National Pooled Fund Workshop on Asphalt Mixture Performance Tester

Summary Report

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Executive Summary

As part of Pooled-fund study TPF-5(178), a national pooled fund workshop on the Asphalt Mixture Performance Tester (AMPT) was organized in Atlanta, GA on September 11 and 12, 2012 to support the AMPT implementation effort. The workshop gathered together pooled fund study participants as well as users and experts in AMPT testing.

The workshop included presentations and round table discussions. There were 12 presentations that covered a wide range of topics, from the importance of performance testing and development of the AMPT to the users' experiences, applications of AMPT testing results and ongoing research relevant to the AMPT. All the slides from the presentations made at the workshop are included in a separate document (ftp://ftp.eng.auburn.edu/pub/nht0002/pdfs/).

There were two round table discussion sessions organized during the workshop to encourage the participants to discuss hurdles in implementing the AMPT, share strategies to address existing issues with equipment, test procedures and acceptance criteria, and identify future needs. A summary of the main topics discussed for AMPT implementation follows.

- There is a need to document the benefits of using the AMPT through case studies in executive memo format for the management level at user agencies. AMPT testing can be used to improve mixture quality, determine material inputs for AASHTOWare® Pavement ME Design, evaluate new materials and technologies, and conduct forensic studies.
- It is important to continue to provide training opportunities for technicians and engineers. The training can be conducted regionally to minimize costs to states.
- It is suggested that AMPT user groups are established within the regional asphalt user producer groups. The user groups can help promote interaction, exchange information and experience, and identify future needs.
- Further guidance on specimen preparation is needed. The guidance should include details on support equipment requirements and potential sources and best practices for technicians to prepare AMPT specimens.
- It is important to have a standard method for flow number testing. While the AMPT can be used for conducting both dynamic modulus and flow number tests, there is only a standard test method for dynamic modulus at this moment. Thus, a similarly detailed standard method is needed for the flow number test. In addition, guidance on using the flow number test results in the mix design and pavement design process should also be developed.
- There is a need to provide updated information on ongoing research on test methods (e.g., AMPT fatigue test and AMPT overlay test) that can be used to evaluate the mixture cracking resistance. The information should include proposed test procedures, equipment upgrade requirements and costs, and future training for the new tests.

In summary, the workshop provided a forum to discuss the development and implementation of the AMPT and relevant test procedures for evaluating the performance of asphalt mixtures and providing inputs for MEPDG pavement design. The main topics discussed will be considered as part of the pooled fund study and/or under other AMPT implementation efforts as time and funding permit.

Table of Contents

1. Introduction

Pooled-fund study TPF-5(178) was initiated in 2008 to support the implementation of the Asphalt Mixture Performance Tester (AMPT) for Superpave mix design and for asphalt pavement design and analysis. The study has procured the AMPT and provided technician training for participating highway agencies to perform the standard tests for measuring dynamic modulus (E*) and flow number (Fn) of asphalt mixtures. Based on the inputs from the pooled-fund participant agencies collected by FHWA, a national workshop for AMPT users was one of the implementation support activities identified as important tasks within the pooled fund study.

Thus, a national pooled fund workshop on AMPT was organized in Atlanta, GA on September 11 and 12, 2012 to support the AMPT implementation effort. The workshop gathered together pooled fund study participants as well as users and experts in AMPT testing. The workshop provided a forum to discuss the development and implementation of AMPT and relevant test procedures for evaluating the performance of asphalt mixtures and providing inputs for the AASHTOWare® Pavement ME Design.

2. Agenda

Figure 1 shows the final agenda of the national workshop, which provided a forum for all the participants to discuss the following topics:

- Importance of performance testing for asphalt mixtures
- Development of the AMPT and current specifications
- Applications of AMPT testing results for mix evaluation and pavement design
- User's experience with AMPT implementation and testing
- Round table discussion to share experiences and strategies to address issues with equipment, test procedures and acceptance criteria and to identify future needs.
- Future plans and other tests that can be performed using the AMPT

3. Participants

There were 72 participants, of which 39 attendees were from the pooled fund study participating highway agencies. A list of participants is provided in Appendix A.

4. Presentations

As shown in Figure 1, there were 12 presentations made during the workshop. The presentations covered a wide range of topics, from the importance of performance testing and development of the AMPT to the users' experiences, applications of AMPT testing results and ongoing research relevant to the AMPT. All the slides from the presentation made at the workshop are included in a separate document (ftp://ftp.eng.auburn.edu/pub/nht0002/pdfs/). {This report and the individual presentations will ultimately be posted on the SE AMPT Users Group website http://www.eng.auburn.edu/center/ncat/SEAUPG/}

Tuesday, September 11, 2012

Session 1 (Ray Brown, NCAT, Moderator)

8:00–8:15	Introduction and Welcome. *John Bukowski, FHWA*
8:15–8:45	Why Performance Testing. *Ray Brown, NCAT*
8:45–9:45	AMPT Development. *Ray Bonaquist, AAT*
9:45–10:00	Break
10:00–10:40	Applications of AMPT Test Results. *Nam Tran, NCAT*
10:40–11:00	AMPT Pooled Fund Study. *Jeff Withee, FHWA*
11:00–11:30	Experience with Equipment Setup, Calibration, Maintenance, and Repair. *Brian Waller, NCAT*
11:30–12:00	Experience with Specimen Preparation. *Adam Taylor, NCAT*
12:00–1:00	Lunch

Session 2 (Mike Heitzman, NCAT, Moderator)

