



Case Study from the Kentucky Transportation Cabinet

Guidelines for the Preservation of High-Traffic-Volume Roadways (R26)

Background

Stretching the time between major rehabilitation projects can save transportation agencies money, reduce congestion, and improve safety. For years, transportation agencies have successfully extended the life of low-volume roadways by applying pavement preservation strategies. Achieving the same results on high-traffic roadways requires employing a systematic approach that considers a variety of road conditions and proper timing of treatments to control risk and reduce traffic impacts.

Since 2013, 14 state highway agencies have partnered with the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) to implement the concepts of *Guidelines for the Preservation of High-Traffic-Volume Roadways (R26 or Guidelines)* through the Implementation Assistance Program (IAP). The Kentucky Transportation Cabinet (KYTC) is one of the Lead Adopter states and constructed one project using the *Guidelines*, a multi-treatment, four-lane rural principal arterial in November 2013 (north section) and August 2014 (south section). This case study highlights the challenges KYTC faced, discusses its approach to implementing the *Guidelines* product, and documents the lessons learned from the process to further the practice of pavement preservation on high volume roads.

Challenges Facing KYTC

Over the past few decades, KYTC has developed a robust resurfacing program. Like many other transportation agencies, however, the primary treatment in its resurfacing program was hot-mix asphalt (HMA) overlays. HMA overlays address a wide variety of surface distresses, but because of their comparatively high initial cost and the associated work to construct them, allowing pavements to

What are the *Guidelines*?

Many conventional preservation techniques—and some new ones—can be used to extend the life of high-traffic roadways without major reconstruction and traffic disruption.

Guidelines for the Preservation of High-Traffic-Volume Roadways (R26) were developed through the second Strategic Highway Research Program (SHRP2). The *Guidelines* offer the technical background and decision-making framework needed to bring preservation strategies widely into play for high-traffic roads.

The *Guidelines* are the first systematic and comprehensive resources designed to expand the use of pavement preservation on high-traffic roads. The guidance is based on the findings from a comprehensive survey of 40 state highway agencies, seven Canadian provinces, and three U.S. cities, as well as a review of existing successful preservation techniques. The *Guidelines* include a selection process and matrices that enable quick identification of treatment options by various categories, such as rural or urban roads, climate zones, work zone duration restrictions, traffic volumes, and relative costs.

deteriorate to poor condition before placing an HMA overlay was a common practice. Two microsurfacing projects were placed on KYTC's parkway system to gain experience with alternative treatments. The treatments were constructed successfully and performed acceptably over the next several years. The agency observed the treatment's performance and contemplated follow-up actions.

In 2007, KYTC initiated a preventive maintenance program with a stated objective to achieve a higher level of pavement performance and provide a better road-user experience. This was accomplished by focusing a portion of maintenance funds on low-cost treatments that extend the life of pavements. (KYTC, 2012). Preventive maintenance treatments were aimed at State-owned pavements that were off the interstate and parkway systems. By 2012, guidelines had been developed to aid districts in determining proper treatments for application on roadway segments with established distress levels. One guiding principle of the KYTC program encouraged applying preventive maintenance treatments before conditions required more expensive alternatives.

Steps Taken to Strengthen KYTC Preservation Program

To effectively administer new treatment options and responsibly grow the preventive maintenance program, the Kentucky Preventive Maintenance Alliance (PMA) was formed. The PMA is a partnership comprising KYTC engineers from Districts, Central Office Maintenance, and Materials. The group works together to select appropriate projects based on a data-driven process and ensures quality applications through review and collaboration. Additionally, this group tracks performance of existing projects, participates in research efforts related to preventive maintenance applications, and provides agency pavement preservation training opportunities.

KYTC's Approach to Implementing the *Guidelines*

Route Selection and Treatment Combinations

As KYTC began to implement the *Guidelines* product, it considered "high-traffic" pavement segments with average daily traffic (ADT) above 10,000 vehicles per day. Ultimately, KYTC decided to construct multiple preservation treatments on U.S. 127 in Mercer County, a four-lane rural arterial.

The two-way ADT count spanning the project length is 12,812 vehicles, with 11.4 percent trucks. Two test sites were established with diverse construction and treatment histories. Treatments were installed on all four travel lanes and shoulders throughout the test sites. More information about the test site locations chosen by KYTC to install pavement preservation treatments is provided in Table 1.

