The meeting was convened on August 28, 2001 by Chairman Jim Musselman of the Florida Department of Transportation. Those members attending were:

James A. Musselman, Florida DOT (Chair)  
John R. Bukowski, FHWA (Secretary)  
Ronald A. Sines, New York DOT (Vice-Chair)  
Lon S. Ingram, Kansas DOT

John Cheeever, Aggregate Industries  
Frank Fee, Citgo  
Kevin Hall, University of Arkansas  
Gerry Huber, Heritage Research  
Richard Kim, North Carolina State University  
Larry Michael, Maryland DOT  
Julie Nodes, Arizona DOT  
Randy West, APAC Inc

Mike Anderson, Asphalt Institute  
John D’Angelo, FHWA (liaison Binder ETG)  
Ted Ferragut, TDC Partners (Support Staff)  
Tom Harman, FHWA (Support Staff)  
Edward Harrigan, TRB (Support Staff)  
F. M. Harvey, Wyoming DOT (liaison AASHTO Subcommittee on Materials)  
Haleem Tahir, AASHTO (liaison)

Those “friends of the ETG” attending were:

Ernie Bastian, FHWA  
Gaylon Baumgardner, Ergon Inc.  
Mike Bienvenu, Troxler Laboratories  
Tom Brovold, TestQuip  
Ken Brown, Troxler Laboratories  
Ray Brown, NCAT  
Chris Brunais, APAC Inc.  
Frank Dalton, Pine Instrument Co.  
Dale Decker, Consultant  
Lee Gallivan, FHWA Indiana Division  
Peter Grass, Asphalt Institute  
Joe Hiddeman, Chevron Asphalt  
David Jahn, Martin Marietta  
Leonnie Kavanagh, TRB  
Brian Killingsworth, Fugro-BRE Inc  
Todd Lynn, APAC Inc  
George Marshall, Troxler Labs  
Paul Messersmith, APAC Inc.  
Bernie McCarthy, Asphalt Institute  
Charles Paugh, FHWA-SaLUT  
Bob Peterson, Asphalt Institute  
Katherine Petros, FHWA  
Roger Pyle, Pine Instruments  
Ali Regimand, Instrotec Inc.  
Gerry Reinke, Mathy Construction  
Greg Schiess, FHWA Florida Division  
Aroon Shenoy, FHWA  
Pamela Turner, Asphalt Institute

Call To Order  
Musselman  
Chairman Musselman welcomed the group. The Chairman reviewed the agenda (Attachment A), emphasized the essential functions of the ETG, and reviewed previous meeting Action Items. Chairman Musselman asked the attendees for self-introductions.

Update of Selected NCHRP Projects  
Harrigan  
Brief on status of selected NCHRP projects, 9-9(1), 9-14, 9-16, 9-19 Task C, 9-22, 9-33 and 9-34.
• 9-9(1) Verification of gyration level in the N design table – verify through field project evaluation that the gyration levels for the Superpave design system are appropriate. It has been observed that rates of densification are varying among the field sections. These are affected by traffic, climate, asphalt content and other mix properties. To be completed in 2003.

• 9-14 Restricted Zone examination, with the potential purpose of eliminating the restricted zone. Work completed, investigated a number of mixes above, through and below the restricted zone. Conclusion; mixes meeting Superpave volumetric criteria and FAA requirements with gradation through the restricted zone had no detectable differences than other mixtures. Panel and researchers recommendation is to eliminate the restricted zone. ETG discussed this effort, and there were some concerns expressed that if an agency has previously relaxed some of the volumetric or FAA criteria and now eliminates the restricted zone, there could be a problem. Those agencies need to pay particular attention to this issue.

**Action:** Based on the discussion and information resulting from NCHRP 9-14 it was agreed by the ETG members that the restricted zone should be removed from the Superpave procedures. In particular, all references to the restricted zone should be deleted from AASHTO MP2 and PP28. A recommendation to eliminate the restricted zone and a one page summary of background information will be provided by the ETG Chair to the AASHTO Subcommittee on Materials (SOM).

**Action:** Further, it was noted by the ETG as well as the 9-14 researchers that the elimination of the restricted zone creates a need for a definition for fine and coarse graded mixes. A Task Group was formed (Frank Fee, John D’Angelo, Ron Sines, Jim Musselman and Gerry Huber) to develop and forward to the ETG Chair by November 1, a recommendation for defining coarse and fine graded mixes used in the Superpave mix design system.

