

AI Corner

Lab

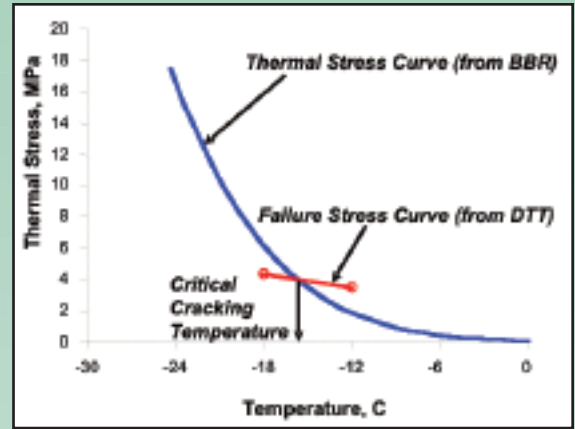
The Asphalt Institute's Lab is available to perform research, testing and training. For lab services contact Mike Anderson.

Determining a Critical Cracking Temperature for Asphalt Binders

Cracking is a distress experienced when the stress within an asphalt pavement exceeds its strength. In single-event thermal cracking, this stress is not caused by traffic but instead occurs when the air temperature gets colder and the asphalt contracts. Since the aggregate is not as affected by temperature changes, the asphalt binder contracts much more as temperature drops, resulting in an increase in stress—termed *thermal stress*. If the temperature gets cold enough, eventually the thermal stress within the asphalt will exceed its strength and a crack will develop. This type of cracking is termed *single-event low temperature cracking* since one instance of very cold temperature can cause this distress.

In the PG specification (AASHTO M320), the low temperature grade is determined from two parameters (Stiffness and m-value) calculated from bending beam rheometer (BBR) test results. Past studies have shown that there is a strong relationship between the stiffness of conventional (unmodified) asphalt binders and the amount of stretching they undergo before breaking.

Although stiffness has been used to estimate failure or strength properties, for some asphalt binders (especially modified asphalts), the relationship between stiffness and strength properties is not well known. Consequently, some researchers believe that the alternate procedure for determining low temperature grade specified in AASHTO MP 1a (Specification for Performance-Graded Asphalt Binder) and detailed in AASHTO



▲ Figure 1:
Determining
Critical Cracking
Temperature

Direct ►
Tension Testing
Equipment



PP 42 (Practice for Determination of Low-Temperature Performance Grade of Asphalt Binders) represents a more rigorous approach than AASHTO M320. In the PP 42 procedure, BBR data is used to generate a predicted thermal stress curve as a function of temperature. The direct tension test (DTT) is used to determine the failure stress in an asphalt binder specimen when tensile fracture occurs. The failure stress is then plotted to determine at what temperature the thermal stress curve from the BBR data exceeds the failure stress from the DTT (Figure 1). This intersection is termed the “critical cracking temperature” in the AASHTO PP 42 procedure.

Although the critical cracking temperature can be calculated manually, the analysis is simplified through the use of commercial software. The data in Figure 1 was generated with the TSAR Plus software available from Abatech (www.abatech.com).

For more information or to get a quote on performing the testing and analysis required to determine the critical cracking temperature of an asphalt binder, please contact either Mike Anderson (manderson@asphaltinstitute.org) or Gary Irvine (girvine@asphaltinstitute.org). ▲