Tech Sec 2d
2015 Webinar Agenda
Page 1 of 17

5AASHTO Subcommittee on Materials
Technical Section 2d
Proportioning of Asphalt-Aggregate Mixtures
Mid-Year WEBINAR
Wednesday, February 04, 2015
2:30 - 4:30 pm EST

MINUTES

I. Call to order/Opening Remarks/General Business - 2:30 P.M. EST

II. Roster – Voting Members in Attendance (For full roster see attachment)

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Mike San Angelo</td>
<td>AK</td>
<td>X</td>
<td>Timothy Smith (Rebeccaah Smith sitting in for)</td>
<td>MD</td>
<td>X</td>
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<tr>
<td>Lyndi Blackburn</td>
<td>AL</td>
<td>X</td>
<td>Richard Bradbury</td>
<td>ME</td>
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<td>Michael Benson</td>
<td>AR</td>
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<td>Curt Turgeon</td>
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<td>Paul Burch</td>
<td>AZ</td>
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<td>Brett Trautman</td>
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<td>Bill Schiebel</td>
<td>CO</td>
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<td>Ross Metcalfe, Vice Chair</td>
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<td>James Connery</td>
<td>CT</td>
<td>X</td>
<td>Jack Cowsert (Todd Whittington sitting in for)</td>
<td>NC</td>
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<td>Amir Hanna</td>
<td>DC</td>
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<td>Ron Horner</td>
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<td>John Bukowski</td>
<td>FHWA</td>
<td>X</td>
<td>Eileen Sheehy</td>
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<td>Wasi Khan</td>
<td>DC</td>
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<td>Darin Tedford</td>
<td>NV</td>
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<td>Jennifer Pinkerton</td>
<td>DE</td>
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<td>Becca Lane</td>
<td>ON</td>
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<td>Timothy Ruelke</td>
<td>FL</td>
<td>X</td>
<td>Cole Mullis</td>
<td>OR</td>
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<td>(Greg Scholar sitting in for)</td>
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<td>Charles Hasty</td>
<td>GA</td>
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<td>Timothy Ramirez</td>
<td>PA</td>
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<td>Eric Shishido</td>
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<td>Michael Byrne</td>
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<td>Mike Santi</td>
<td>ID</td>
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<td>Joe Feller</td>
<td>SD</td>
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<td>Matthew Mueller</td>
<td>IL</td>
<td>X</td>
<td>Brian Egan (Mike Dorn and Mark Woods sitting in for)</td>
<td>TN</td>
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<tr>
<td>Ronald Walker</td>
<td>IN</td>
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<td>Caroline Heinen</td>
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<td>Richard Kreider</td>
<td>KS</td>
<td>X</td>
<td>Scott Andrus</td>
<td>UT</td>
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<td>Allen Myers</td>
<td>KY</td>
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<td>William Ahearn</td>
<td>VT</td>
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<td>Chris Abadie, Chair</td>
<td>LA</td>
<td>X</td>
<td>Kurt Williams (Joe DeVol sitting in for)</td>
<td>WA</td>
<td>X</td>
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<tr>
<td>John Grieco (Derek Lee sitting in for)</td>
<td>MA</td>
<td>X</td>
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</tbody>
</table>
Additional Attendees as confirmed by email:
Haleh Azari – AMRL/Pavement Systems, LLC
William Bailey – VA DOT
Audrey Copeland – National Asphalt Pavement Association
John Crane – WV DOT
Steve Davis – WA DOT
Victor (Lee) Gallivan – Gallivan Consulting
Georgene Geary – GGfFA Engineering
Robert Horan – Asphalt Institute
Robert Horwhat – PA DOT
Troy Lehigh – PA DOT
Steven Lenker – AMRL/CCRL
Robert Lutz - AMRL
Pamela Marks – Ontario Ministry of Transportation
Hong Park – TN DOT
Al Vasquez – CA DOT
Victoria Woods – Invia Pavement Technology
Merrill Zwanka – SC DOT

III. Approval of Technical Section Minutes from July 30, 2014, meeting in Minneapolis, Minnesota

IV. Old Business
A. 2014 SOM Ballot Items - Items 41-50

Item 41 – SOM ballot to REVISE R35 to clarify and provide a consistent definition of Ps by making changes in sections 9.2 and 9.3.6
See page 1 and 23-26 of the minutes.
Negatives: None; no comments