1:00–3:00	User's Experience with AMPT - Maryland. *Chuck Schwartz, UMD* - Utah. *Kevin VanFrank, UDOT* - Colorado. *Ed Trujillo, CDOT* - Wisconsin. *Judie Ryan, WisDOT*
3:00–3:15	Break
3:15–5:00	First Round Table Discussion Session (based on User/Producer Groups)
5:00	Adjourn

Wednesday, September 12, 2012

Session 3 (Ray Brown, NCAT, Moderator)

8:00–9:15	Second Round Table Discussion Session (based on Discipline and Geography)
9:15–9:30	Break
9:30–10:15	Reports on Round Table Discussion. *Group Facilitators*
10:15–10:30	Plan for Pooled Fund Inter-laboratory Study. *Nam Tran, NCAT*
10:30–11:00	S-VECD Fatigue Testing on AMPT. *Richard Kim, NCSU*
11:00–11:30	Additional Questions and Wrap-up. *Jeff Withee, FHWA & Nam Tran, NCAT*
11:30	Adjourn

Figure 1 Agenda for National Pooled Fund Workshop on AMPT in Atlanta, GA

5. Round Table Discussion Sessions

There were two round table discussion sessions organized during the workshop to encourage the participants to (1) discuss hurdles in implementing the AMPT, share strategies to address existing issues with equipment, test procedures and acceptance criteria, and (2) identify future needs. Figure 2 shows the plan for the round table discussion sessions.

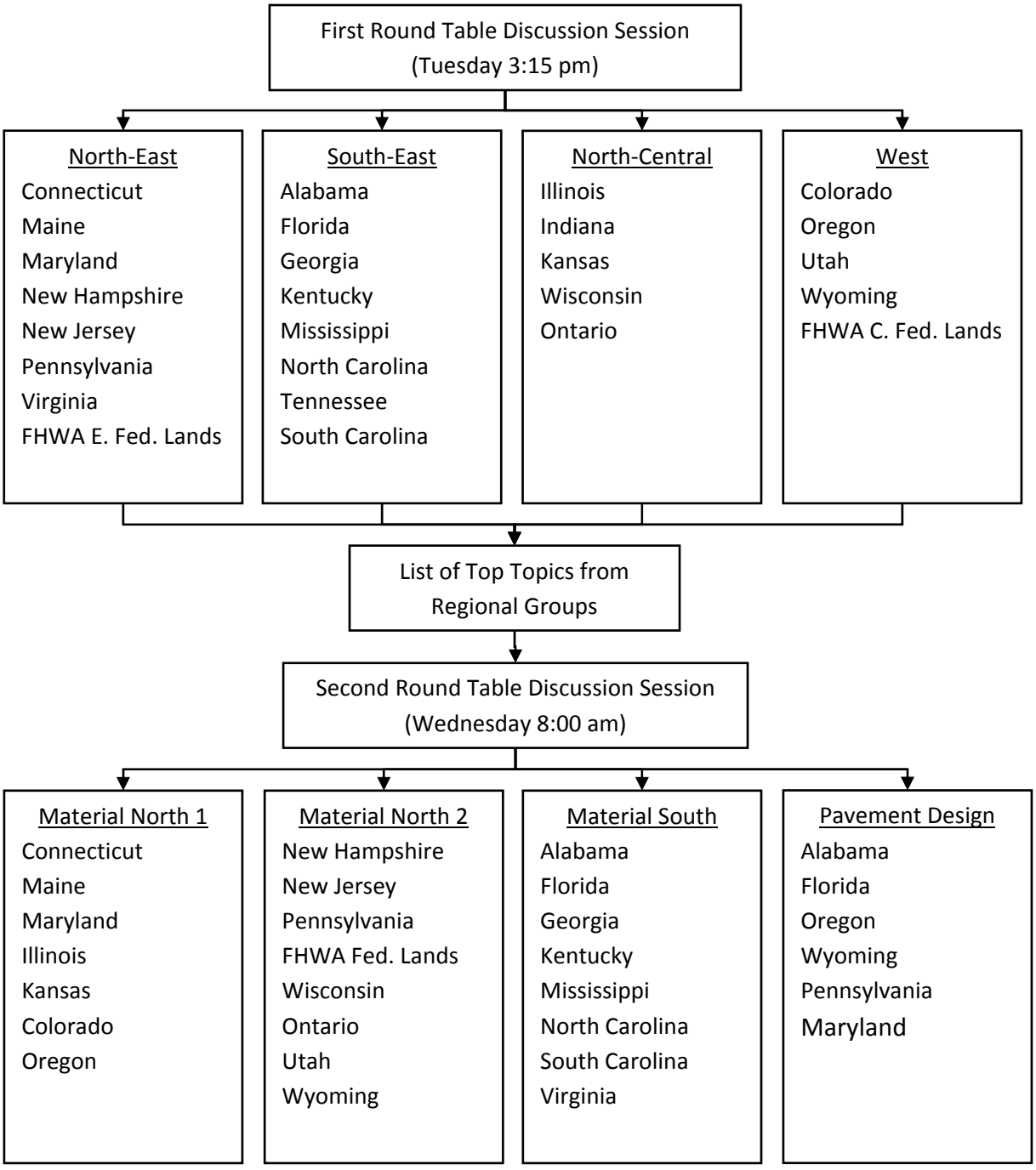


Figure 2 Break-out Sessions for National Pooled Fund Workshop on AMPT

The 100-minute first round table discussion session was setup based on four agency regions—North-East, South-East, North-Central, and West. This session allowed the participants from the state agencies that may share similar conditions on a regional basis to share their expertise and identify issues that needed to be addressed. Both material and pavement engineers from the agencies were participating in these discussions. During both the round table discussion sessions, the non-state agency participants

were free to attend the group of their choice. The topics identified in each regional group discussion in the first round table discussion session are summarized in Appendix B.