Table 1. KYTC Test Site Description

Test Site, Log Mile	Test Section Placed, year	Prior surface placed, year	R26 treatments	Main distresses present at time of treatment
North 14.169 to 17.15	2013	2012	<ul style="list-style-type: none"> • JointBond longitudinal joint stabilization • Reclamite rejuvenator 	Low-severity, longitudinal joint separation; low-extent, low-severity, top-down fatigue cracking
South 12.74 to 14.169	2014	2003	<ul style="list-style-type: none"> • Single microsurface • Cape seal • Double microsurface • Thin HMA overlay • Crack seal • Black onyx fog seal with aggregate 	Extensive moderate severity, top-down fatigue cracking; extensive severe raveling; moderate longitudinal joint separation

A monitoring plan was developed to provide preapplication condition assessments and periodic performance assessments two to three times per year. Conditions being monitored include cracking, raveling, rutting, friction, permeability, and smoothness. The 1,500-foot test sections have been divided into smaller grids to have varying distresses represented for each treatment type.

Figure 1 shows a schematic of the treatments applied on U.S. 12; the test sections include untreated control sections for comparison. Mainline treatments consisted of longitudinal joint stabilization (JointBond®), crack sealing, a thin HMA overlay, double microsurface, cape seal (chip seal with microsurface application), and single microsurface applications. Shoulder treatments consisted of a fog seal with aggregate (black onyx) and an asphalt rejuvenator (Reclamite).