Item 42 – Concurrent ballot item to REVISE R 35 to clarify the different purposes of Section 6.5 and 6.7 – “Superpave Volumetric Design for Asphalt Mixtures”
See pages 1-2 and 27-28 of the minutes.
Negatives: None; no comments

Item 43 – SOM ballot item to REVISE TP 79 to make changes to the reference equipment specification in Sections 6.2 and 6.3-
“Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)”
See page 2 and 29-31 of the minutes.
Negatives: None; no comments
Item 44 – Concurrent ballot item to REVISE TP 79 to add Appendix X3 related to small size samples - “Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)”
See pages 2-3 and 32-34 of the minutes.
   Negatives: None; no comments

Item 45 - Concurrent ballot item to REVISE MP 23 to clarify section 5.1 – (old MP 15) “Reclaimed Asphalt Shingles For Use in Asphalt Mixtures”
See page 3 and 35-38 of the minutes.
   Negatives: None ; no comments

Item 46 – Concurrent ballot item for a New Provisional Standard TP 116 – “Rutting Resistance of Asphalt Mixtures using Incremental Repeated Load Permanent Deformation (IRLPD)”
See pages 3-4 and 39-46 of the minutes.
   Negatives: Alabama
   Comments: “As currently written the document incorrectly interchanges “strain” and “strain rate”. Once corrected, Alabama DOT would vote in favor of this proposal.”
   -- Comments addressed. See editorial corrections to the standard attached. Alabama removed the negative.

Item 47 – SOM ballot item for a New Provisional Standard TP 117 – “Determination of the Voids of Dry Compacted Filler”
See pages 4-5 and 47-53 of the minutes.
   Negatives: None; no comments

   Negatives: None ; no comments

Item 49 – SOM ballot item for a New Standard R.68, “Preparation of Asphalt Mixtures by Means of the Marshall Compactor”, developed from T -245
   Negatives: Pennsylvania See page 6 and 66-72 of the minutes. Chris Abadie has not had a chance to talk to Tim Ramirez; Tim was aware of the comments since they were generated by one of his staff

b. 1.1. add “, asphalt emulsion” before or and after “asphalt binder” Mark Woods – TN is the author of this one and a.; discussed with Georgene - AL; recalls someone objected to the removal of “cutback” previously; emulsion is used with cold mix, so doesn’t see a problem with adding it; if adding emulsion, may want to put it in a separate paragraph

c. 4.4.7 add sentence. “And cure emulsion mixtures in oven at 38C until constant weight is observed.”— see comments

d. 4.6.1 change to: “Thoroughly clean the specimen mold assembly and heat to a temperature equal to the compaction temperature. Heat the face of the compactor on a hot plate or in an oven to a temperature between 93.3 and 148.9C (200 and 300).—see comments

e. 4.6.5 change “nad” to “and”. And remove the extra period on the end of the sentence. Done

Comments: Section 4.4.8 includes procedure for cutback; suggestion made to define “constant weight” – will work on this; AL – emulsions weren’t in T 245 before, so it should be handled as new business instead of handling it during the webinar; suggestion made to find the negative non-persuasive for this ballot since we’re adding something to it. Becca (ON) commented on precision of Celsius temperatures where Fahrenheit was converted to Celsius; some conversions are hard and others are soft; should review conversions at some point; suggestion made to round Celsius temperatures to nearest whole number – TF 15-01 will review this also; Becca from ON will also assist with TF; PA has withdrawn negative with condition that TF has been formed to deal with adding emulsions and reviewing compaction temperatures

Pennsylvania removed its negative vote and this New Standard R68 was approved. Task force created to address the addition of emulsion to this standard. Task Force 15-01; PN and TN.

Item 50 – SOM ballot item to REVISE T 312 to add Section 4.1.3 related to the equipment specifications -“Preparing and Determining the
Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor”

See page 6 and 73-75 of the minutes.

Negatives: None; no comments

B. Technical Section Ballot Items from Fall 2014 TS ballot
There were no Technical Section Ballot Items on the Fall 2014 TS ballot, aside from the concurrent ballot items.