At the end of the first session, each group ranked the issues as high/medium/low in each category. The topics highly ranked in the four regional groups were then summarized and divided into two categories—material-related and pavement design-related. Table 1 lists the top topics from the first round table discussion session in the two categories.

Table 1 Highly Ranked Topics from the First Round Table Discussion Session

Topics – Implementation Challenges & Needs	Material-Related	Design-Related
Provide guidance on sample preparation (3 groups)	✓	
Form user groups to share experience	✓	
Do not have adequate staff (2 groups)	✓	
Need a fatigue test	✓	✓
Address equipment overheating	✓	
Is there an overlay test procedure?	✓	✓
Installing the equipment (agency management issue)	✓	
Need a low temperature test	✓	✓
Need an incentive for management to use (2 groups)	✓	✓
Need guidance for use as part of Mix Design	✓	
Need more training (2 groups)	✓	✓
Need funding support for additional needed equipment	✓	
Need a standard Flow Number Test Procedure (2 groups)	✓	✓
Need to improve E* Quality Control and Master Solver	✓	✓
Need to determine specimen air voids criteria (+/- 0.5 vs. +/- 1.0)	✓	

In the 75-minute second round table discussion session, the attendees were participating in four group discussions setup by discipline and geography—Material-North 1, Material-North2, Material-South, and Pavement Design. The participants were able to select the second session for materials or design to match their expertise and interest. The top material-related topics were further discussed in the three material groups, and the top design-related topics were further discussed in the pavement design group. Table 2 lists the top ranked topics selected by each group for further discussion in the second round table discussion session. It should be noted that some top topics identified in the first round table discussion session (Table 1) were combined in three of the four group discussions in the second round table discussion session. The implementation activities discussed will be considered as part of the pooled fund study and/or under other efforts as time and funding permit. The notes of the discussed topics in the second round table discussion session are provided in Appendix C, and a summary of the main topics is presented in the next section.

Table 2 Top Topics Further Discussed in the Second Round Table Discussion Session by Each Group

Topics	Material North-1	Material North-2	Material South	Pavement
Provide guidance on sample preparation	✓		✓	
Form user groups to share experience	✓	✓		
Do not have adequate staff			✓	
Need a fatigue test		✓	✓	✓
Address equipment overheating				
Is there an overlay test procedure?	✓		✓	✓
Installing the equipment				
Need a low temperature test				✓
Need an incentive for management to use		✓		✓
Need guidance for use as part of Mix Design	✓		✓	
Need more training			✓	✓
Need funding support for additional equipment				
Need a standard Flow Number Test Procedure	✓			✓
Need to improve E* Quality Control and Master Solver		✓		
Need to determine air voids criteria (± 0.5 vs. ± 1%)	✓	✓		

6. Summary of Prioritized Needs for AMPT Implementation

In the second round table discussion session, each group selected top topics for further discussion (Table 2) and developed a list of potential action items to address specific needs within each topic. Below is a summary of the main topics and needs combined from the second round table discussions.

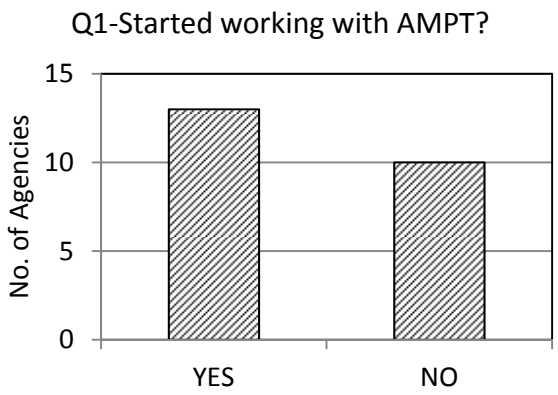
- Promote benefits of use
    - Executive memo for management level
    - Cost/benefit information and case studies
    - Various use categories
        - Performance testing to improve mixture quality
        - Material inputs for mechanistic-empirical pavement design
        - Ability to evaluate alternative materials and technologies
        - Potential to perform forensic studies
- Deliver continuing training opportunities
    - Regional training sites (e.g., Superpave centers)
    - On-going training opportunities for new staff
    - Technician training for specimen preparation and AMPT operation
    - Engineers training for data analysis and interpretation
    - Minimal or no cost to states (including travel support)
    - On-site equipment setup and support
- Facilitate AMPT user groups
    - Establish regionally (e.g., asphalt user producer groups)

    - Identify lead staff for coordination responsibilities
    - Document scope, objectives, and budget
    - Schedule meetings or on-line forums to promote interaction
    - Develop contact lists (operating technicians, data analysis engineers, etc.)
    - Web based bulletin board for posts and discussion threads
- Provide guidance on specimen preparation
    - Details on support equipment requirements and potential sources
    - Establishing appropriate air void tolerance (±0.5% or ±1.0%)
    - Achieving target air voids and air void uniformity
    - Saw cutting for end flatness and perpendicularity
    - Documenting other effective tips for technicians
- Standardize flow number test procedure
    - Common test parameters (axial pressure, confinement, temperature selection)
    - Uniform results reporting (Fn, slope & intercept, strain at 10,000 cycles)
    - Mixture performance criteria for the standardized test procedure
- Develop guidance for use in mix design processes
    - Comparison of Flow Number (Fn) with APA and Hamburg results
    - Targeted testing for maximum benefit in a mixture design approval process
    - Options and best practices to minimize testing time
- Refine fatigue testing for the AMPT
    - Guidance on testing procedure and variability
    - Equipment upgrade requirements and costs
    - Estimating fatigue life and managing extended testing times
    - Training on continuum damage theory in layman's terms
- Provide guidance on overlay testing in the AMPT
    - Comparison study of Texas overlay tester to overlay testing in AMPT
    - Equipment upgrade requirements and costs