• 9-16 Utilization of the Superpave Gyratory Compactor (SGC) to also determine indications of mixture performance. The particular property to investigate would be some indicator for mix stability. One area being investigated is whether the stability for a particular mix peaks before or after N \(_{\text{design}}\). Indications are that a mixture will be unstable in performance if the maximum stability occurs before N \(_{\text{design}}\). Some equipment “add-ons” to the SGC are being investigated. The presentation by Mike Anderson, project principal investigator, is contained in **Attachment B**

• 9-19 Task C is to identify a simple performance test for rutting and possibly serve as an indicator of fatigue cracking potential. Currently, efforts are being conducted to validate candidate devices.

• 9-22 Performance Related Specifications are being developed and validation performed on HMA production in selected field trials. A number of construction projects were investigated using the FHWA Mobile Laboratory.

**Planned FY 2002 Projects:**

• 9-33 “Superpave Mix Analysis Method, Software, and Manual” would develop a working version of a mix analysis method based on performance testing, material tests and performance models in the 2002 Pavement Design Guide. It is hoped that these models could also be used in performance related specifications. This would result in the same model platform for mix design, structural design and specification control.
9-34 “Improved Test Procedure for Determining the Moisture Damage Susceptibility of Bituminous Pavements” would develop an improved method for HMA moisture susceptibility testing based on the environmental conditioning system (ECS) and simple performance tester.

Adoption and Revision Process by Subcommittee on Materials

Harvey

Brief on the technical sections’ organization, standards review and adoption process. Presentation is contained as Attachment C.

In the SOM there are five divisions; geotechnical, bituminous materials & mixtures, cements & concretes, manufactured materials, and quality assurance/data evaluation/acceptance plans. These divisions are further divided into twenty-one technical sections. The ETG is particularly involved with the following technical sections; (1c) aggregate materials, (2b) asphalts, (2c) asphalt-aggregate mixtures, (2d) proportioning asphalt-aggregate mixtures, (5a) pavement measurement technologies, and (5c) quality assurance/data evaluation/acceptance plans.

The provisional standards use a streamlined process. This allows for easier revisions during a provisional period of up to 8 years. The SHRP standards used this process in 1993.

When standards are balloted (for adoption or revisions), all negative comments are distributed to the associated technical section for resolution. This typically takes place between November and January of each year. The complete timeline for full standards and provisional standards activities were discussed and are contained in the attachment.

Update on Subcommittee on Materials

Harvey/Tahir

Brief on status of changes to specifications currently being balloted by SOM and status of ETG recommendations. A copy of the presentation is contained as Attachment D.

The current provisional standards were distributed in April 2001. For 2002 and 2003 the provisional standards will continue to be a separate book. For Superpave, four standards have been accepted as full standards, eight are due to move to full standards by end of this year and six will be balloted and probably move to full standards in the next 2 to 3 years. Some standards not being used by State agencies will probably be dropped after 2002, these include TP7 (Superpave Shear Tester) and TP9 (Indirect Tensile Tester).

The Mixture and Binder ETGs have played a vital role and their involvement has accelerated the acceptance process. Continued technical input is still needed to refine the standards.

Action: An issue was raised concerning heating of molds for the SGC. The TP4 standard stated that molds should not be heated for more than one hour. Members questioned whether T312 still has this restriction. Rich Harvey will investigate and recommend removal of this one hour maximum, should it still exist in T312.

Report of Binder ETG Activities/Issues

D’Angelo

The Binder ETG Secretary, John D’Angelo provided a briefing on the activities of the Binder ETG. Modified systems have issues that need to be resolved. This is important since polymers are being used more frequently. The equipment to evaluate binders is well accepted, so we don’t want to change the equipment in order to evaluate modified binders. This will be a major focus of the Binder ETG activities.
with 2005 set as a target for resolution.

The Binder ETG continues to examine the feasibility of controlling the operational temperature of the rotational viscometer to greater tolerances. It is hoped that the rotational viscometer will aid in the determination of mixture and compaction temperatures for modified binders. However, no near future changes are foreseen regarding the ability to determine mix and compaction temperatures for modified binders.