C. Task Force Reports

1. T247 TF “Preparation of Test Specimens of Bituminous Mixtures by means of kneading compactor” –Nevada is Steward and has provided some revisions to this document that will be forwarded for ballot

2. John Bukowski provided review of Mixture ETG activities - John B. spoke about this during the webinar; TS needs to decide how they want to pursue this as far as polling members; PP78 –reclaimed asphalt shingles also discussed, 0-15% binder from shingles is being treated the same way as 0-15% binder from RAP but binder is different; Chris Abadie asked how P&B statements are developed – John B. said ETG is made up of volunteers and aren’t capable of doing that; AMRL may be able to assist with P&B statements; It was stated that there was a TS section, perhaps 5c, working on a list of standards that need P&B statements

V. New Business

A. AMRL Comments

B. NCHRP

1. Proposed NCHRP Problem Statements Due July 1, 2015 for SOM endorsement
   a. Statement AASHTO 2d R1 2015. Title: Longer Pavement Life from Increased In-Place Density of Asphalt Pavements. See attachment.

C. New Business Concerning Standards; no new business concerning standards has been proposed at this time.

D. Standards Requiring Reconfirmation

1. Status of 2d Standards

The following standards were balloted for reconfirmation after this webinar:
(Reconfirmation results dated Feb 17, 2015 and my comments are noted below)
R30-02; moist conditioning of asphalt; 31 affirmative no negative. Steward: Alabama

T167; compressive strength of hot mix asphalt; Missouri Brett.Trautman@modot.mo.gov suggested that he knew of no States using this procedure and ask TS 2d to poll its members to confirm the need to maintain this standard. This question will be discussed at summer meeting as time permits. 31 affirmative no negative Steward: Idaho.

T 246; resistance to deformation and cohesion of hma by means of hveem; Steward: Nevada. 31 affirmative no negative

T247; prep of test specimens of hot mix asphalt (HMA) by means of California kneading compactor **(change this to practice?)** ; Steward: Nevada

T340; determining rutting susceptibility; 31 affirmative no negative Steward: Kentucky.

T342-11 Determining Dynamic Modulus of Hot mix asphalt (HMA) ; 31 affirmative no negative  Steward: FHWA

The following standards are listed as due for reconfirmation in 2016 and will be added to the agenda for the summer meeting:
T320 ; Determining shear strain and stiffness of asphalt mixtures using the superpave shear tester (SST) ; **(needs P/B)**; Steward: Louisiana
T322-07 Determining Creep compliance and strength of hot mix asphalt (HMA) using Indirect Tensile Test Device **(needs P/B)**; Steward: Florida

Note to Stewards listed above and below: As comments from the reconfirmation ballots come in, stewards will be copied when action is necessary outside of the regular business meeting environment. When this occurs, I ask that the Steward address each comment and advise the chair upon completion. Your help is appreciated, communicate any problems or unresolved comments to the chair.

2. TS 2d Provisional Standards due for reconfirmation; Chair will investigate each provisional listed below with Mixture ETG chair to consider either reconfirmation, or if applicable, moving some of these ballots forward to become a formal standard. This will be an item of discussion at the summer meeting
   a. PP60-14 “Preparation of cylindrical specimen using the Superpave Gyratory Compactor” ; Steward: FHWA
   b. PP61-13 “Developing Dynamic Modulus Master Curves for Asphalt Mixtures using the Asphalt Mixture Performance Tester(AMPT); Steward: FHWA
c. PP 76-13 “Troubleshooting Asphalt Volumetric Differences between Superpave Gyratory Compactors (SGC’s) used in the Design and Field Management of Superpave Mixtures; Steward: FHWA
d. TP79-13 Determining Dynamic Modulus and Flow Number for Asphalt Mixtures using the Asphalt Mixture Performance Tester (AMPT); Steward: FHWA
e. TP105-13 “Determining the Fracture Energy of Asphalt Mixtures using the Semi Circular Bend Geometry (SCB); Steward: Minnesota
f. Other Provisionals PP61, PP76, and TP105 to consider for ballot to be made permanent.

E. Potential SOM TS Ballot Items for Spring 2015? None mentioned at webinar.

This item will be finalized after the April 8-10, 2015 Mix ETG meeting in Fall River, MA.

VI. Adjourn

Appendices
A- Minutes of Summer 2014 meeting with TS 2d Roster and Status of Standards
B- TS 2d SOM 2015 Ballot Results and Comments (page 11-22)
   C- Standards with editorial adjustments – C1. TP-116 revised per Alabama request. “Rutting Resistance of Asphalt Mixtures using Incremental Repeated Load Permanent Deformation (IRLPD)” ; C2- R 68, “Preparation of Asphalt Mixtures by Means of the Marshall Compactor”, developed from T -245
Minutes 2014 Annual SOM meeting with TS 2d Roster and Status of Standards can be found at
http://materials.transportation.org ➔ Meetings ➔ Annual
### TS 2d
2014 SOM Ballot Items

