AASHTO TP 107: AMPT Cyclic Fatigue

Proposed Revisions

Y. Richard Kim, Sonja Pape
NC State University
Dave Mensching, Amir Golalipour
FHWA Office of
Asset Management, Pavement, and Construction

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Specifically for the AMPT

- Figures updated for the AMPT
- Sample preparation and test setup information updated to be clearer for AMPT users
- Removed Appendix X7 (strain selection to target specific $N_f$) from 2014 version to alleviate confusion on strain selection
  - Specific $N_f$ is not as important as range of $N_f$ for this process
Example of Updated Figures

**New Version**
- Top Plate
- Axial Specimen
- Deformation Sensors
- Bottom Plate
- Load Cell
- Actuator

**2014 Version**
- Top Plate
- Load Cell
- LVDTS
- Axial Specimen
- Bottom Plate
New Strain Selection Appendix

- Family of curves method
- Allows simpler estimation of AMPT input “target on-specimen strain”
- Run initial test at a strain specified by fingerprint dynamic modulus
- Use included table to reach an approximate $N_f$ for subsequent specimens
Strain Selection Procedure

| Case (units in MPa) | ε<sub>os</sub>| | | | |
|--------------------|---------------|----------------|----------------|
| 8,800 < |E*|<sub>fingerprint</sub> | 300 | - | - | - |
| 4,400 < |E*|<sub>fingerprint</sub> < 8,800 | 500 | - | - | - |
| |E*|<sub>fingerprint</sub> < 4,400 | 800 | - | - | - |

1. |E*|<sub>fingerprint</sub> = 7,500 MPa
2. ε<sub>os1</sub> = 500 με
3. N<sub>f</sub>1 = 4,900 cycles
4. ε<sub>os2</sub> = 450 με
5. ε<sub>os3</sub> = 550 με
6. ε<sub>os4</sub> = 400 με

If 8,800 > |E*|<sub>fingerprint</sub> > 4,400 MPa, select 500 microstrain as the first specimen's strain

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Clarified Number of Specimens

- Material Ranking or Index Property
  - Minimum of 3 strain levels

- Pavement Performance Analysis
  - Minimum of 4 strain levels
  - Better extrapolation of $G^R$ vs. $N_f$ curve in log-log scale
Platen Size & Gluing Jig

- Platens - Changed the size limits
  - Old: 100 ± 0.5 mm
  - New: 100 < x < 105 mm
  With a recommendation for diameters closer to the sample diameter to improve alignment

- Gluing Jigs - Allowed for gluing jigs to hold a small weight (no greater than 10 lbs) on the sample without holding a fixed height
Ball Joint vs. Ball Bearings

- The "ball joint" language caused confusion
  - Only meant for non-AMPT machines
  - Is now removed in AMPT-specific standard
- Some users placed a "ball bearing" between the upper platen and the machine.
- Ball bearing is not recommended because there is a potential to tighten the upper platen unevenly and damage the sample.
Terminology and Calculations

- Added calculations for the energy based failure criteria ($G^R$)
  - Also required for the report
- Added dynamic modulus ratio (DMR) to terminology
- Added tensile strain-based fatigue model coefficients ($K_1$, $K_2$, $K_3$) to terminology
Calculating Alpha Value

- Changed the method to calculate the $\alpha$ term to a simpler and more stable method based on the tangential slope of $E(t)$ vs. time in log-log scale.
Small Specimen Testing

- Added appendix to include small specimen testing possibility
  - Mirrors AASHTO TP 79-15
- Open doors to testing field cores and more specimens from one gyratory specimen
THANK YOU

- Due date for comments: September 25th
- Comments sent to Dave Mensching (FHWA): david.mensinghing@dot.gov