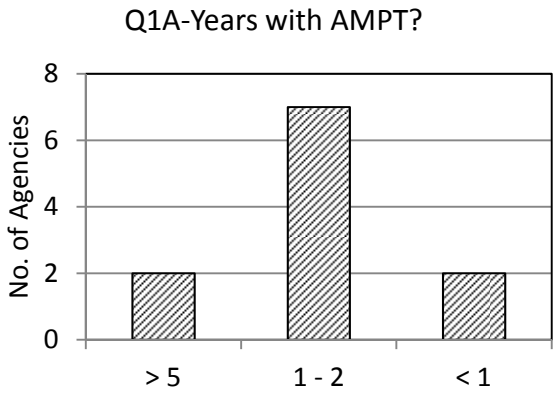
7. Survey of State Agencies Attending the Workshop

During the first round table discussion session, a brief survey of state agency personnel attending the workshop was conducted to better quantify the level of experience and planned use of the AMPT for evaluating asphalt mixtures and providing inputs for mechanistic empirical pavement design. The questions asked in the survey are included in Appendix D. A summary of the survey results is presented in Table 3.

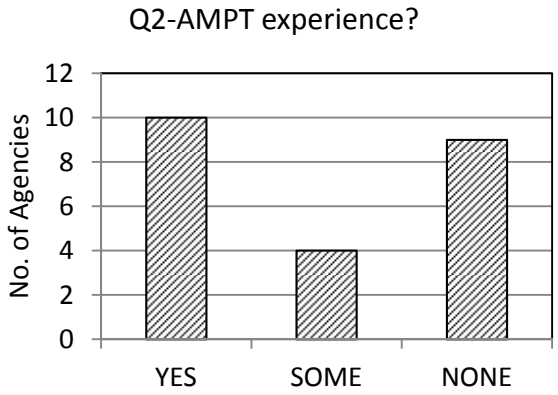
Table 3 Summary of Survey Results



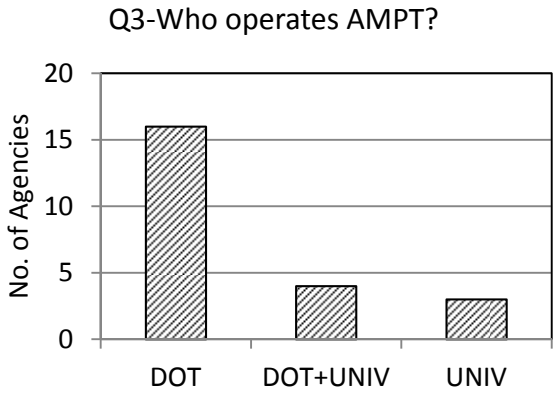
Q1: Over half of the agencies attending the workshop have worked or started working with AMPT.



Q1A: Only two agencies indicated that they had over 5 years of experience with the equipment. The respondents may have limited their response to only agency experience.

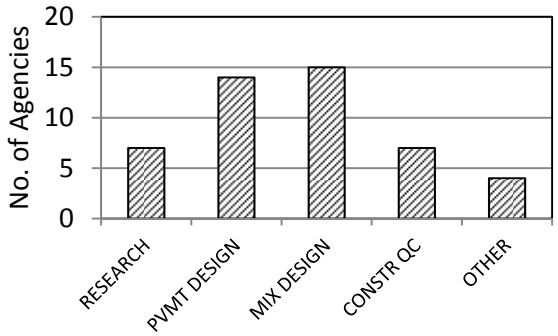


Q2: The responses are similar to those of Q1, and some of the agencies note that their experience is limited.

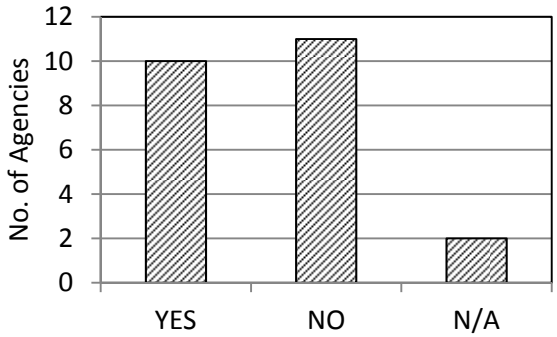


Q3: Most of the agencies will operate the AMPT in their central materials lab. About one-third of the agencies will co-locate and operate the device with the university/research organization or allow the university/research organization to operate it for the agency.

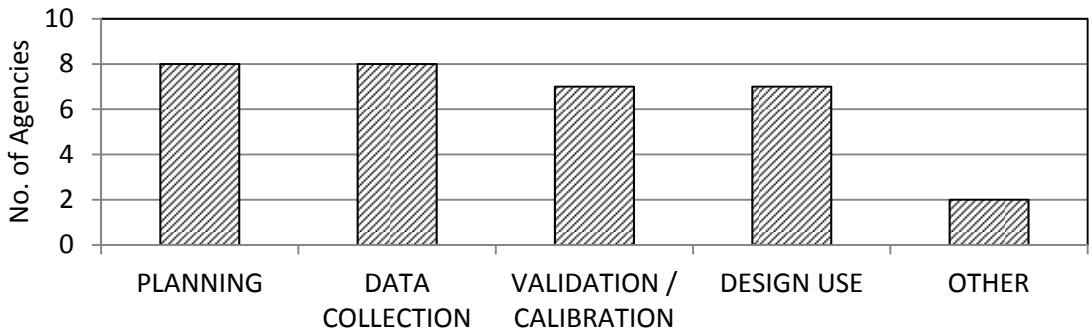
Table 3 Summary of Survey Results (Continued)



Q4: Over half of the agencies indicated that the primary use for the AMPT was to provide input data for DARWin-ME or to evaluate mixture performance for asphalt mixture design.