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<tr>
<th>#</th>
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<td>X</td>
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<tr>
<td>48</td>
<td>SOM ballot item to REVISE T 245 to remove the preparation of specimens – “Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus” See page 6 and 54-65 of the minutes.</td>
<td></td>
<td>X</td>
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<td>49</td>
<td>SOM ballot item for a New Standard R xx, “ Preparation of Asphalt Mixtures by Means of the Marshall Compactor”, developed from T-245 See page 6 and 66-72 of the minutes.</td>
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Proposed Standard Test Method for

**Rutting Resistance of Asphalt Mixtures Using Incremental Repeated Load Permanent Deformation (IRLPD)**

**AASHTO Designation: TP 116-15**

1. **SCOPE**

1.1 This standard describes the test method for measuring the resistance of asphalt mixtures to rutting using Minimum Strain Rates (MSR) from the incremental Repeated Load Permanent Deformation (iRLPD) Test conducted by means of the Asphalt Mixture Performance Tester (AMPT) System. This practice is intended for dense- and gap-graded mixtures with nominal-maximum aggregate sizes up to 37.5 mm.

1.2 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use.

2. **REFERENCED DOCUMENTS**

2.1 **AASHTO Standards**

- AASHTO PP 60, Fabrication of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor

- AASHTO R30, Standard Practice for Mixture Conditioning of Hot Mix Asphalt (HMA)

2.2 **Other Publications**

- LTPPBind V 3.1, Developed by Pavement Systems, LLC (PaveSys), LTPPBind.com


3 TERMINOLOGY

3.1 Permanent Deformation – Non-recovered deformation in a repeated-load test

3.2 Repeated Load Cycle – Loading of 0.1 s followed by a 0.9-s rest period

3.3 Loading Increment – 500 cycles of a repeated load

3.4 Confining Pressure – Stress applied to all surfaces in a confined test

3.5 Deviator Stress – Difference between the total axial stress and the confining pressure in a confined test

3.6 Contact Stress – The constant axial stress applied to hold the specimen in place

3.7 Strain Rate – The permanent axial strain due to one repeated load cycle

3.8 Strain Acceleration – The rate of change of the strain rate

3.9 Secondary Loading Stage – The loading cycle where the axial strain rate is stable

3.10 Minimum Strain Rate (MSR) – The lowest permanent strain per cycle in a loading increment which is the strain rate due to the 500th cycle in the secondary stage

4 SUMMARY OF THE TEST METHOD

4.1 This test method describes procedures for evaluating resistance of asphalt mixtures to rutting by measuring the Minimum Strain Rate (MSR) at various stress and temperature combinations using the iRLPD test.
4.2 The iRLPD test is conducted at one test temperature and confining pressure in four 500-cycle increments. The deviator stress is held constant during each increment and it is increased for each subsequent increment. The load pulse is 0.1 s every 1.0 s. Permanent axial strains due to each load cycle (permanent strain rate) are measured by the actuator. The minimum strain rate for each increment is defined as the permanent axial strain due to the last (500th) cycle.

5 SIGNIFICANCE AND USE

5.1 The Minimum Strain Rate (MSR) is the permanent deformation property of asphalt mixtures and represents the unit rutting damage due to a single heavy-axle load at a specific temperature and tire pressure. MSR is used for mixture design verification, material characterization, and rutting performance evaluation.

5.2 This test method uses MSR as resistance of HMA to permanent deformation instead of the flow number which is used in AASHTO TP 79. The flow number is the number of load cycles when asphalt mixture reaches flow; however, MSR is the permanent strain rate after 500 cycles before flow is reached. While reaching flow is the condition for the flow number, the condition for MSR is not reaching flow.

6 APPARATUS

6.1 Specimen Fabrication Equipment – Equipment for fabricating iRLPD test specimens as described in PP 60.

6.2 Asphalt Mixture Performance Tester (AMPT) – A dynamic test system meeting the requirements of the Equipment Specification for the Simple Performance Test System, Version 3.0.

6.3 Conditioning Chamber – An environmental chamber for conditioning the test specimens to the desired testing temperature. The environmental chamber shall be capable of controlling the temperature of the specimen over a temperature range from 40 to 70 °C (104 to 158 °F) to an accuracy of ±0.5 °C (1 °F). The chamber shall be large enough to accommodate the number of specimens to be tested plus a dummy specimen with a temperature sensor mounted in the center for temperature verification.