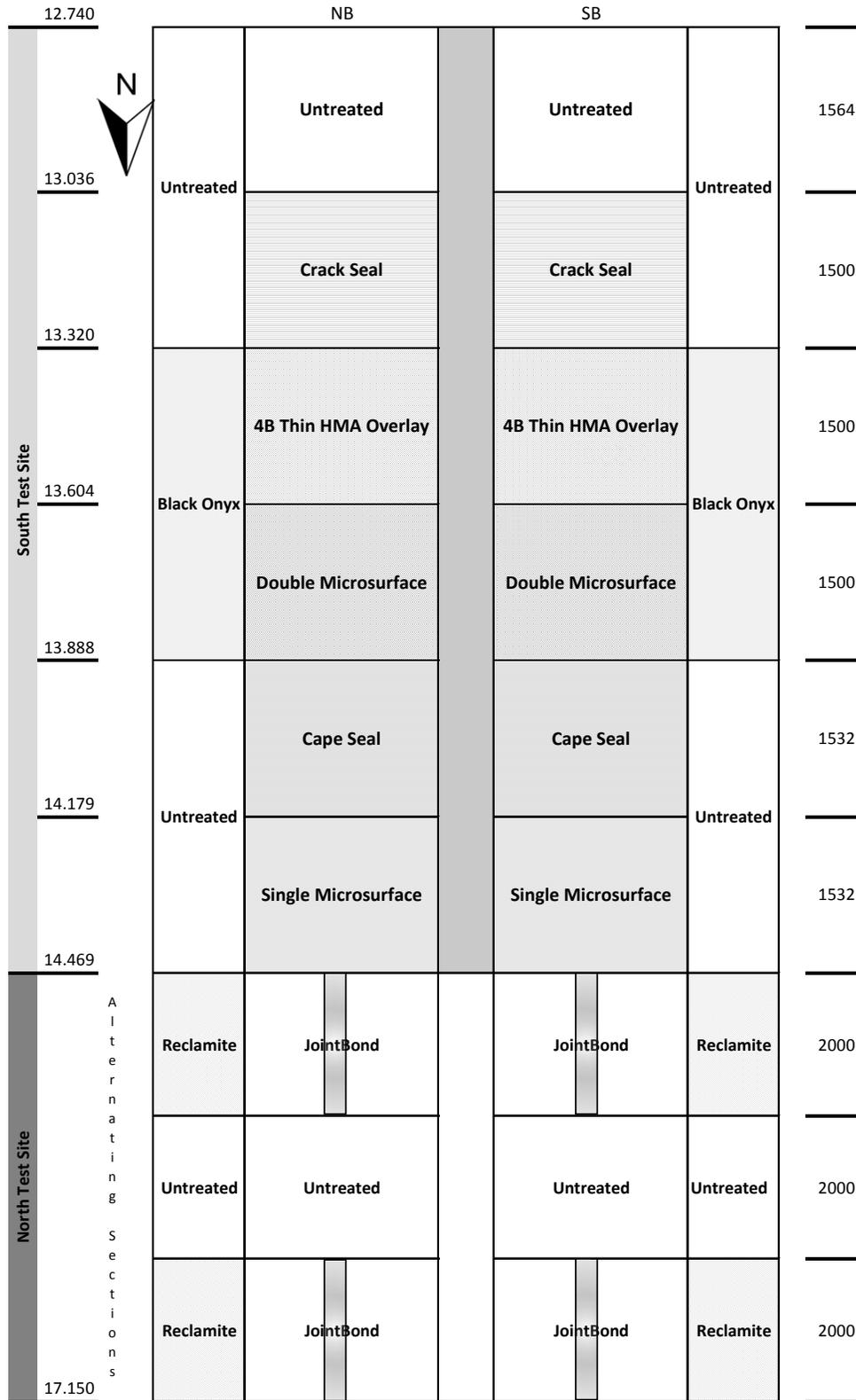


Figure 1. Schematic of Treatment Applications on U.S. 127 in Mercer County, Kentucky

Pre-Treatment Surface Condition

The KYTC has previously installed a 1.5-inch dense graded asphalt overlay on U.S. 127 in 2012 on the northern site and in 2003 on the southern site. Therefore, treatments on the northern site were applied on 1-year-old pavements. KYTC reported low distress extent and severity at this site before treatment application. The surface age on the southern section was 11 years at the time of treatment and, as shown in Figure 2 below, the pavement exhibited varied distresses throughout the section. A pavement distress survey conducted just prior to application of the surface treatments identified extensive, moderate-severity, top-down fatigue cracking, and extensive raveling of the pavement surface. The southbound lanes showed slightly more extensive distress than the northbound lanes. KYTC hopes to use this test section to gain a sense of the treatment life and benefit for each treatment, so that ultimately treatment applications can be timed to yield a longer life cycle and minimize the life-cycle cost.



**Figure 2. Pretreatment Condition of U.S. 127 (southern section)
in Mercer County (source: KYTC)**

Performance Monitoring

KYTC partnered with the University of Kentucky Transportation Center (UKTC) to install the sections. KYTC prepared the construction specification for each treatment, while the UKTC obtained bids to install the treatments. The initial test plan called for longer sections; however, higher-than-expected bids limited the length of the research segments. The KYTC documented the installation costs, but they were determined not to represent large-scale work done by the cabinet.

The KYTC has continued assessing the research segments since installation in 2013 and 2014, with limited findings at this time. To keep with the goal of extending pavement life, the KYTC expects anticipated results will not emerge until several years of monitoring are completed, especially for the

south section. This trial section of treatments represents the most controlled data set for microsurfacing and thin asphalt overlays in the state. The test section is also the first application of a cape seal in the state. The KYTC hopes to develop deterioration curves once sufficient time series data are available, compare performance of treatments, and monitor any potential safety concerns, such as surface friction.

Process Improvement

Although test section construction seemed to go rather smoothly, KYTC identified areas where improvements would increase the likelihood of project success and acceptance. For example, during the construction of the cape seal section, traffic rode on the limestone chip seal, shown in Figure 3, for approximately 10 days before the chip seal was covered by a microsurface.

During that period of time, several calls from the public were received in the District and resident engineering offices. Callers were unfamiliar with the process and concerned about safety and loss of chips and expressed the opinion that the chip seal surface would be inferior to an HMA surface.

KYTC saw a need to address public concerns and share project expectations with the public. Therefore, in subsequent chip seal projects, KYTC specified that a fog seal be placed over the chip layer within hours of placement. The additional bituminous material added a nominal cost to the application, but provided substantial benefit in chip retention and in camouflaging the light-colored, limestone aggregates. The fog seal returned the pavement to a shade of black, glued down the stone chips, and reduced the calls of concern before the microsurfacing was placed.

KYTC also adopted a proactive step informing the public about the treatment that would be applied to the roadway. The process starts during the project development phase to determine the best means for conveying the information to the public. Depending on the project location and traffic level, various outreach tools are used such as news media releases or hand-delivered flyers.

