Project Profile – Bonded Pavement—BondTekk™, Franklin Co MO

Location: Route T in Missouri, between Route 100 East and Route 100 West
Road Owner: Missouri Department of Transportation
Applicator: N.B. West
Date Placed: October 8-10, 2008

Road Science™, a Division of ArrMaz Custom Chemicals, in conjunction with the Missouri Department of Transportation (MoDOT) decided to experiment with Bonded Dense Graded Hot Mix Asphalt (BDGHMA) in part to answer the following:

- *Is there a difference in the ability to compact the test sections with Polymer Modified Asphalt Emulsion (PMAE) tack relative to the control sections with conventional CSS-1h tack?*
- *Will the use of PMAE tack, applied with a spray paver, affect the pavement performance with respect to rutting, cracking, potholing and centerline joint deterioration?*
- *Will the spray paver placement of a conventional tack (e.g. CSS-1h) improve its performance?*

The pavement in the area of the test sections consisted of a jointed Portland cement concrete pavement that had been overlaid multiple times with asphalt concrete. The average asphalt concrete total thickness over the PCC was estimated at 6 to 7". In general, the pavement surface was aged, and showed signs of moderate to severe transverse cracking and some longitudinal cracking. The west end of the test section did show some signs of fatigue damage.

Mix and Trial Information: The mix was a MoDOT BP-1 Dense Graded HMA placed at a compacted thickness of 1.75 inches. The binder was PG 64-22 and the mixture contained 15% RAP. The bonding agent for the test sections was NovaBond PMAE while a CSS-1h diluted 50:50 with water was used as the bonding agent for the control section. CSS was applied at a rate of 0.08 to 0.15 gallons per square yard and PMAE was applied at a rate of 0.1 to 0.21 gallons per square yard.

Route T, Franklin County, MO

Construction Information: The mix was placed with a RoadTec SP-200 track spray paver aided by a RoadTec SB-2500C material transfer vehicle. The mix arrived at the paver at approximately 340°F with a temperature of 305°F behind the screed. The average paving speed was 40 ft/minute allowing placement of the 1 ¾" BP-1 mix at the rate of 228 ton/hr. Compaction was achieved with two Caterpillar 10 ton double drum vibratory rollers, and one Dynapac 10 ton steel wheel roller. Density targets for the project were 90% minimum on the unsupported centerline joint and 94% ± 2% across the mat. As the rate of application of tack coat material was changed for each test section, a new roller pattern was established. The traditional tack coat material test sections required the most passes and compaction to achieve the desired level of density.

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Construction Observations: *Was there a difference in the ability to compact the test sections with PMAE tack relative to the control sections with conventional CSS-1h tack?*

The PMAE tack appears to enhance the mixes ability to be compacted. Roller operators could distinctly determine when the tack coat emulsion was switched from PMAE to CSS-1h. The roller patterns involved more passes to achieve the same density when placing the mix on top of the conventional tack.

The upper lane has already been paved and the unpaved section is the general condition of the transverse cracks before BondTekk application

Did the spray paver placement of a conventional tack (e.g. CSS-1h) improve its performance?

During the construction phase, there is no visible difference in how the mix was performing whether the conventional tack was placed through the spray paver or through a distributor. Density was achieved, although with difficulty, in the control section using distributor sprayed CSS-1h tack. Similarly, density was successfully achieved in the test sections where spray paver applied PMAE tack was used.

Missouri Route T with BondTekk application complete

Performance: *Did the use of PMAE tack, applied with a spray paver, affect the pavement performance with respect to rutting, cracking, potholing and centerline joint deterioration?*

At ten months after construction, there was 13 times more cracking in the control sections compared to the PMAE tack sections. Clearly, there is an advantage to the improved bonding. No rutting, potholing or centerline joint deterioration was observed.

After 10 months, the control section has cracked while the PMAE section has not cracked

For more information on this project, or other solutions available in your area for your paving needs, contact your local Road Science representative.

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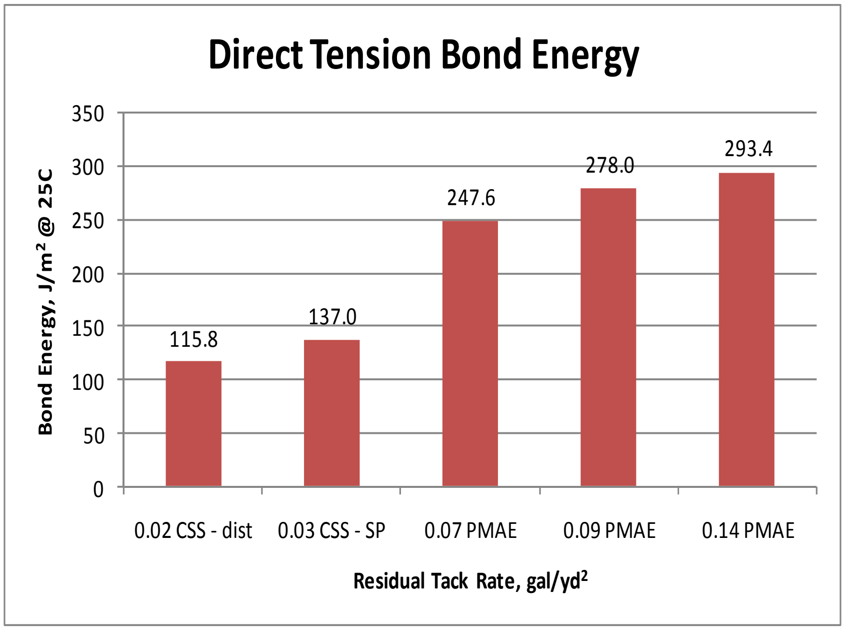
Profile Update— July 2011 (29 month) Test Results:

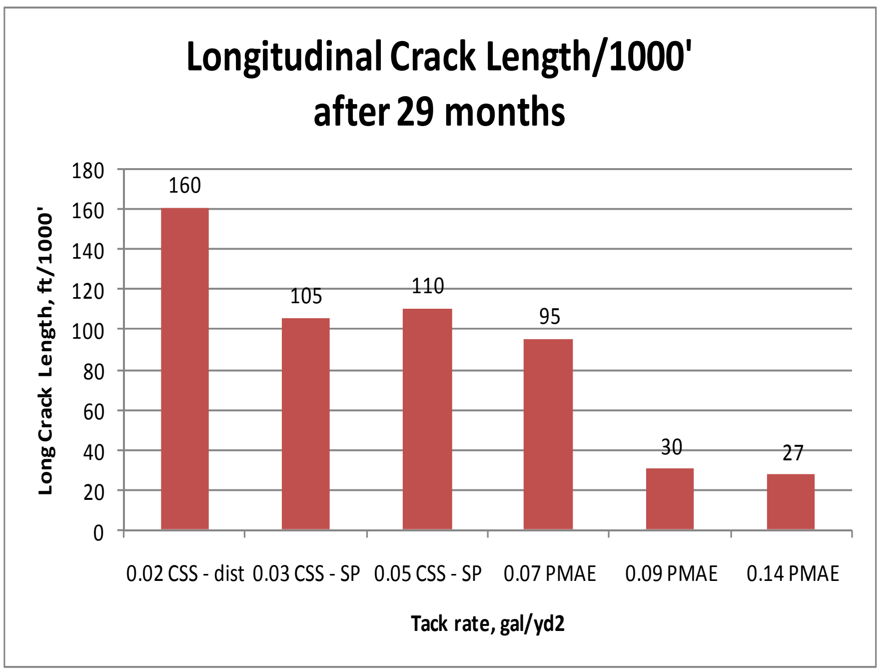


Direct Tension Bond Energy

A direct tension bond energy (a method for measuring the work or energy required to separate the overlay from the existing surface) was run on a matrix of cores taken from the project within a few weeks after construction. The test was run at 77F and 0.5 mm/minute rate of loading. The bond energy significantly increased with the application of polymer modified asphalt emulsion (PMAE) and continued to increase the bond energy as the application rate of PMAE increased

Longitudinal Crack Length after 29 months

A visual survey with measurements was conducted after 29 months of service of the overlay. The lowest rate of CSS tack coat emulsion resulted in the greatest amount of longitudinal cracking. As the application rate of CSS tack coat was increased, the length of longitudinal cracking remained fairly constant. The two higher rates of PMAE tack coat resulted in a significant reduction in the length of longitudinal cracks.



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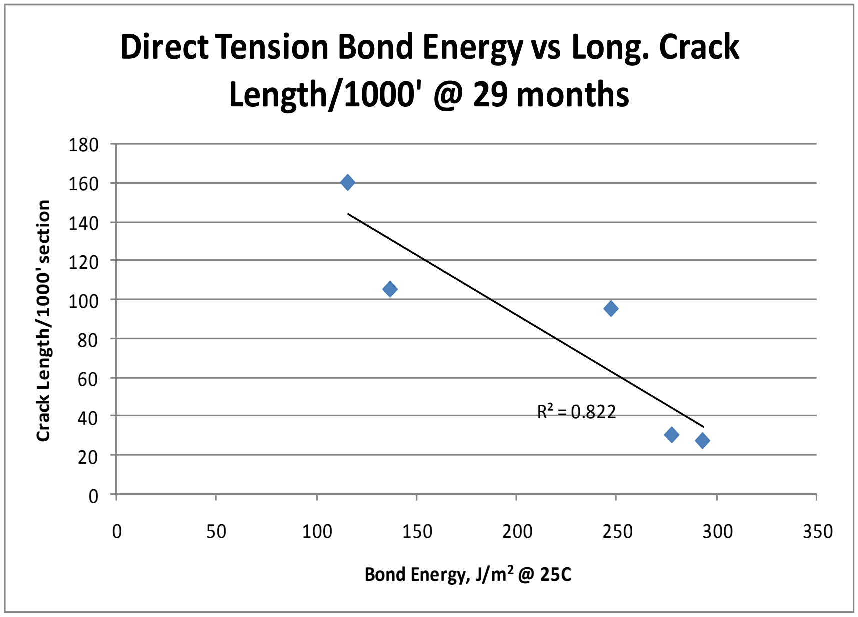

Direct Tension Bond Energy vs. Longitudinal Crack Length

The bond energy of the different test sections were plotted against length of longitudinal cracking after 29 months of service. A linear equation was fit to the data points which appears to show a correlation between the bond energy and the appearance of longitudinal cracking.

Transverse Crack Length vs. Time

A visual survey and measurement of transverse cracks was performed every 6 to 12 month period for the last 30 months since the placement of the new overlay. The lowest application rates of CSS tack show a significant increase in the length of transverse cracks over the current evaluation period with a significant jump in the length of cracks between the 12 and 18 month time period (2 winters) as compared to the higher tack rate sections. The highest application rates of PMAE tack coat have resulted in the lowest rate of transverse crack growth.