6.4 Latex Membranes – 100-mm (4-in.) diameter by 0.3-mm (0.012-in.) thick for use in confined tests.

7 HAZARDS

7.1 This test and associated standards involve handling of hot asphalt binder, aggregates and asphalt mixtures. It also includes the use of sawing and coring machinery and servo-hydraulic testing equipment. Use standard safety precautions, equipment, and clothing when handling hot materials and operating machinery.
8 STANDARDIZATION

8.1 Items associated with this test that require calibration are included in the documents referenced in Section 2.2. Refer to the pertinent section of the referenced documents for information concerning calibration.

9 PROCEDURE

9.1 Test Specimen Preparation

9.1.1 Testing shall be performed on 100-mm (4-in.) diameter by 150-mm (6-in.) high test specimens fabricated in accordance with PP 60.

**Note 1** – Cylindrical test specimens of 100-mm (4-in.) diameter by 150-mm (6-in.) high may be compacted to the proper size instead of being cut and cored from 150-mm (6-in.) diameter specimens using PP 60. For this purpose, T 312 may be followed with the exception that a 100-mm (4-in.) diameter SGC mold is used instead of a 150-mm (6-in.) mold. The SGC stress of 600 kPa at 30 gyrations per minute may be utilized to compact the loose mixture to the proper height. The loose mixture mass should be adjusted for the 100-mm (4-in.) mold such that the desired air void is achieved.

9.1.2 Prepare at least three test specimens at the target air void content and aging condition.

9.1.3 The target air void content should be selected based on the in-place density specification for the project.

**Note 2** – For typical in-place density specifications, a target air void content of 7.0 percent and tolerance of ± 0.5 percent is reasonable.

9.1.4 Assemble each specimen to be tested with the platens and membrane as follows. Place the specimen on the bottom platen. Stretch the membrane over the specimen and bottom loading platen. Install the lower o-ring seal. Stretch the membrane over the top platen. Install the upper o-ring seal.

9.1.5 Encase the dummy specimen in a membrane.

9.1.6 Place the specimen and platen assembly in the environmental chamber with the dummy specimen, and monitor the temperature of the dummy specimen to determine when testing can begin.

9.1.7 Turn on the Asphalt Mixture Performance Test (AMPT) System; set the temperature control to the desired testing temperature, and allow the testing chamber to equilibrate at the testing temperature for at least 1h.
9.1.8 When the dummy specimen and the testing chamber reach the target temperature, open the testing chamber; remove a test specimen and platen assembly, and quickly place it in the testing chamber.

**Note 3** – When performing confined tests the specimen must be vented to atmospheric pressure through the drainage lines. Properly connect the drainage lines to the loading platens, and ensure they are vented to atmospheric pressure through the bubble chamber to identify any leaks.

9.1.9 Close the testing chamber, and allow the chamber temperature to return to testing temperature.

9.1.10 Ensure Sections 9.1.8 and 9.1.9, including return of the test chamber to the target temperature, shall be completed in 5 min.

9.2 *Test Temperature*

9.2.1 The test temperature is calculated from the Degree-Days (DD) parameter of the construction site using LTPPBind V3.1 software and the following equation:

$$T = 58 + 7 \times DD - 15 \times \log (H + 45)$$

(1)

Where:

- $T =$ test temperature, °C
- $DD =$ Degree-Days$>10^\circ$C (x1000) from LTPPBind Version 3.1; and
- $H =$ 0 for surface layer, depth to top of layer for base layer.

**Note 4** – When the location of the construction is not known, the most reasonable effective temperature for the region may be used. The effective temperatures in the U.S. mostly vary between 50 and 60°C. Therefore, the most reasonable test temperature for a moderate climate is 55°C. However, for a cold climate 50°C, and for a hot climate 60°C is more reasonable.

9.3 *Test Description*

9.3.1 The test is conducted using one conditioning increment of 500 cycles and three consecutive test increments of increasing deviatoric stress for 500 cycles each.

9.3.2 The stress level for the conditioning increment is 200 kPa.

9.3.3 The stress levels for testing increments are 400, 600 and 800 kPa.

9.3.4 The contact stress for each increment is 5 percent of the deviator stress.

9.3.5 The confining pressure of 69 kPa is used throughout the test.

9.3.6 Follow the software prompts to begin the test. The Asphalt Mixture Performance Test System will automatically unload when the test is complete.
9.3.7 Upon completion of the test, open the test chamber, and remove the tested specimen.