Q5: Based on the knowledge of the participants from the agencies, more than half stated that the agency had not begun working with DARWin-ME. This question did not specifically include MEPDG, so the response may be higher than actual level of effort. The N/A responses are for two agencies that didn't intend to implement DARWin-ME.



Q6: The response for the use of DARWin-ME is mixed. A better stated question may have provided more information. The responses to Q5 and Q6 do not agree in some instances.

Appendix A. Participant List

ID	Agency Name	First Name	Last Name
1	Advanced Asphalt Technologies, LLC	Ramon	Bonaquist
2	Alabama Dept of Transportation	John	Jennings
3	Alabama Dept of Transportation	Robert	Shugart
4	American Engineering Testing, Inc.	Dave	Van Deusen
5	Asphalt Institute	Richard Michael	Anderson
6	Asphalt Institute	Phillip B	Blankenship
7	Colorado Department of Transportation	Edward A.	Trujillo
8	Connecticut Dept. of Transportation	David B.	Howley
9	Connecticut Dept. of Transportation	Jonathan	Boardman
10	Cooper Technology	Andrew	Cooper
11	Federal Highway Administration	Matthew	Corrigan
12	Federal Highway Administration	John	Bukowski
13	Federal Highway Administration	Jeffrey	Withee
14	Federal Highway Administration	Christopher	Wagner
15	FHWA Central Federal Lands	Charles	Luedders
16	FHWA Central Federal Lands	Ronald	Andresen
17	FHWA Eastern Federal Lands	Jason Anthony	Moore
18	Florida Department of Transportation	Hyung Suk	Lee
19	Florida Department of Transportation	Scott Mathew	Ellis
20	Georgia Dept. of Transportation	Peter	Wu
21	Georgia Dept. of Transportation	Shelia	Hines
22	Georgia Dept. of Transportation	James	Brandon
23	Georgia Dept. of Transportation	Steve	Pahno
24	Georgia Dept. of Transportation	Ben	Augustine
25	Illinois Dept. of Transportation	Anthony	Karas
26	Illinois Dept. of Transportation	Thomas G.	Zehr
27	InstroTek, Inc.	Adam C.	O'Neill
28	InstroTek, Inc.	Lawrence	James
29	Kansas Department of Transportation	Charles R.	Espinoza
30	Kansas Department of Transportation	Brian	Coree
31	Kansas State University	Ryan	Benteman
32	Kentucky Transportation Cabinet	Thomas	Clements
33	Kentucky Transportation Cabinet	Robert T.	Semones
34	Maine Department of Transportation	James	Robinson
35	Maine Department of Transportation	Scott R.	Jones
36	Martin Marietta Materials	Sam R.	Johnson
38	Maryland State Highway Administration	Ronald F.	Toloczko
39	Mississippi Dept. of Transportation	Kevin	McCaskill
40	Mississippi Dept. of Transportation	James	Williams

ID	Agency Name	First Name	Last Name
41	Mississippi Dept. of Transportation	Mike	Sullivan
42	Mississippi Dept. of Transportation	Griffin	Sullivan
43	National Center for Asphalt Technology	Michael	Heitzman
44	National Center for Asphalt Technology	Ray	Brown
45	National Center for Asphalt Technology	Nam	Tran
46	National Center for Asphalt Technology	Adam	Taylor
47	National Center for Asphalt Technology	Don	Watson
48	National Center for Asphalt Technology	Brian	Waller
49	New Hampshire Dept. of Transportation	Matthew	Courser
50	New Hampshire Dept. of Transportation	Denis	Boisvert
51	New Jersey Dept. of Transportation	Jude	Kianka
52	New Jersey Dept. of Transportation	Walter	Apgar
53	North Carolina Dept. of Transportation	James	Budday
54	North Carolina Dept. of Transportation	Kevin McDonald	Smith
55	North Carolina State University	Richard	Kim
56	Oregon Department of transportation	Larry	Ilg
57	Ontario Ministry of Transportation	Sayed	Tabib
58	Ontario Ministry of Transportation	Imran	Bashir
59	Pennsylvania Dept. of Transportation	Joshua	Freeman
60	Pennsylvania Dept. of Transportation	Troy	Lehigh
61	PRI Asphalt Technologies	Matthew	Groh
62	PRI Asphalt Technologies	Duc	Nguyen
63	South Carolina DOT OMR	Cliff	Selkinghaus
64	South Carolina DOT OMR	Caleb	Gunter
65	Troxler Electronic Laboratories	Darin	Smith
66	University of Maryland	Charles W.	Schwartz
67	Utah Dept. of Transportation	Kevin	Van Frank
68	Utah Dept. of Transportation	Clark	Allen
69	Virginia Dept. of Trans. Research Council	Donald	Dodds
70	Virginia Dept. of Trans. Research Council	Harikrishnan	Nair
71	Wisconsin DOT - Bureau of Tech Svs	Judith A.	Ryan
72	Wyoming Dept. of Transportation	Michael	Spilker
73	Wyoming Dept. of Transportation	Christopher	Escandon