The ETG has also been examining NCHRP 9-10 results for modified binders to verify the high temperature performance. The low temperature performance is being addressed by the new specification using the DT equipment. The MP1(a) specification incorporates a critical low temperature cracking evaluation, with the BBR and DT. Using BBR results at two temperatures to create a master curve and then use the DT to calculate the binder cracking temperature. The ETG is working with the FHWA’s ALF to validate work performed under 90-07. The ETG reported good correlation between G*sinδ for neat binders but not for modified binders.

SGC Comparisons and Calibration Task Force

Harman/Huber

Brief on status of Task Group and FHWA evaluation of an internal angle measuring device and activities to develop an appropriate procedure to address concerns over dissimilar mixture specimens produced by different gyratory compactors.

The angle verification kit (AVK) has been under development for over a year, and is now commercially available for approximately $8900 by TestQuip. The kit also contains a NIST traceable device for angle and alignment. The AVK allows for a highly accurate measurement of internal angle on the mixture in the gyratory compactor during operation. The AASHTO standard for the SGC, T312 requires that the ram be perpendicular to the platens and the platens need to be parallel. The AVK placed against the top and bottom platens during compaction measures the internal angle between the platens and the wall of the compaction mold. The FHWA is working with the ETG Task Group on the development of a procedure for using the AVK. Ultimately, a revised T312 procedure will be recommended to AASHTO. It is hoped that by use of the AVK, the precision of the SGC can ultimately be improved.

A concern that emerged is that the AVK is intrusive to the compaction process. The basic concern is that when the AVK is used, the measured angle is not the same angle that the mix experiences without the AVK.

Harman discussed what defines a Superpave Gyratory Compactor (SGC), the background on the compactor’s development and evolution. Recommendations from the initial FHWA study, that examined over 500 specimens, include, (1) establishment for further evaluation a tentative dynamic internal angle (DIA) at 1.16 ± 0.03° and (2) expansion of study to include different mixes, different SGCs (8 models), additional laboratories and ETG partners. Harman’s presentation is contained in Attachment E.

The ETG discussed this effort and future direction. The ETG members believe there is good preliminary data and that the study, measuring the internal angle, appears to be going in the appropriate direction.

It was recommended that the SGC manufacturers continue to be included in this effort. It is important to include a variety of SGC models. It appears, at least preliminarily, that most SGCs can adjust external angle to result in an internal angle of 1.16°.
At least one State still compacts specimens to $N_{\text{maximum}}$ and has not seen differences. It was suggested that one factor that might have increased the problem was the change of compaction to $N_{\text{design}}$. When specimens were compacted to $N_{\text{maximum}}$ with a lower air void target (2% instead of the 4% at $N_{\text{design}}$) there was possibly closer comparison between the SGCs.

In summary the ETG concluded that a uniform calibration process for the SGC is needed. The AVK appears to address this issue, but needs a national standard and process that is repeatable/reliable.

The ETG Task Group working on this issue is now composed of the following members; Randy West (lead), Gerry Huber, Larry Michael, Julie Nodes, Tom Harman, Frank Dalton and Ken Brown.

**Action:** The Task Group will (1) develop a work plan and calibration procedure for study of the SGC and AVK, (2) solicit ETG members, State agencies and others to participate in a round robin evaluation, and (3) analyze existing data.

**Action:** ETG members are encouraged to participate in expanded study of the SGC and AVK. In addition to the States already involved, Florida and Kansas are interested in participating.

**Action:** For the next ETG meeting (February 2002) the Task Group will (1) prepare in AASHTO format a standard practice for use of the AVK, and (2) recommended modifications to AASHTO T312.

**AASHTO Standards Options**

Kevin Hall was charged to look at test methods related to bulk and rice gravity calculations. He reviewed AMRL analysis and specimen testing results for T209 and provided a number of recommendations, contained in Attachment F.

**Action:** Kevin Hall, on behalf of the ETG will request that AMRL also gather data on the type of flasks being used during their next round robin testing. It is suggested that consideration be given to limiting number/type of acceptable flasks (e.g. D2041, Sect. 6.1).

**Action:** Recommend the following to T209; change Section 7.2 (sample size) to reflect consistent Superpave terminology and eliminate the hand agitation method. Kevin Hall will prepare a memo summarizing the proposed changes and related rationale to the SOM, (Attachment F1).

