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TEXAS PAVEMENT PRESERVATION CENTER
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Our Mission

The mission of the TPPC, in joint collaboration with the Center for Transportation Research (CTR) of the University of Texas at Austin and the Texas Transportation Institute (TTI) of Texas A&M University, is to promote the use of pavement preservation strategies to provide the highest level of service to the traveling public at the lowest cost. The executive sponsor for the TPPC is the Texas Department of Transportation (TxDOT).

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Past and Upcoming Events

Ongoing TPPC Courses

TPPC is currently collaborating with the TxDOT Training Department to develop training courses in topics that include crack sealing, fog seals, chip seal, thin asphalt overlays, hot and cold-in-place recycling, micro-surfacing, slurry seals, and how to plan a pavement preservation program.

For more information contact TPPC Director, Dr. Yetkin Yildirim, at **yetkin@mail.utexas.edu**.

Courses for 2013

The TPPC continues their ongoing mission to educate industry practitioners about the most recent developments in pavement technology and knowhow with training courses which provide the latest crucial information and advancements in pavement technology to a wide audience of engineers, technicians and policy makers. In pursuit of this end, the TPPC will offer several different training courses in 2013.

TPPC Board of Directors

TxDOT: Quincy Allen, P.E., Gary D. Charlton, P.E., Paul Montgomery, P.E., Ted Moore, P.E., Andy Keith, P.E., Howard Holland, P.E., Nancy-Ellen Soterious, PhD

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MNT 705 & 706 - Microsurfacing

The TPPC will be offering new training courses in several TxDOT districts in 2013. One of these courses, MNT 705, is titled "Guidelines on the Use of Microsurfacing" and will be taught by TPPC staff. This course provides guidelines for planning and designing microsurfacing. The application of microsurfacing or slurry seals to existing pavements does not increase the structural capacity of the pavement, but it does help preserve the structural capacity, primarily by reducing the environmental damage that would otherwise develop in the original asphalt concrete pavement from the surface down. Increased moisture levels will reduce stiffness of most pavement layer materials. Reduction of moisture infiltration reduces this loss of strength and may allow some strength to be regained during hot, dry periods. This preserves the structural capacity of the existing pavement so that it can continue to effectively support traffic loads. The TPPC course on this topic is composed of three chapters which will cover all of the components of microsurfacing. Topics will include: TxDOT specifications for microsurfacing, mix design requirements and criteria, different applications and usage of microsurfacing, causes of microsurfacing failures, TxDOT's use of Cape Seals, the concept of pavement preservation strategy, guidelines for appropriate selection of roadways for microsurfacing, guidelines for filling ruts, and guidelines for the use of Cape Seals.

A second course developed by the Texas Pavement Preservation Center, MNT 706, is titled "Best Practices of Microsurfacing." This course will be taught by TPPC staff as well. "Best Practices of Microsurfacing" builds upon MNT 705 and is intended to provide guidelines for planning, design and construction in microsurfacing projects. More specifically, this course covers the following topics: the components of microsurfacing, how microsurfacing works as a surface treatment, guidelines for quality assurance and possible problems that may occur. The course is organized in three chapters, starting with an introduction to microsurfacing. Chapter two deals with the guidelines for quality assurance, while the last chapter gives an overview on the possible problems that could occur in microsurfacing application.

Taken together, these two courses will provide attendees with much needed expertise in the following topics concerning microsurfacing: Selection Guidelines - these guidelines include when to use these types of treatments in place of conventional seal coats, layer thickness guidelines, when not to use this type of surfacing as a surface treatment, and how to use as a rut filler. Opening to Traffic Guidelines - normally, micro-surfacing can handle rolling traffic in less than one hour after placement without damaging the pavement; stop-and-go traffic, especially heavy vehicles in cool, moist or very hot weather, may require additional curing time. Quality Assurance Guidelines - microsurfacing and slurry seals, as a material, appear to violate many of the techniques TxDOT inspectors have developed over the years to ensure that quality hot-mixed asphalt concrete pavements are constructed. For example, microsurfacing requires that the surface be pre-wet, whereas normal hot mix asphalt application requires a dry surface. Training is needed to give direction for the checks and tests during the application of microsurfacing and slurry seals to ensure that a quality product is provided by the contractor. Possible Problems, Prevention and Correction - microsurfacings and slurry seals are maintenance processes that are new to many TxDOT inspectors who may not be familiar with the potential problems that can occur on a job. Training is needed to provide inspectors with the information needed to recognize whether or not the contractor is making reasonable modifications to his work to prevent and/or correct problems which can occur.

MNT 705: Guidelines on the Use of Microsurfacing

This course provides guidelines for planning and designing microsurfacing. The course is composed of three chapters which will focus on the components of microsurfacing, TxDOT specifications for microsurfacing, mix design requirements and criteria, different applications and usage of microsurfacing, causes of microsurfacing failures, TxDOT's use of Cape Seals, concept of pavement preservation strategy, selection of roadways appropriate for microsurfacing, guidelines for filling ruts, and guidelines for the use of Cape Seals. The following is a brief summary of each chapter from this course.