Appendix B. First Round Table Discussion Session Notes

B.1. North-East Region

Installation of Equipment

- Need to find a way to get funding for future equipment modifications if needed
- Need to provide guidance on expected costs and efforts for equipment installation

Equipment Issues

- Equipment overheating in one case
- Equipment generating heat in room

Staffing

- Testing requires too much staff time (1 week for specimen preparation and testing per mix)
- Need to find a way to reduce testing time

Sample Preparation

- Need to get a gyratory compactor that can prepare 180-mm tall samples
- Need to provide guidance on avoiding chipping of edges (cutting the sample first, then coring the center)
- Need to provide guidance on equipment for cutting perpendicular and parallel ends

Environmental Chamber

- May need additional air-conditioning if the equipment is in a small room

Top Issues/Concerns

- Incentive to use
- Staffing
- Installation of equipment
- Setting up sample preparation and testing processes in the lab
- Temperature control

Incentive to Use

- Improve quality
- Evaluate alternative materials
- Provide inputs for DARWin-ME

B.2. South-East Region

Concerns/Issues

- Staffing/Level of technician
    - Need to continue training opportunities. FHWA assistance with funding through co-op has been helpful and needs to be continued.
    - With agency reductions in staffing, this position may be difficult for DOT to dedicate staff to.
    - Some agencies conduct 800-1200 mix designs/year. AMPT testing will have to be selective; need guidance for what project levels will benefit from AMPT most.
- Equipment (saws, drills, environmental chamber) [Package with AMPT] (Purchase through projects. How much benefit?)

    - Agencies have been frustrated when buying AMPT only to have it sit while they try to get accessory equipment budgeted and purchased. Need to include all supporting equipment in a package deal.
    - FHWA needs to be flexible enough to allow equipment purchase to be made through construction contracts (Agencies may be able to justify by using AMPT to study effects on performance if AMPT is used versus when AMPT is not used.)
- Time (5 days)
    - The length of time needed to get results limits AMPT use in production lab. Can testing time be shortened?
- Repeatability
    - Need to study lab and inter-lab precision and bias. (This work is underway.)
- Training - See first item
- Procedure
    - Need to decide on issues such as sample prep to ±0.5 or ±1.0% air voids.
- Confined/Unconfined
    - Need to establish national consensus or standard on when to use and what pressures to use.
- Quantified Difference
    - Need to provide a cost-benefit for both AMPT and MEPDG in order to justify change.

Research

- Effect of RAP/RAS on Fn - This work is being done.
- Is Fn better predictor than APA or Hamburg?
    - Agencies already have a level of comfort with the torture tests and have specification tolerances in place for their use. That level of comfort does not exist with AMPT.
- Performance of WMA
    - Why does WMA need lower strength criteria than HMA? Will that difference lead to rutting issues in the future? Need to provide compelling data to support the lower standard.
- Chemically treated layers (PG-67-22) {Needed in MEPDG}
    - Research needed to address use of these layers.

Flow Number Testing

- Training
    - Need trouble shooting guidelines for how to adjust mixes depending on Fn results.
- Reduced Cost of Equipment
    - Need to continue purchases through FHWA co-op to get bulk order prices.
- Time - Reduce the lab/technician time needed (Duplicate)
- Develop a plan
    - How to use?
    - When?
    - What is needed to get there?

B.3. North-Central Region

Concerns/Issues (topics are listed by agency and not edited for duplication)

Illinois

- Need to understand the best practices for specimen preparation (7 votes) TOP 4 TOPIC
  - topic is known, need guidance from experts
- Need a better understanding of the Fatigue Test (5 votes) TOP 4 TOPIC
  - This is under study
- Need a better understanding of the Overlay Test (3 votes)
  - This is under study
- Need a test to measure the low temperature cracking properties (5 votes) TOP 4 TOPIC
  - This is under study
- Need to address equipment communication errors
  - topic is known, need guidance from experts

Ontario

- Do not have adequate trained staff to operate the test (2 votes)
  - This is a DOT management issue
- Need a test to measure low temperature cracking potential - DUPLICATE
- Need to address data variability when testing at high temperature (2 votes)
  - This is under study
- Need guidance on sample preparation - DUPLICATE
- Need standards for including AMPT results in mix design specifications
  - This is under study
- Need a fatigue test - DUPLICATE

Kansas

- Need a better understanding of the Fatigue Test - DUPLICATE
- The pavement engineers need input for implementing MEPDG (2 votes)
  - This is a DOT management issue
- Need to develop a mix design specification - DUPLICATE

Wisconsin

- Need a website for “chatting”
  - Funding is needed to develop this site
- Need better communication between materials and pavement offices (3 votes)
  - This is a DOT management issue
- Need a better understanding of the Fatigue Test - DUPLICATE
- Need a better understanding of the Texas overlay test - DUPLICATE
- How to manage the data
  - topic is known, need guidance from experts
- Database – National (5 votes) TOP 4 TOPIC
  - Funding is needed to develop this database
- Need better understanding of specimen preparation - DUPLICATE

- Need a low temperature performance test - DUPLICATE
- Need to understand the sensitivity of the test to changes in material properties
    - Topic is known and more study is underway

Additional Topics

- Need to shorten specimen temperature conditioning (3 votes)
    - Research funding is needed
- There are "other" equipment needs and cost associated with the AMPT
    - This is a DOT management issue
- Is there industry acceptance (future project use…) (3 votes)
    - This is a DOT management issue
- Requires communication between Materials & Pavement engineers - DUPLICATE
- How to fund implementation
    - This is a DOT management issue
- How to work with multiple consultants (AMPT & DARWin-ME) (1 vote)
    - This is a DOT management issue
    - topic is known, need guidance from experts

