test mixtures with various modified binders using the latest laboratory performance tests and then validate the mix testing with the ALF. He briefly discussed the laboratory-testing plan, which includes the following:

1. High Temperature – SST, French, Hamburg
2. Intermediate Temperature – Beam Fatigue
3. Low-Temperature – TSRT, IDT
4. Moisture Sensitivity – Hamburg, Pull off

He showed the preliminary test data indicating that binders with similar PG grades do not ensure similar mix properties. See presentation on separate disk.

Dave Anderson reported on the activities of NECEPT. NECEPT and CAP Lab are actively involved in a Regional Binder Certifications Program. The binder certification program is a three-day process, in which all the test methods are reviewed and then the technicians have to demonstrate the test methods and procedures. To date they have certified about 30 technicians from the Northeast region. Other topics he discussed are as follows:

1. Split Sample Program
2. Asphalt Binder Workshop for Users/Producers in Northeast Region

He briefly discussed the issues/concerns/problems that were raised by the technicians at the Asphalt Binder Workshop held at Penn State and CAP Lab. He suggested that these issues have to be considered in refining asphalt binder specifications. The list of issues he discussed is attached.

John D’Angelo reviewed the binder aging procedures. The modified rolling thin film as proposed by NCHRP 9-10 to improve the aging characteristics of modified binders with the metal rods did not materialize. The evaluations conducted by the South Eastern Asphalt user-Producer Group and the FHWA 90-02 work were not able to duplicate the results of MRTFOT. A detailed report on the MRTFOT has been submitted to NCHRP and TRB committee. He said that, we still have problems
with the short-term aging of asphalt binders; especially the modified binders and we need to address this issue. He suggested that we could take the following two approaches for short-term and long-term aging:

1. The Modified German Rolling Flask
2. To consider the 8-hour Classification system using the Microwave aging procedure.

Primary work on the modified German Rolling Flask was conducted by WRI, which has produced similar test results as the RTFOT. He proposed that FHWA would purchase the equipment and evaluate the German Rolling Flask procedure using modified binders. He mentioned that WRI is also evaluating the long-term aging of asphalt binders from the chemistry point of view. Meanwhile Dave Jones will continue the work on 8-hour classification system using microwave aging.

Action: FHWA under the 90-02 project will procure the German Rolling Flask apparatus to evaluate the short-term aging procedure using modified binders from the new FHWA Polymer study. The test results will be discussed in the next meeting.

Mike Zupanick presented his perspective on the research needs, activities and priorities to improve the asphalt binder specifications. He listed four major research needs in their order of priority. The proposed research needs/activities are as follows:

1. Fatigue Issues - His view is that the fatigue in binders is poorly understood and need a fundamental study to understand how binder influences fatigue cracking.
2. Rutting Issues – need better way of predicting rutting
3. Aging Issues – need better aging procedure to replace RTFOT
4. Thermal Cracking Issues – Thermal Fatigue

Other non-specification priorities included: water resistance, grade selection algorithms, implementation of binder specifications at the counties and municipalities level, and uniformity of the Binder specifications nationwide. He urged the group that the above issues can be addressed in a systematic approach by planning the research activities, listing the options, brainstorming, and economic considerations, volunteering and finally providing funding for essential research projects. Detailed list is on separate disk.

Executive session:

- It was agreed that the ETG should continue to look at procedures to improve the repeatability of the Direct Tension test TP 3. FHWA will work on pulling together the recommendations and submit a revised sec to AASHTO.

- The ETG supports the concept of using only DT data for determination of the Critical Cracking Temperature for thermal cracking. More data has to be analyzed to determine the variation in test results using only the DT.

- The ETG is in favor of putting out a Grade Bumping white paper. Comments are to be to
John D’Angelo by 4-20. D’Angelo will then distribute the document.

- The High Temperature Task Group should continue to evaluate the 9-10 concepts, but should not disregard new ideas.

- Aging of binders is still not well understood. The ETG should establish a task group to describe the problem.

The next Binder ETG meeting is planned for August 29th & 30th, 2001. The meeting will be held in Washington D. C. Additional details will follow the minutes.