Multiple Stress Creep Recovery (MSCR) Binder Specification Implementation

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Our visit today

• What is MSCR (pronounced massacre) test?
• PG binder grading system for SE states
• What are advantages of MSCR?
• What is the status of the AASHTO specifications for MSCR?
• What role will SEAUPG play in evaluation and/or implementation of MSCR?

What is MSCR?

The MSCR test is a new test for measuring high temperature properties of an asphalt binder which:
• can replace the existing high temp. test for short term aged binder in M 320 (G*/sinδ)
• can better relate predicted laboratory polymer-modified binders’ high temp properties to actual rutting performance of in-service pavements
• allows for a much more economic use of polymers to improve performance

What is MSCR?

• It is the Asphalt Institute’s opinion that MSCR represents a technical advancement over the current PG specification
• AI recommends that agencies move toward implementing MSCR
• It is recommended that this implementation be accomplished regionally or through the User Producer Groups

What is MSCR?

• The test method is detailed in AASHTO TP 70
• The test uses the same Dynamic Shear Rheometer (DSR) as required in the original M 320
• Only minor software changes are needed to run the MSCR test
• The test uses the creep and recovery method to measure the percent recovery and non-recoverable creep compliance (Jnr)
MSCR Advantages

- Jnr is better correlated with rutting potential than $G^*/\sin\delta$
  - Lab research
  - Field Studies
- MSCR can be used effectively for both modified and unmodified binders
- May eliminate the need for “PG Plus” tests

History of SEAUPG

- Formed in 1993
- Regional forum for discussion and exchange of asphalt pavement technology
- Original focus was on implementation of Superpave binder and mix technologies
- Performance Grade (PG) binder grading system was adopted by SEAUPG states in mid 1990s

AI State DOT Binder Database

PG Binder Grading System

- PG Binders for SE states
  - Most Common “Neat” Binder Grades
    - PG 64-22
    - PG 67-22
  - Most Common “Modified” Binder Grade
    - PG 76-22

Why Do We Need New Binder Test?

- PG Binders for SE states
  - Most Common “Neat” Binder Grades
    - PG 64-22 [Current PG spec. works OK for neat binders]
    - PG 67-22
  - Most Common “Modified” Binder Grade
    - PG 76-22 [Current PG spec. doesn’t work as well for modified binders]

The use of polymer modified binders has grown tremendously in recent years.

However, AASHTO M 320 was based on a study of neat (unmodified) binders, and may not properly characterize polymer modified binders.
Status of AASHTO MSCR Spec

- Originally, proposal was to add MSCR spec as Table 3 in standard specification M 320 – PG Binders
- However, suggestions to consider making this a provisional spec to allow more study
- Ballot at recent SOM meeting was passed that created a new Provisional MSCR Specification (MP 19)

Guidance Documents

- AI Guidance Document: “Guidance on the Use of MSCR Test with AASHTO M320 Specifications”
- FHWA TechBrief

AI Guidance Document

- Become Familiar with MSCR Test / Specs.
- Conduct Transitional Testing as Needed
- Transition Regionally and Uniformly
- Use MSCR Recovery if there is a Need to Identify Elastomeric Modification in an Asphalt Binder…
- …And Eliminate the Use of Other “PG Plus” Tests

Two Ways to Implement MSCR

- Partial Implementation
  - Use in conjunction with M 320
  - MSCR test used as PG Plus
- Full implementation
  - Adopt MP 19
  - Revised grading system based strictly on climate and loading
  - Eliminate graded bumping
  - Eliminate “PG Plus” tests
New PG Grading System (MSCR)

- Environmental grade plus traffic level designation; i.e. PG 64-22E
  - Four traffic levels
    - S = Standard: < 10 million ESALs and standard traffic loading
    - H = Heavy: 10 – 30 million ESALs or slow moving traffic loading
    - V = Very Heavy: > 30 million ESALs or standing traffic loading
    - E = Extr. Heavy: > 30 million ESALs and standing traffic loading

What's Next?

- Nationally
  - Consensus that MSCR has been validated
  - MSCR testing by individual states and UPGs
  - Likely that MSCR will be adopted in the future by states / UPGs

- SEAUPG
  - Binder Task Group taking a look
  - MSCR Task Force formed
  - Round Robin testing planned

Conclusion

- MSCR looks like a very promising tool to improve current PG binder specification
- SEAUPG Binder Task Group has decided to focus on evaluating MSCR for possible implementation through round robin testing, parallel testing of existing binders, etc.
- Look for annual updates from the MSCR Task Force at future meetings

MSCR Implementation-DOT Perspective

Questions?

What is MSCR?

Definitions:

Creep and recovery – a standard test protocol whereby a specimen is subjected to a constant load for a fixed time period and then allowed to relax (recover) at a zero load for a fixed time period

Percent Recovery – A measure of how much the sample returns to its previous shape after being repeatedly stretched and then relaxed

Non-Recoverable Creep Compliance (Jnr) – a measure of the amount of residual strain left in the specimen after repeated creep and recovery, relative to the amount of stress applied
**PG Plus Tests**

- Most states have added “PG Plus” tests to PG testing (M 320) to ensure presence of polymers and improved elastic properties

**PG Plus Tests**

- PG Plus tests (elastic recovery) have issues:
  - Time consuming
  - Good at confirming the presence of polymers
  - Don’t predict field performance well
- MSCR seems to be better than PG Plus:
  - Quicker/easier to run with existing DSR
  - Better at predicting performance