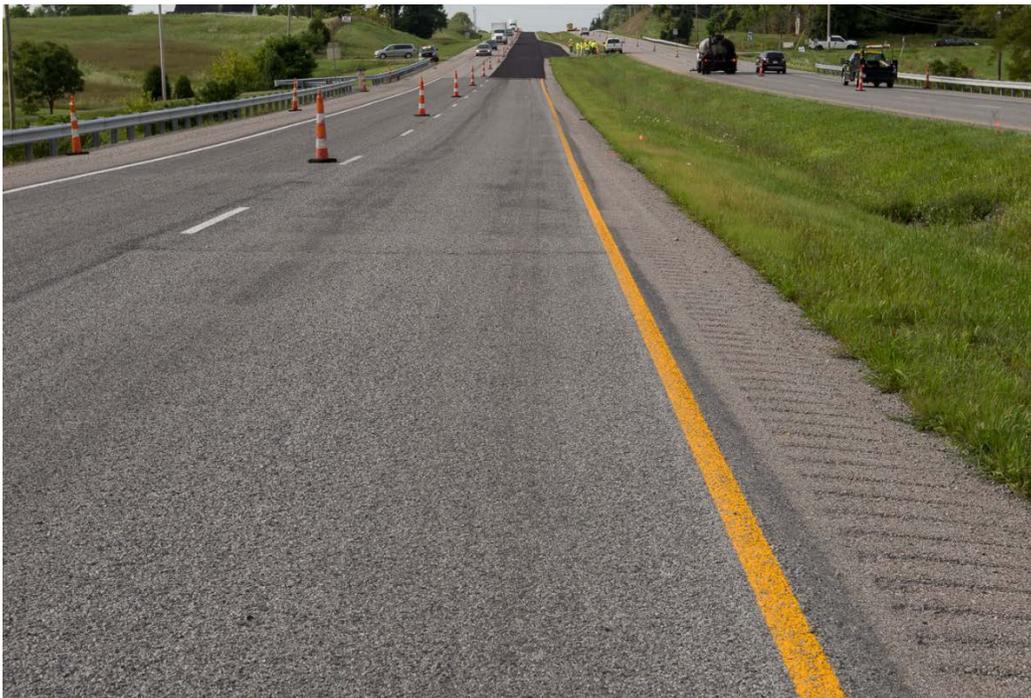


Figure 3. Chip Surface before Cape Seal Microsurface Placement (source: Strawser Construction, Inc.)

Implementing and monitoring the sections helped KYTC overcome minor concerns held before entering the project. Other states reported that the longitudinal joint treatment residue, as shown in Figure 4, could dull the reflectivity of pavement markings for the first few weeks following application. KYTC also considered whether sealing the shoulders would substantially reduce surface friction. Through project experience, KYTC realized the pavement marking reflectivity was not significantly affected by the opaque longitudinal joint spray. As KYTC monitored the test sections, the fog-sealed shoulder treatment showed acceptable surface friction similar to a new overlay.

Benefits of Using the *Guidelines*

The process that KYTC employed has resulted in several benefits. First and foremost, placing the test sections has generated confidence in the treatments themselves. Constructing the test sections required a planned approach to monitor treatment performance, which has also proven beneficial. In establishing the implementation project, the process has fostered the development of an agency preservation alliance to share regional experiences horizontally across the agency.



Figure 4. JointBond Longitudinal Joint Stabilizer within Minutes of Application (Source: KYTC)

Confidence Gained from Other Agencies

KYTC implemented a policy of pavement preservation in 2007; however, the agency had little experience with treatments other than HMA overlays, and the staff was cautious about placing unfamiliar treatments on high-volume roads. The *Guidelines* provided a level of assurance to agency management that other transportation agencies were achieving positive results using other

preservation treatments on high-volume roads. The *Guidelines* reported treatment application on routes within similar geographical and climatic regions as Kentucky, providing more encouragement that KYTC could achieve similar results in prolonging life cycles and lowering life-cycle costs.

Data-Driven Processes

The KYTC test sections have been constructed and performance monitoring is ongoing. Data generated from monitoring the sections can produce comparisons among the various treatments that were applied and confirm conditions where each treatment may be considered most effective. KYTC has committed to monitoring these sections for several years to create treatment performance curves that can be applied across its network. Monitoring is also generating familiarity with the treatments and building confidence across the agency. Proper documentation and reporting are essential to expanding familiarity within the agency and to other transportation agencies learning from lead adopter neighbors.

Building Agency Awareness

In 2014, KYTC formed the PMA consisting of engineering staff from multiple disciplines within the agency to improve pavement preservation in Kentucky. Functional areas represented in the alliance included the following:

- Central office maintenance
- Operations and pavement management
- Roadway maintenance
- Central office construction
- Central office materials
- Eleven operational districts

Table 2 lists the tasks assigned to the alliance members. The work of the PMA enables the central offices to organize their preservation program consistently across the state, analyze the treatments and projects implemented, and promote the successes identified through the analysis. Districts are able to share construction and performance experiences, select projects meeting the KYTC treatment guidelines, and develop communication and outreach tools aimed at helping the public understand the preservation goal and process of the agency. The PMA members have trained staff on the project selection process and treatment application requirements to yield consistency in treatment performance across the state.

