Name of Test **Direct Tension Cyclic Fatigue Test**	Developer(s) Kim and co-workers North Carolina State University
Test Method(s) AASHTO TP 107-14 (Large Specimens) AASHTO TP 133-19 (Small Specimens)	Adoption by Agencies None
Description First, a non-destructive dynamic modulus fingerprint test is performed to determine the linear viscoelastic property of the asphalt mixture. Then the cyclic fatigue damage tests are performed at a controlled strain level. The stress and strain results are used to determine the damage characteristic curve of the asphalt mixture as well as to predict the pavement fatigue life. The S_{app} index parameter may be calculated from these results as well. An E* master curve is required for conducting cyclic fatigue analysis.	Photographs/Illustrations 
Test Results S_{app} Fatigue Index Parameter Damage Characteristic Curve (C vs. S)	Test Temperature(s) Average of the high- and low-temperature PG temperatures minus 3°C (not exceeding 21°C)

Equipment & Approximate Cost	
Asphalt Mixture Performance Tester	$100,000
End platens and gluing jigs	$5,000
Core drill	$3,000
Environmental chamber	$3,000
Saw for cutting specimens	$6,000

Specimen Fabrication	Number of Replicate Specimens
Gyratory specimen, 2 cuts, 1 core, gluing gage points, gluing end platens (6 hours)	3 specimens
Specimen Conditioning Short-term aging for 4 hours at 135°C Conditioning for 4 hrs. at desired test temperature	Testing Time Dependent on mixture fatigue life. 2 days per mixture for 3 specimens is typical.
Data Analysis Complexity Fair – S_{app} FlexMAT calculation Complex – model structure using FlexPAVE™	Test Variability N/A
Field Validations Good (pavement sections in North Carolina and on FHWA-ALF)	Overall Practicality for Mix Design and QA Fair for Mix Design Poor for QA

Key References

- Hou, T., B.S. Underwood, and Y.R. Kim (2010). Fatigue Performance Prediction of North Carolina Mixtures Using the Simplified Viscoelastic Continuum Damage Model, Journal of the Association of Asphalt Paving Technologists, Vol. 79, pp. 35–80.
- Underwood, B.S., Y.R. Kim, and M.N. Guddati. (2010). "Improved Calculation Method of Damage Parameter in Viscoelastic Continuum Damage Model," International Journal of Pavement Engineering, Vol. 11, No. 6, pp. 459–476.
- Wang, Y. D., Underwood, B. S., & Kim, Y. R. (2020). Development of a fatigue index parameter, Sapp, for asphalt mixes using viscoelastic continuum damage theory. International Journal of Pavement Engineering. https://www.tandfonline.com/action/showCitFormats?doi=10.1080/10298436.2020.1751844.

Video Resources

- AMPT Video 1: Fabrication of Small and Large Specimens: https://www.youtube.com/watch?v=raDoPi1jcag
- AMPT Video 2: Dynamic Modulus Small Specimen Test: https://www.youtube.com/watch?v=ZlCHD3Mf1z4
- AMPT Video 3: Cyclic Fatigue Small Scale Specimen Test: https://www.youtube.com/watch?v=MKN1ihZkWr0