U.S. Department of Transportation
Federal Highway Administration

TOPS
Targeted Overlay Pavement Solutions

CASE STUDY

December 2021

CRACK ATTENUATING MIXTURE TEXAS DEPARTMENT OF TRANSPORTATION

This is one of five case studies highlighting FHWA's Every Day Counts initiative known as Targeted Overlay Pavement Solutions (TOPS). The purpose of TOPS is to integrate innovative overlay procedures into practices to improve performance, lessen traffic impacts, and reduce the cost of pavement ownership.

Reflective cracking can be a concern for rehabilitation projects. Blankenship (2019)[1] found that that cracks typically migrate approximately one inch per year through conventional overlays. According to Blankenship's research, properly designed crack attenuating mixture (CAM) interlayers may reduce the number of reflective cracks and slow the rate of reflective cracking by up to 50 percent.

> **"The Houston district has several hundred lane miles of continuously reinforced concrete pavements at or near the end of their designed service life with varying levels of surface distress. Many of these old pavements are heavily trafficked and unsuitable for reconstruction due to lane closures and high costs. These are good candidates for CAM interlayers."**
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> *—TxDOT Transportation Engineer Beata Kwater, Houston District*

The concept of CAM interlayers was initially developed as a reflective cracking mitigation strategy for Jointed Reinforced Concrete Pavement rehabilitation. However, according to Kwater, TxDOT has used these mixes successfully on Continuously Reinforced Concrete Pavement (CRCP) and asphalt surfaces where crack mitigation is desired.

Research

The Houston district's first overlay project with a CAM interlayer was in 2014 on a stretch of Interstate 69. The 2014 design's annual average daily traffic was 300,000 vehicles per day. With the cracks spaced approximately 10 to 20 feet on the original CRCP, the Houston district worked with the Texas A&M Transportation Institute to design a CAM interlayer with a thin overlay mix surface course. A seal coat layer was placed over the existing pavement to seal the surface before placing the CAM interlayer.

According to Kwater, the CAM overlay system has performed well on Interstate 69. Today, the Houston district calls CAM interlayers TOM-F or TOM-Fine. TOM-F and CAM were developed in different TxDOT districts around the same time during the early 2000s. Since they have similar characteristics, the two mixes were integrated around 2014.

Construction of the Interstate 69 overlay system.
Source: *Tom Scullion, Texas A&M Transportation Institute.*

[1]Blankenship, P.B. (2019). *Reflective Crack Relief (Asphalt) Interlayer.* Blankenship Asphalt Tech. https://www.blankenshipasphalttech.com/news/2019/10/18/reflective-crack-relief-asphalt-interlayer

Characteristics

According to TxDOT, CAM interlayers include the following characteristics:

- High asphalt content using modified binder (typically around 7 percent).
- Quality virgin aggregate (no reclaimed products).
- Fine gradations (typical nominal maximum aggregate size of No. 4 to 3/8-inch sieve).
- Applied in thin 0.5- to 1-inch lifts.
- Placed as an interlayer in an overlay system.
- Mixture performance tested for crack propagation and rut resistance. TxDOT uses the Hamburg Wheel Tracking Test to evaluate rutting resistance and moisture susceptibility. Reflective cracking resistance is evaluated using the Overlay Tester.

CAM is the new go-to solution for the Houston district when reflective cracking is a concern.

Construction Considerations

According to Kwater, there are limitations to what CAM and other thin lifts can fix, and project-specific pre-overlay repairs should be considered when using CAM overlay systems. The Houston district recommends repairing cracks wider than ¼ inch and making full-depth repairs on distresses that extend through the pavement's depth, including transverse cracks, shattered slabs, and corner breaks. Good bonding to the existing surface is critical for thin lift asphalt applications. The Houston District specifies a seal coat to enhance bonding and sealing using an asphalt-rubber binder and a thin layer of aggregate.

TxDOT Houston District's current construction notes include the following construction best practices for thin lifts like CAM [2]:

- Place mixtures only when the air temperature is above 70°F.
- Use Warm Mix Asphalt (WMA) when the plant to job haul distance exceeds 40 miles. When WMA is required, no reduction in temperature will be permitted (the WMA is a compaction aide).
- Use two steel wheel rollers working in tandem for breakdown rolling. Keep the rollers as close as possible to the lay-down machine. Do not use pneumatic tire rollers.
- Provide and use a paver-mounted thermal profiling system or thermal camera system.
- Establish a rolling pattern using water flow measurements per test method 246.

Performance

TxDOT has found that CAM interlayer performance depends on selecting an appropriate surface mix to complement the CAM. According to TxDOT, dense-graded mixes do not perform well with CAM, and it is common for cracks to skip the CAM interlayer and appear on the surface of the stiff surface mix. The Houston district prefers a 1-inch TOM-coarse (TOM-C) surface with a TOM-F CAM interlayer. The TOM-C is a more coarse, open-graded mixture with a lower minimum asphalt content but with skid and rut-resistant properties. TxDOT also tests TOM-C mixes for reflective crack resistance using the Overlay Tester. However, TxDOT's mix design specification for TOM-C requires only 300 cycles to failure, compared to 500 to 750 cycles for CAM layers.

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[2] Wilson, B., Scullion, S., Estakhri, C., Arellano, M., and Blackmore, T. (2015). *Thin Overlay Guidelines: Project Selection, Design, and Construction.* Project 0-6742. Texas Department of Transportation.

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