9.3.8 Repeat Sections 9.3.6 and 9.3.7 for the remaining test specimens.

10 CALCULATIONS

10.1 The Minimum Strain Rate (MSR) for each test increment (400, 600, and 800 kPa stress) is determined from total permanent strain collected by the actuator.

10.2 Export the output data table into an Excel file. Compute the strain rate for each cycle by subtracting the total strain for the cycle from the total strain of the previous cycle as follows:

\[ SR_i = TS_i - TS_{i-1} \]  

where:
- \( i \) = cycle number;
- \( SR_i \) = strain rate at the \( i \)-th cycle;
- \( TS_i \) = total permanent strain at the \( i \)-th cycle; and
- \( TS_{i-1} \) = total permanent strain at the cycle before the \( i \)-th cycle.

10.3 Perform a linear regression using data for the last 50 cycles of the increment (cycles 451 to 500) with cycle number \( i \) as the \( x \)-value and strain rate \( SR_i \) as the \( y \)-value as follows, and determine the \( c \) and \( SA \) coefficients.

\[ SR_i = c + SA \times i \]  

Where:
- \( c \) = model intercept; and
- \( SA \) = strain acceleration.

Note 5 – The Strain Acceleration \( SA \) should always have a negative value. If \( SA \) becomes a positive value for an increment, it is an indication that the test has reached tertiary flow, and thus MSR may not be determined for that increment.

10.3.1 Determine the MSR for each loading increment which is the estimated strain rate at 500th cycle as follows:

\[ Minimum \ Strain \ Rate \ (MSR) = c + SA \times 500 \]  

10.3.2 The graph of MSR versus Test Temperature \( T \) * Deviator Stress \( P \) for three increments is called the MSR master curve. The equation is as follows:

\[ MSR = a \times (T \times P)^b \]  

Where:
- \( T = \) test temperature, °C;
P = deviator stress, MPa; and
a, b = model coefficients.

**Note 6** – The MSR master curve explains the permanent deformation at any temperature and stress level. The b coefficient may be estimated using the MSR at 600 kPa ($MSR_{600}$) and assuming a value of 0.001 for the “a” coefficient as follows:

$$MSR_{600} = 0.001 \times (T \times 600/1000)^b$$  \hspace{1cm} (6)

$$b = \log (MSR_{600} \times 1000) / \log (0.6 \times T)$$  \hspace{1cm} (7)

**Note 7** – The b coefficient is open-ended but mostly ranges between 2.0 and 3.0 and can be used for ranking of mixtures. A b value of 2.0 is an indication of a very stiff material, and a b value of 3.0 is an indication of a very soft material.

10.3.3 The allowable traffic level at a certain effective temperature may be determined from MSR at 600 kPa ($MSR_{600}$) calculated from the test data or the master curve. Use Equation 9 or Table 1 to determine the allowable traffic.

$$\log (ESAL) = 1.7 - 0.07 \times MSR_{600}$$  \hspace{1cm} (8)

$$ESAL = 10^{1.7 - 0.07 \times MSR_{600}}$$  \hspace{1cm} (9)

where:
ESAL = allowable ESALs, millions; and
$MSR_{600}$ = minimum strain rate at 600 kPa and effective temperature.

<table>
<thead>
<tr>
<th>Traffic Level</th>
<th>Design ESALs (Million)</th>
<th>Max. MSR Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>&lt;=1</td>
<td>24</td>
</tr>
<tr>
<td>Standard</td>
<td>&gt;1 to 3</td>
<td>17</td>
</tr>
<tr>
<td>Heavy</td>
<td>&gt;3 to 10</td>
<td>10</td>
</tr>
<tr>
<td>Very Heavy</td>
<td>&gt;10 to 30</td>
<td>3</td>
</tr>
<tr>
<td>Extreme</td>
<td>&gt;30</td>
<td>1</td>
</tr>
</tbody>
</table>

**Note 8** – If the test is not conducted at the effective temperature of the site, then MSR for this temperature must be determined using the MSR master curve equation.

11 REPORT

11.1 Report the following:

11.1.1 Test temperature for each increment
11.1.2 Average applied deviator stress for each test increment
11.1.3 Average applied confining pressure
11.1.4 Minimum Strain Rate (MSR) for each increment
11.1.5 $b$ power coefficient of the MSR master curve
11.1.6 Estimated ESAL for the test temperature
11.1.7 iRLPD software summary report for each specimen tested.

12 KEYWORDS

Asphalt Mixture Rutting Test, incremental Repeated Load Permanent Deformation, Minimum Strain Rate