Analysis of Hwy 25 Reclamite Treatment

By: Isaac L. Howard and Jason M. Barham

Reclamite was placed as a fog seal on *Hwy 25* just north of Jackson, MS; the surface was 9 years old at the time of application (surface built in the fall of 2000). Four sections were placed: 1) northbound lane-southern section in Rankin county received 0.23 L/m^2 (0.05 gpsy); 2) northbound lane-northern section ending at the Rankin/Scott county line received 0.27 L/m^2 (0.06 gpsy); 3) southbound lane-southern section received 0.32 L/m^2 (0.07 gpsy); and 4) southbound lane-northern section received 0.27 L/m^2 (0.06 gpsy).

Section 2 was investigated in this paper, which was constructed November 17, 2009. Sixteen 150 mm diameter cores were taken near the county line on December 10, 2009 (cold and sunny day). Eight treated cores were taken on the order of 15 m south of the county line and eight untreated cores were taken on the order of 15 m north of the county line. All cores were taken in the outside lane heading north. Core locations were spaced on the order of 0.6 m along the direction of traffic and all cores were taken on the order of 0.3 m from the edge of the lane (i.e. from the inside of the white line). The pavement had a small asphalt shoulder beyond the white line.

Visually, the pavement had raveled somewhat under action of traffic, and the sealed section was only slightly darker than the unsealed section. Specimens sealed with Reclamite were allowed a minimum of 30 days before being sawn and tested. Permeability (k), viscosity, and stiffness change testing was performed.

Brookfield viscosity testing in accordance with *AASHTO T 316-04* at 135 C with an S27 spindle was performed on four treated and four untreated cores by slicing the top 6.3 mm from the pavement surface and extracting bituminous material for testing. Extraction was performed with 85% toluene and 15% ethanol using two washes each lasting 45 $\pm$ 5 min. Test parameters were based on work performed to date within *MDOT* State Study 211. The extraction was only intended to remove effective asphalt and not absorbed asphalt.

Asphalt extraction for viscosity testing was performed on pairs of cores; four viscosity tests were conducted and test results are provided in Table 1 alongside the amount of asphalt removed (AC_{Rem}) with the two solvent washes.

Table 1. Viscosity Test Results

Condition	**AC_{Rem} (%)**	**Viscosity (cP)**
Untreated	4.9	16780, 13520, **15150**
Treated	5.1	5020, 4790, **4905**

1: Asphalt extracted with two solvent washes.

Percent decrease in viscosity ($V_{D\%}$) was calculated using Eq. 1, where V_U is the untreated viscosity, and V_T is the treated viscosity. Average values are denoted in bold in Table 1 and resulted in $V_{D\%}$ of 68.

$$V_{D\%} = \frac{V_U - V_T}{V_U}(100) \qquad (1)$$

Permeability testing was conducted according to *ASTM PS 129-01* with the exception that testing proceeded beyond 30 minutes. Two treated and two untreated cores were used for permeability testing and subsequently re-used for other testing; core thicknesses were on the order of 4 cm. Permeability (k) test results were 447e^{-7} cm/sec for untreated specimens while treated specimens were impermeable at the resolution of the test indicating the Reclamite successfully sealed the pavement.

Bending Beam Rheometer (*BBR*) testing to investigate flexural creep stiffness was performed according to *AASHTO Idea 133 Draft Specification*. Four treated and four untreated cores were sawn and tested in the *BBR*. The test was conducted by slicing the surface of the core into bars that could be placed into the *BBR* and tested. Testing the surface of an aged pavement poses formidable challenges including brittleness leading to specimen breakage and non-uniform bar thicknesses if the surface is raveled (the test is intended for uniform specimen dimensions).

The surface of a 150 mm diameter core can produce up to five *BBR* test specimens. These specimens can be: broken during sawing (B_{saw}), sawn but break during the *BBR* test (B_{BBR}), or tested successfully. Data from the cores tested is provided in Table 2. As seen, 7 and 12 tests were all that could be conducted for the untreated, and Reclamite treated specimens, respectively.

Table 2. *BBR* Beam Fabrication Summary

Condition	Total	B_{saw}	B_{BBR}	Tested
Treated	20	2	6	12
Untreated	20	4	9	7

Three treated beams that were tested were removed from the analysis since their midpoint thickness was appreciably different than the average thickness (midpoint thickness for all three specimens removed was less than 5 mm whereas the typical average thickness would be on the order of 7 to 8 mm). All untreated beams that were tested were used in analysis resulting in nine treated data points and seven untreated data points.

Visually the treated (T) specimens were more raveled than the untreated (U) specimens (Figure 1). Qualitatively, the ability to saw more specimens and have less breakage during testing on a surface with more raveling favors reduced brittleness due to Reclamite. Over half of the untreated specimens broke during testing while only one-third of the treated specimens broke during testing.

Figure 1. Photograph of *BBR* Test Specimens

The raveled surface yielded varying thickness values at the surface of the pavement and as a result the *BBR* test data was analyzed: 1) using the average thickness of multiple measurements along the specimen; and 2) using the midpoint thickness. In that the effect of the surface treatment was the primary variable under consideration slicing the top few millimeters off the pavement to obtain a smooth surface was not performed. It should be understood that thickness of the specimen has a considerable effect on the stiffness calculated and as such the data reported from the *BBR* test results on the surface of *Hwy 25* should be considered an estimate.