**Field Mixture Verification**

John D’Angelo has written a standard procedure to verify that plant produced hot mix asphalt will meet mix design criteria, (Attachment G).
ETG members discussed aspects of the procedure. This discussion included recommendations for use of forced draft oven, compaction to $N_{\text{maximum}}$, use of bulk or apparent specific gravity, and setting reasonable limits on tolerances. It was noted that each agency needs to establish their own tolerances for criteria shown in the procedure. However, once the mix design is verified, then the targets need to be adjusted to that of the produced mix.

Gerry Huber is leading an NCHRP funded activity to investigate modifying the findings from NCHRP 9-7 (Superpave QC/QA) into more useable specifications. It is anticipated that this effort will result in a newly proposed QC/QA procedure by the end of 2001. It is recommended that the mix verification procedure being reviewed by the ETG be incorporated into the 9-7 review effort.

**Action:** It is requested that John D’Angelo provide an updated copy of the FHWA field mix verification procedure to Gerry Huber for use in the 9-7 work.

### Aggregate Gradation Optimization

**Huber**

As a follow-up from last meeting’s discussion of the Bailey Method, participant’s experience using the method were reviewed.

Gerry Huber briefly highlighted the key aspects of the Bailey Method. This kind of procedure is needed as we move to eliminate the restricted zone. Something is needed to assist in controlling gradations, evaluating how aggregate gradations go together, and in helping to define/quantify a design aggregate structure. Aggregate packing is affected by compactive effort, particle shape, surface texture and size distribution or gradation. The Bailey Method addresses the gradation aspect by determining how much aggregate can be packed into a given volume.

During the 2000/2001 construction seasons ETG members studied the method.

Gerry Huber suggested that the Bailey Method steps could be put in a “TRB Circular” type format. Additionally it was suggested that the Method be used in the upcoming NCHRP 9-33 as a guide for developing aggregate gradations in a new unified Superpave mix design method.

**Action:** It is requested that Gerry Huber write the steps of the Bailey Method in a TRB Circular format, providing sufficient background information to potential users. Prior to the end of October, Huber will forward this draft Circular to the TRB A2D00 Committee for it’s consideration. A copy will also be provided to the ETG Chair.

**Action:** It is requested that Gerry Huber also prepare a problem statement for an NCHRP synthesis study of various aggregate blending methods. This statement will be sent the ETG Chair and Ted Ferragut.

### 4.75 mm “Superpave” Mixture

**Michael**

Discussions and review of recommendations for changes to MP2 to incorporate a 4.75 mm nominal size mixture. Larry Michael prepared a recommendation for inclusion of a 4.75 mm nominal maximum size mixture into MP2.

The Maryland DOT has used a 4.75 mm nominal maximum size mixture, placed 19.0 mm thick. Georgia DOT has also used a similar mix. Both States used these mixtures in conjunction with MP2, but with
some modifications for air voids and compaction gyrations. NCAT has also conducted a number of studies on a 4.75 mm nominal maximum size mixture. Several of the States would like to see such a mixture further developed. The ETG reviewed a handout of recommended MP2 changes.

Ray Brown further discussed various related NCAT studies. Various aggregate types and gradations were investigated. In some cases it appeared that design air void content needed to be modified, not just specify 4% air voids, but rather utilize a range. Test designs resulted in relatively high asphalt contents mixtures. There is some concern that a maximum asphalt content needs to be established for these mixes. Many of the mixes evaluated appeared to have good rut resistance especially for low to medium traffic. High angular aggregates will probably be needed for higher traffic levels.

Maryland DOT experience with this mix has been good, when used in thin lifts. Some ETG members were concerned that when constructed in thin lifts, the pavement layer may not have proper density and will age very quickly. Where design requires unusually high asphalt contents, there may be a need to redesign using more mineral dust.

There appears to be limited experience with design and use. ETG members were split whether to move forward at this time with a recommendation to AASHTO for inclusion under the Superpave system. This mix appears to have unique design characteristics and possibly should be treated as a separate standard.

**Action:** A Task Group was formed with the following members; Jimmy Brumfield (lead), Larry Michael, John D’Angelo, David Jahn, Gerry Huber, and Ray Brown. The Group was requested to synthesize current information and prepare a best practice for design/use of a 4.75 mm nominal maximum size mixture. It was additionally requested that by January 15, 2002, a copy of this suggested practice be sent to the Chair and to John Bukowski for distribution and review by the entire ETG.