Table 2. Expectations of Partnership Members

Central Office Divisions	Operational Districts
<ul style="list-style-type: none"> • Provide districts with project selection training. • Provide districts with application training. • Perform formal pavement evaluations. • Maintain pavement data and continuous candidate lists. • Analyze project performance. • Perform final project selection when necessary. 	<ul style="list-style-type: none"> • Submit projects for preventive maintenance treatments. • Verify central office project selections. • Attend project selection and application training. • Have qualified personnel on site during application. • Attend annual meeting. • Provide contractor and project review for all projects during annual meeting.

Building Industry Awareness

As additional preservation projects are implemented, the KYTC hopes that perspectives change for the local contracting community. With the commitment of a funded pavement preservation program and multiple treatment applications available for use, local contractors skilled in treatment application are desirable. Local contractors typically have better relationships with suppliers and local subcontractors that could translate into lower-cost projects. As local contractors adopt additional product lines, they are less likely to be unilaterally opposed to using new treatments. Increasing the market for pavement preservation is also good for the industry. Municipalities and local jurisdictions are likely to adopt new treatment strategies if a state standard and market exist that they may use. The increasing amount of preservation work builds a sustained market that encourages competition and lowers treatment costs.

Applicability to Kentucky

Internal guidelines were developed and in use by the KYTC prior to the agency’s participation in the *Guidelines*. Because the *Guidelines* are based on experience from several states, the credibility of both KYTC’s initial process and the *Guidelines* have been reinforced as a result of the IAP effort. With this confidence, KYTC is choosing a programmatic treatment selection process for preservation on high-traffic roadways as a preference. Alternative treatments were used in other states to lower life-cycle costs, and their functionality in Kentucky is reported to be similar. KYTC developed thresholds for treatment selection that complement the *Guidelines* and fit with the KYTC pavement rating process. Collectively, the districts and central offices bring together candidate projects with applicable preservation treatments. Using more consistent pavement evaluation and treatment selection practices has enabled the KYTC to move from sporadically applying alternative treatments prior to 2007 to systematically applying 300 lane-miles of alternative treatments in 2016. Greg Garner, KYTC Operations and Pavement Management Branch Staff Engineer, reported that the “big thing we learned from participating in R26 was about making people feel comfortable with the process.”

Lessons Learned

KYTC has adopted the *Guidelines* into its internal preservation policy, and their use continues to grow in what can be considered the new “normal” business practices. The *Guidelines* test sections allow for a complete data set to be collected and a variety of treatments to be directly compared. The test sections provide a quick reference for the state to view the appearance and differences between the treatments. The test sections also demonstrate a commitment that KYTC is responsibly monitoring new

techniques to grow its preventive maintenance program in a cost-effective manner. The deterioration curves and application guidelines developed through this study will guide decisions and educate members of the Kentucky PMA to ensure that quality applications are applied at appropriate locations.

KYTC identified the following improvements to its pavement preservation processes as the *Guidelines* were adopted:

- Identified a need to share agency experiences internally
- Alleviated concerns of treatment applications through experimentation
- Provided positive public outreach before and during project implementation
- Specified fog seal application onto the chipped surface of cape seals

These improvements help institute a sustainable pavement preservation program in Kentucky. Triggered to the appropriate condition, pavement preservation strategies lengthen the life cycle of pavements and lower pavement life-cycle costs. KYTC and the public benefit from maintaining its pavements at the lowest life-cycle costs, and from maximizing the benefits obtained within statewide funding scenarios. The *Guidelines* provided a basis on which the KYTC could apply the test sections with confidence and offered a framework to monitor the sections and evaluate treatment performance. Implementing the *Guidelines* will ultimately help to raise public awareness of pavement preservation, and confidence in KYTC's ability to effectively implement a preservation strategy on high-volume roads.

References

Kentucky Transportation Cabinet (KYTC). 2012. *Pavement Management in Kentucky*. Operations and Pavement Management Branch. Division of Maintenance. Department of Highways. Frankfort, KY.

Agency Contacts

For more information about KYTC's use of the *Guidelines*, contact Greg Garner, P.E., Staff Engineer, Operations and Pavement Management Branch, at Greg.Garner@ky.gov, (502) 564-4556.

For more information on the *Guidelines* product in general, contact Thomas Van at FHWA at Thomas.Van@dot.gov or Keith Platte at AASHTO at kplatte@aaashto.org.

The AASHTO SHRP2 product page is available at http://shrp2.transportation.org/Pages/R26_HighTrafficVolRoadways.aspx.