B.4. West Region

Issues/Concerns

- Use of AMPT testing for QC/QA (Production)
- Field Sampling (Buckets of mix)
    - No. of specimens
    - Sampling so much mix
- Importing E^* into master solver and quality control
- Changing latex grease from 0.25 to 0.30
- Training
- Void consistency (±0.5 or ±1.0%)
- Sample preparation
    - Procedure and tools (WY Report)
    - Edge chipping issues
- Testing conditions for Fn
- Testing procedure for Fn
    - Testing parameters (similar to PP61)
- Forming user groups

Appendix C. Second Round Table Discussion Session Notes

C.1. Materials Engineers North-1 (CT-ME-MD-IL-KS-CO-OR)

Group Topic Ranking

- *Sample Preparation (4 votes) SELECTED FOR FURTHER DETAIL*
- *Form User Groups (5 votes) SELECTED FOR FURTHER DETAIL*
- Staffing (1 votes)
- Fatigue Test (1 votes)
- Overheating Equipment
- *Overlay Test (6 votes) SELECTED FOR FURTHER DETAIL*
- Install Equipment
- Low Temperature Test
- Incentive to Use (3 votes)
- *Use for Mix Design (5 votes) SELECTED FOR FURTHER DETAIL*
- Training (2 votes)
- Additional Required Equipment (1 votes)
- *Standard Fn Test (7 votes) SELECTED FOR FURTHER DETAIL*
- E* QC – Master Solver
- *Va +/- 0.5 vs. +/- 1.0 (7 votes) SELECTED AND COMBINED WITH SAMPLE PREPARATION*

Sample Preparation

- Need to understand how to get target Air Voids
  - Topic is known, need guidance from experts
- Need to understand how to get uniform Air Voids
  - Topic is known, need guidance from experts
- Need to understanding the relationship between NMAS and gyratory sample height
  - Topic is known, need guidance from experts
- Need to understand the expected variability of dynamic modulus values
  - Topic is known, need guidance from experts
  - Topic should get more research funding
- Need a standard worksheet to prepare samples
  - Topic is known, need guidance from experts
- Need guidance on the selection of cutting equipment and the best process
  - Topic is known, need guidance from experts
- Need to determine the correct target Air Voids (0.5% vs. 1.0%)
  - This topic is under study

Form User Group (the ability to have a User Group is known, need guidance from active User Groups)

- Need to coordinate meetings
- Need a list of contacts
- Need a website
- Need to coordinate Round-robin Testing

- How do we pay for the User Group activities?
- Who will host and manage the User Group
- Need to define the Scope and Objectives for the Group
- Divide the groups by regional diversity (examples: FHWA SUPERPAVE Groups, AASHTO regions)

Overlay Test

- Need a test to measure cracking potential, due to low asphalt binder contents
  - Topic is known, need guidance from experts
- Determine which is the better test (TX overlay vs. E* fatigue)
  - Needs research funding
- Need to have a test for field core samples
  - Topic is known, need guidance from experts
- need a test for between layer bond strength
  - Needs research funding

Use for Mix Design

- Need a standard JMF specification for mixture approval process
  - Use research funds to perform a synthesis of practice
- Need mix criteria for different levels of traffic (30M ESAL vs. 300K ESAL)
  - Topic is known, need guidance from experts
- Need guidelines to assist with adjusting the mixture to achieve target performance criteria
  - Topic is known, need guidance from experts
- Test time too long

Standard Fn Test

- Need a standard confining stress
- Need a standard load
- Need guidance on selecting the appropriate temperature
- Need standard data reporting (Flow Number vs. slope & intercept)
- Need a standard for evaluating test variability
- Need to know when to terminate a test
- Need to select a static or dynamic test procedure

C.2. Materials Engineers North-2 (NH-NJ-PA-WI-UT-WY- Federal Lands-Ontario)

Group Topic Ranking

- *Form User Group (6) (#5)*
- Staffing
- *Fatigue Test (11) (#1)*
- Overheating Equipment
- Overlay Test (3)
- Install Equipment (1)
- Low Temperature Test (5)
- *Incentive to Use (8) (#3)*
- Use for Mix Design (3)

- Training (4)
- Additional Added Equipment
- Standard Test Procedure (3)
- *E* QC and Master Solver (9) (#2)*
- *Va +/- 0.5 vs. +/- 1.0 (7) (#4)*

Fatigue

- May justify use of test
- Balance the mix
- Tend to minimize binder
- High RAP, RAS etc.
- Maybe determine endurance limit
- Issues:
    - Conducting tensile test is problem
    - Highly variable
    - Must improve estimate of fatigue
    - Test time
    - Training
    - Cost to upgrade

E* QC Master Solver

- Interlaken and IPC have this software.
- Improved software to be available soon; maybe at no cost.
- Becomes a black box
- Not applicable to individual mixes but to family of mixes

Incentive to Use

- Improve quality of mix
- End product test
- Help to evaluate alternative mixes, RAP, RAS, WMA, etc.
- Pavement design
- Maybe okay for QA
- FHWA funding to participate
- Issue:
    - Time of test for materials testing
    - Standards, criteria
    - Intimidating – “Training”

Sample Prep – Air Voids (0.5, 1.0)

- Need standard procedure
- Auxiliary equipment
- Samples must be 180mn tall
- Chipping of edges
- Sawing perpendicular
- Testing split samples, QC, QA, etc.