**Tender Zone Study Anderson**

Working with the FHWA, the Asphalt Institute and a team of consultants have developed a moisture test to identify potential mix tenderness problems. A copy of Mike Anderson’s presentation is contained in Attachment H.

Study tasks include: (1) develop/evaluate procedure to trap moisture in an asphalt mixture in the laboratory, (2) evaluate test method to accurately measure the moisture in an asphalt mixture sample, (3) develop a lab procedure to simulate tender mix behavior and determine susceptibility to tenderness, (4) determine the effect of entrapped moisture on initial mixture stiffness, and (5) examine the effect of trapped (internal) moisture on asphalt binder and mastic stiffness.

Currently field evaluations of the procedure are being conducted and will be completed in 2002. These tests are particularly applicable to highly absorptive mixes, but the procedure will be useful for all mixes.

**Mixture Performance Testing Using the DSR Reinke**

Briefing on work being conducted at Mathy Construction using the DSR as a method to evaluate mixture performance characteristics.

Gerald Reinke’s presentation on this innovative procedure is contained in Attachment I. Using mixtures from MnRoad, this study utilized the DSR to simulate the Superpave Shear Tester frequency sweep and creep test. Specimens, 6mm in size, were cut from SGC compacted cylinders. Tests were performed at
This procedure gives indications of mix rutting potential. Correlations are now being evaluated with actual field performance and the test repeatability appears to be very good.

Team Reports
In 2000 the ETG formed teams to provide technical monitoring of the FHWA Superpave mixture and aggregate related activities and to provide the TRB Superpave Committee a continuing assessment of the AASHTO/TRB funded activities being conducted by the FHWA. Each team acts in a similar manner to an NCHRP Project Panel by commenting on the scope of work, providing technical input for FHWA consideration, coordinating the presentation of deliverables to the ETG for deliberation, and recommending necessary actions to the ETG.

Team 1: Status of Projects 90-01, 90-03 and 90-05   D’Angelo
Role of the team is the review of projects 90-01, 90-03, and 90-05. Members include Ron Sines, John Cheever, Kevin Hall, and John D’Angelo (FHWA lead). A summary of the projects and their objectives is as follows:

- 90-01 “Demonstration Project 90: Advanced Asphalt Mix Design and Field Quality Control” This project is a continuation of the FHWA’s mobile testing laboratory which provides data for equipment validation and field control. This effort has produced considerable data for the ETG’s consideration/recommendations. One current study has been to evaluate the use of the AVK, including the evaluation of the intrusiveness of the AVK in various compactors as well as determination of an appropriate internal angle. This work is in support of a larger FHWA study that is being conducted in cooperation with the ETG and was discussed earlier in the meeting. This summer the mobile laboratory conducted field projects (Arizona, Florida and Colorado) in support of NCHRP 9-22 “Beta Testing and Validation of HMA PRS”. Future planned activities will involve field evaluation of the Simple Performance Tester under NCHRP 9-29.

- 90-03 “Superpave Mix Tenderness” This project is investigating mixture tenderness during compaction, specifically tenderness caused by moisture in the mix. Heritage Research and the Asphalt Institute are working with FHWA on this study. This project is to be completed in 2002.

- 90-05 “Fine Aggregate Specific Gravity Test” This project has developed a simple, repeatable fine aggregate specific gravity test based on a prototype device developed by NCAT. The device determines the aggregate’s saturated surface dry weight. Error in determining the saturated surface dry condition of fine aggregate is considered to be a major source of error in the current fine aggregate specific gravity test procedure. Development of an improved test procedure is of particular importance because the fine aggregate specific gravity is used in the determination of the uncompacted void content of fine aggregate angularity (FAA) and mixture volumetric properties. The device also has the potential to reduce testing time. Some tests could be reduced from days to a few hours. In addition, automated tests generally improve reliability. Several commercial production versions have been developed. A comparison is being conducted of the new devices and old procedures. A further step will be equipment ruggedness, and then possible ETG recommendation to AASHTO.