Figures 2 and 3 plot *BBR* stiffness as a function of time when tested at -12 C; Figure 2 uses the average thickness while Figure 3 used the midpoint thickness. In both figures treated specimens were less stiff, in general, than untreated specimens. At early test times, treated specimens were less stiff while at later test times the two curves either converged or the treated specimens became slightly stiffer. The difference between treated and untreated specimens was higher when average thickness was used; the magnitude of stiffness was lower when average thickness was used.

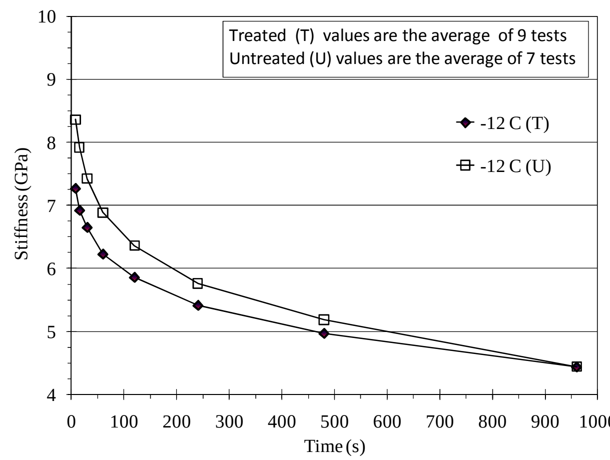

Figure 2. *BBR* Results vs. Time-Avg. Thickness

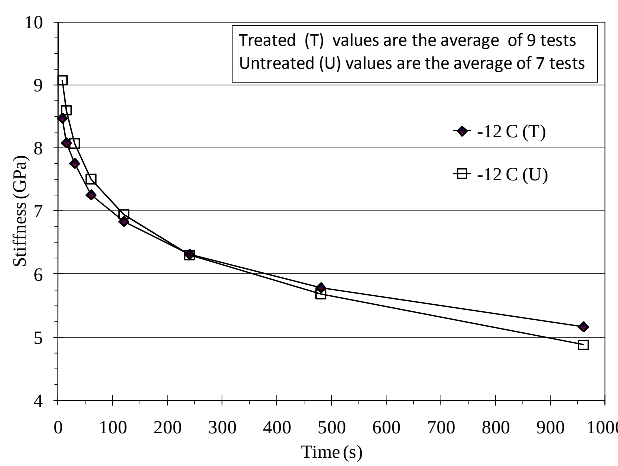

Figure 3. *BBR* Results vs. Time-Mid. Thickness

Figures 4 and 5 plot frequency histograms of treated and untreated specimens at a test time of 60 seconds; Figure 4 uses average thickness and Figure 5 uses midpoint thickness. Note that the data in

Figures 4 and 5 were each represented by one treated and one untreated marker in Figures 2 and 3. The mean stiffness was lower for the treated specimens, but not by an appreciable amount. Of note is that the untreated specimens appeared to have a minimum threshold stiffness, while the treated specimens on occasion had appreciabially less stiffness. For the majority of the data the treated and untreated stiffness values were essentially the same.

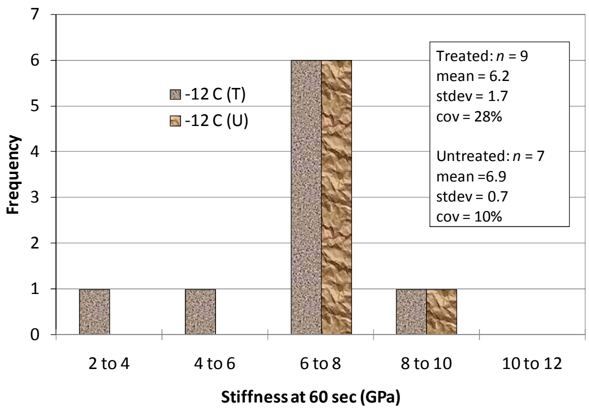

Figure 4. *BBR* Histogram-Avg. Thickness

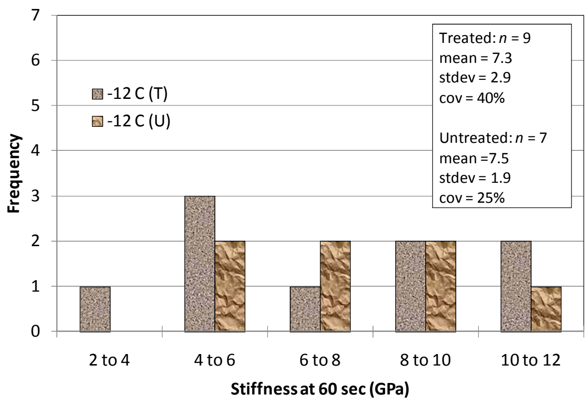

Figure 5. *BBR* Histogram-Mid. Thickness

The Reclamite treatment applied in November of 2009 to *Hwy 25* in Mississippi had a measurable effect on the pavement surface. Viscosity was reduced by 68% in the top 6.3 mm of the pavement and the surface was made impermeable according to the test conducted. *BBR* testing slightly favored Reclamite treated specimens. Overall, the treatment appears to have improved the surface just after placement, with additional investigation after a period of service needed for a more comprehensive assessment.

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Mississippi State University
Construction Materials Research Center
Ph: 662-325-3050

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State Research Engineer-James Watkins