- Solution:
  - More research
  - Participation in user groups
  - More detailed procedure

User Groups

- See previous page
- How do you put the groups together?
- Organize under user/producer group
- Peers working together can solve problems

C.3. Materials Engineers South (AL, FL, GA, KY, MS, NC, SC and VA)

Group Topic Ranking

- *Sample Preparation (11 votes) Selected for Further Discussion*
- *Staffing (9 votes) Selected for Further Discussion*
- *Develop Fatigue Test (3 votes)*
- *Develop Overlay Test (3 votes)*

  } *Combined for Further Discussion*

- Install Equipment (1 vote)
- Develop Low Temperature Test
- Need Incentive to Use (3 vote)
- *Training (9 votes) Selected for Further Discussion*
- Additional Added Equipment
- Standard Fn Test Procedure (2 vote)
- Overheating Equipment
- *Use for Mix Design (3 votes) Selected for Further Discussion*
- E*, QC and Master Solver (1 vote)
- Va +/- 0.5 vs. +/- 1.0 (1 vote)

Sample Preparation

- Flatness/Perpendicularity
  - Problems caused by sawing (Saw is used for cutting multiple types of samples)
  - One suggestion presented was to make samples at high end of thickness tolerance so you could possibly tweak the sample to meet flatness/perpendicularity if needed. Need consistency and guidance.
- Saw (Multiple uses)
  - Does the saw need to be dedicated to AMPT? Is there a brand that seems better than others?
- Summary of Good Practices
  - Make these as Appendix to AASHTO spec?
  - Make them available on website
- Need list of what equipment to get and available sources

Staffing

- Quality level of technician- Typical technician will probably not be able to interpret data.

- Support staff- May need someone to prepare samples and another to test.
- Data Acquisition
  - Too much copy and pasting between software packages
  - Need to develop a standard format and software that will support it without having to manipulate or manually move the data.
- National arm-twisting
  - Need motivation from FHWA to implement the procedures within a reasonable time frame
  - Need similar motivation to implement MEPDG (there is some fear that MEPDG may require unnecessarily thick structures.
- Need incentive to use
  - Need Executive Memo or similar paper that explains benefits and success stories to dispel fears

Training

- Low/No cost to state
  - Providing at no cost makes it easier to send people; Help with travel costs will make it more appealing or easier to get permission from upper management to send someone.
- Mitigating staff turnover
  - What does data mean? Who will analyze and interpret the data?
  - Continuing training- Seeing the equipment one time is not enough; training needs to be on-going.
  - Initial set-up
    - Can FHWA provide a person, or pool of persons, available to assist from planning the equipment location to installing equipment?
- AMPT Certification- Should operators be certified/qualified through a regional or national effort?
- Co-Op/Superpave Centers- Some agencies can use Superpave Center funds to provide training; others may have to use regional or FHWA Co-Op sponsored training.
- Materials and designers- Much attention has been given to those performing the tests, but designers need similar training in how to use the database
- Continuum Damage Theory in Layman terms
  - Need a workshop, or webinar, on Continuum Damage Theory that a non-technical person can understand.

Develop Other Test

- Fatigue *Still in committee
- Overlay-Need to develop test so agency can get as much information from the equipment as possible.
- What additional equipment will be needed for these additional tests? Cost? (Package Deal)
- Need funding path
  - For purchase of equipment
  - For cost/benefit of implementation

Use for Mix Design

- Compare APA/Hamburg
  - Agencies are already comfortable with APA/Hamburg. Can wheel tracking tests be improved to provide the information? Is AMPT Fn more reliable that wheel tracking tests?
- Selective Criteria
  - High volume traffic- When and where will receive most benefit from using?
  - New mix sources- Test only on new material sources, or all mixes? Need criteria.
  - High RAP mixes- Duplicate of above concern
- Time for testing

C.4. Pavement Design Engineers (All Agencies)

Top 5 Topics

- Incentive to use AMPT
- Testing plan for E* (& Fn) library for implementation of DARWin-ME
- Training (AMPT and DARWin-ME)
- Standard procedure for Fn
- Cracking tests (fatigue, overlay, low temperature)

Incentive to Use AMPT

- Evaluation of new materials
- Inputs for DARWin-ME
- Forensic study

Testing Plan E* (& Fn) Library

- Guidelines for setting up a plan
- How often the library needs to be updated
- Guidelines for all equipment needs

Training (AMPT and DARWin-ME)

- Through consultants
- Technology transfer
- Training in regional groups

Standard Procedure for Fn

- Stresses (deviator and confining)
- Temperature
- Criteria
- How to analyze data (if the NCHRP 9-30A procedure is recommended in the future)

Cracking Tests (fatigue, overlay, and low temperature)

- Procedures
- Training
- This can be one of the incentives to use AMPT

Appendix D. Survey Questions for State Agencies Attending the Workshop

Please fill in the response for your State
State Name:

AMPT Related Information

1) Have you started working with the AMPT?
   If yes, when?

2) Does your State have experience using the AMPT? And are you willing to share that knowledge?

3) Who operates the AMPT?
   - DOT central Lab
   - University
   - Other

4) What are your plans for using the AMPT?
   - Only research
   - DARWin-ME data library
   - Mix Design
   - Construction Quality Assurance
   - other

DARWin-ME Related Information

5) Have you started working with the DARWin-ME
   If yes, when?

6) What is the status of your DARWin-ME implementation plan?
   - Developing the plan
   - Collecting data
   - Validate/calibrate models
   - Pavement design use
   - other

Issues and Concerns

7) What are your 2-3 top issues/comments/concerns?

8) What are your 2-3 top needs to successfully use the AMPT?
   - Equipment
   - Test procedures
   - Mix design specifications
   - Pavement Design
   - Construction specifications
   - other