Team 2: Status of Projects 90-07 and 90-09   Michael/Harman
Role of the team is to review projects 90-07 and 90-09. Members include Larry Michael (lead), Rebecca McDaniel, Mike Anderson, Lon Ingram, Richard Stuart, and Tom Harman (FHWA lead).
• 90-07 “Understanding the Performance of Modified Binders” This project is an extension of the FHWA’s polymer asphalt program (mix and binder specification development) examining the binder specification as it relates to various methods of modification. This effort is validating some of the aspects of NCHRP 9-10 project findings for modified binders. Premise is that neat asphalt works well in the specification. A further, more comprehensive study is planned with new asphalt modifiers, which represent a very good sampling of currently used materials. Will conduct a full suite of binder tests; high temperature, intermediate temperature, and low temperature as well as moisture sensitivity. The FHWA’s accelerated load facility is being used as part of this project. Have seen a good correlation with ALF and actual field performance. Other testing included in the study are the SST, French PRT, TSRST, and Hamburg Moisture Sensitivity. Results will be reported to the ETG. Funding of the complete study remains a challenge, and will likely be conducted as a pooled fund.

A copy of this presentation is contained in Attachment J.

**Superpave 2005 – Long Range Plan**

Ted Ferragut gave an update on the current long-range plan developed as a requirement of AASHTO resolution AR-5-98 and future research topics.

A copy of this presentation is contained in Attachment K and K1.

Ferragut reviewed the Superpave related projects to be conducted over the next few years, 2003, 2004 and 2005 and those related to long-range 2005 plan goals. Technical issues include: (1) simple performance tester being developed to augment volumetrics, (2) 2002 Design Guide issues, (3) advanced modeling, and (4) mix design method advances and PRS.

Support is still needed for sustaining momentum, integrated projects, training workers, combining mix and structural design and in particular improvement of construction techniques to ensure designs are actually put into place. Another growing area of interest is the use of Superpave on low volume roads. Mike Anderson will survey the Asphalt Institute field engineers to determine needs/issues in this area. This item will be further investigated at the next meeting.

**Executive Session – ETG Members Attached action items**

**ETG meeting adjourned.**

Next meeting will be held in Denver, Colorado and start at Noon on February 20 and conclude at 5:00 pm on February 21, 2002.
Action Items

1. All presenters should forward an electronic copy of their presentation to ETG Secretary.

2. Forward recommendations to SOM to remove the restricted zone from MP2 and PP28 and provide a one-page summary of background rationale based on the 9-14 study. - Musselman/Sines

3. Develop, by November 1 a definition and rationale for coarse and fine aggregate gradations.-Fee/Sines

4. Revise T312 to remove requirement of maximum one-hour mold heating. - Harvey

5. Task Group will (1) develop a work plan and procedure for study of the SGC and AVK, (2) solicit ETG members, State agencies and others to participate in a round robin evaluation, and (3) analyze existing data. – West/Harman

6. ETG members are encouraged to participate in expanded study of the SGC and AVK, Florida and Kansas are additionally interested. - All

7. For the next ETG meeting (February 2002) the Task Group will (1) prepare in AASHTO format a standard practice for use of the AVK, and (2) recommend modifications to AASHTO T 312. – West/Harman

8. Request AMRL to gather data on types of flasks being used for T209 during their next round robin testing. - Hall

9. Recommend to SOM to change T209, Section 7.2 (sample size) to reflect consistent Superpave mixture terminology and eliminate the hand agitation method. Prepare a memo to SOM summarizing proposed changes and rationale. – Musselman/Hall

10. Provide a copy of latest FHWA mix verification procedure to Gerry Huber for use in the current 9-7 effort. - D’Angelo

11. Prepare the Bailey Method in a TRB Circular format, providing sufficient background information to potential users and forward to the TRB A2D00 Committee (and ETG Chair) prior to the end of October. - Huber

12. Prepare a problem statement for a NCHRP synthesis study of various aggregate blending methods, send to ETG Chair and Ted Ferragut. - Huber

13. Task Group requested to synthesize current information and prepare a best practice for design/use of a 4.75 mm nominal maximum size mixture. Request that by January 15, 2002, a copy of this suggested practice be sent to ETG Chair and to John Bukowski for distribution and review by the entire ETG. - Brumfield

14. Comments on Long Range Plan and Status of Research to Ted Ferragut - All