

REVIEW OF APPLICABLE BOND STRENGTH TESTS FOR ASSESSING ASPHALT DELAMINATION POTENTIAL



Evaluation of test methods for assessing the bond strength achieved between asphalt layers

Effective bonding of successive layers in full-depth asphalt (FDA) pavements is critical for managing traffic-induced stresses and achieving the expected service life. Main Roads Western Australia (Main Roads) is concerned that adequate bonding between asphalt layers may not be consistently achieved in WA. In the absence of a standard bond strength test, specification and minimum criteria, the aim of this project is to assist Main Roads in the adoption of a reliable method to quantify the bond strength achieved between asphalt layers.

Background

Sufficient bonding between pavement layers is fundamental for achieving good pavement performance. Most pavement design and evaluation techniques assume that successive pavement layers are fully bonded together, with no displacement between them. However, anecdotal evidence suggests full bond is not always achieved. Theoretical evaluation and research have shown that poor interlayer bonding affects stress/strain distributions within a pavement structure. This reduces the capability of the pavement to support traffic and environmental loadings. West, Zhang and Moore (2005) indicated that a reduction in interface bonding of only 10% could result in a decrease in fatigue life of 50%.

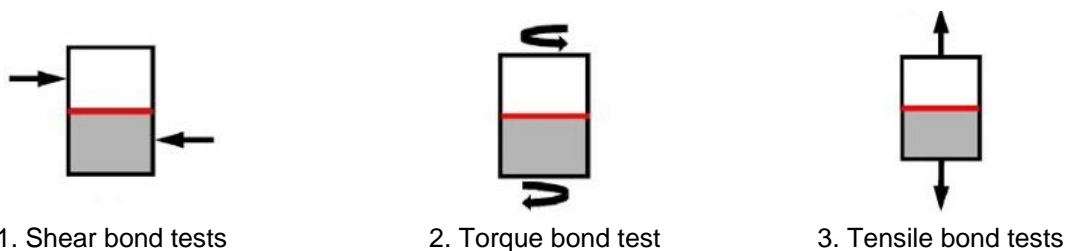
Approach

- Literature review of current Australian practice
- Review of Australian and International standard test methods

Literature Review

- Australian Practice – none of the Australian state road agencies currently adopt a test method for assessing the bond strength between asphalt layers. However, most indirectly address the issue through the specification of tack coat application rates.
- Existing Destructive Asphalt Bond Strength Tests – three main types with numerous derivatives including:

THREE MAIN TYPES OF DESTRUCTIVE ASPHALT BOND STRENGTH TESTS



Legend:

- Layer 1
- Interface
- Layer 2

Source: Rahman et al. 2016



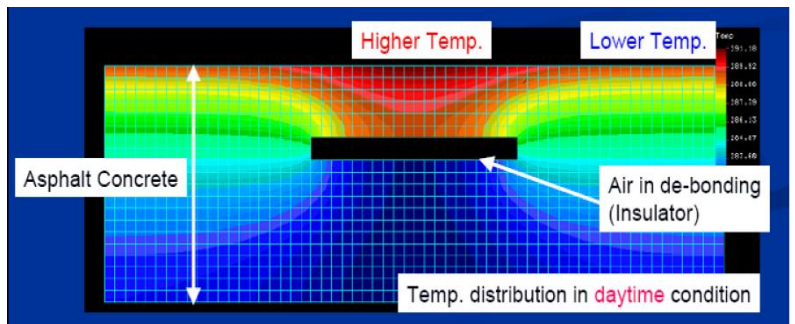


- Existing Non-Destructive Asphalt Bond Strength Tests:
 - Electromagnetic
 - Impulse methods
 - Vibration methods
 - Sonic/ultrasonic seismic methods
 - Thermal methods

What have we learned?

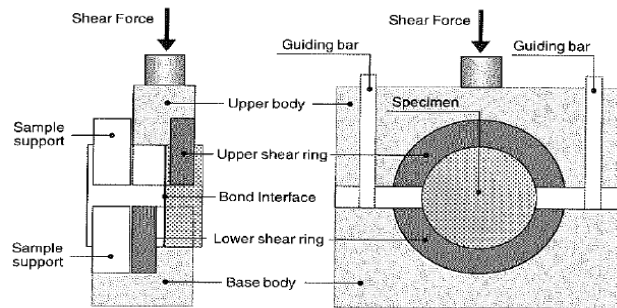
- Destructive methods are typically used for quality control and for ranking tack coat materials and application rates
- Non-destructive methods are commonly employed for forensic investigation of long lengths of pavement where delamination is suspected. These methods can provide an indication of both the extent and severity of delamination in FDA pavements
- The Leutner shear tester has been recommended for further investigation

EXAMPLE IMAGE OF THERMAL ANALYSIS



Source: Tsubokawa et al. (2007 cited in Celaya et al. 2010)

LEUTNER SHEAR TESTER



Source: Hakimzadeh (2015) and Canestrari et al. (2012)

Assessment of standard methods utilising the Leutner shear tester

Benchmarking the performance of typical FDA pavements in WA

FUTURE CONSIDERATIONS

How do results from laboratory tests correlate with field performance?