Chapter 1: Introduction to Microsurfacing

Microsurfacing is a laboratory designed mixture of polymer-modified emulsified asphalt, aggregate, mineral filler, water, and other additives accurately proportioned, mixed and uniformly spread over a properly prepared surface. The mixture is made by a specialized machine and placed on a continuous basis by mixing the materials simultaneously in a pug mill. Due to the mixture's consistency, it can be evenly spread over the pavement, forming as adhesive bond.

Microsurfacing Paving Train

The two primary uses of microsurfacing are Preventive Maintenance, to prevent surface distresses in pavements, and Corrective Maintenance to correct surface distresses in older pavements. An example of preventive maintenance would be the use of microsurfacing to cover oxidized or raveled pavement to prevent further deterioration. An example of corrective maintenance would be using microsurfacing to restore surface friction on a road where skid numbers have fallen below safety minimums.

Microsurfacing is capable of performing at various levels of thickness, such as ruts, scratch courses, and milled surfaces. After curing and initial traffic consolidation, surfaces with microsurfacing should resist further compaction. Microsurfacing is applied as a homogenous mat, adheres firmly to prepared surfaces, and has a skid-resistant texture throughout its service life. It is designed to handle traffic within approximately one hour after placement. Service life is five to seven years for relatively high traffic areas and considerably longer for low to moderate traffic areas. Microsurfacing seals the surface and protects underlying layers, restores surface texture, improves friction, and fills cracks and minor surface voids as well as ruts. It corrects moderate flushing and bleeding and can serve as a leveling course.

Construction practices and procedures vary from region to region and are generally associated with the climate conditions in which the microsurfacing will be applied. It is widely recognized that weather-related factors are often responsible for the failure of newly constructed microsurfacing. Ideal microsurfacing weather conditions are those with low humidity, a slight breeze, and with sustained high temperatures throughout the following days. High humidity is a detriment to any microsurfacing owing to moisture's ability to retard the breaking of the emulsion.
The key to successful microsurfacing is a clean spreader box with no leaks that is pulled smoothly and evenly without vibration. Machine speed should be kept uniform. During application, the equipment operator changes the amount of water to control consistency and the amount of additive to control break time. Changes in temperature, humidity or surface texture will generally lead to a change in the amount of additive needed.

Material Specification Requirements

Successful microsurfacing operations adhere to the following materials guidelines:

- Cationic Polymer-Modified Asphalt Emulsion: CSS-1P
- Mineral Aggregates:
  - –Crushed aggregate
  - –From single source
  - –SAC B minimum requirement
  - –99 to 100% finer than 3/8-inch sieve
  - –Well graded
  - –Magnesium Sulfate Soundness, 30% max
  - –Sand Equivalent, 70% min
- Hydraulic cement or hydrated lime
  - –Used to improve mixture consistency and to adjust mixture breaking and curing properties
  - –0.5 to 3.0% by weight of dry aggregate
- Water:
  - –Free of harmful salts and contaminants.
- Additives:
  - –Used to accelerate or retard the break/set time. Appropriate additives and their applicable use range should be approved as part of the mix design.

Developing Microsurfacing Mixture Design

Chapter 2: TxDOT's Experience with Microsurfacing

When a thin surfacing is required but a seal coat is not a good option, many districts have successfully used microsurfacing instead. Some of the effective uses of microsurfacing as an alternative to seal coats include the following:

- To maintain curb and gutter lines
- To surface bike lanes
- In high traffic areas
- Where a low noise surfacing is desired
- To restore skid resistance
- To correct rutting
- On low volume FM roadways (which have had many seal coats and exhibit uneven texture due to flushing and/or rock loss)
- On low volume FM roadways to correct minor profile irregularities
- For cool weather applications

Curb-line Microsurfacing

Cape Seals

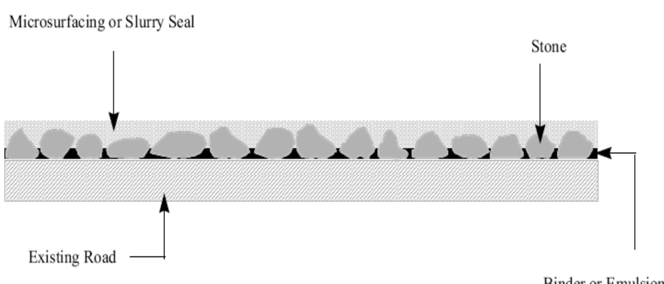
A cape seal consists of a seal coat covered by a slurry seal or microsurfacing. The seal coat provides an impermeable seal to the pavement surface. The microsurfacing over the seal coat eliminates the problem of loose aggregate, holds the stones of the seal coat firmly in place, and reduces traffic noise.

The Cape seal process was developed around Cape Town, South Africa. The South African experience with Cape seal projects has indicated that surfaces do not need to be resealed even after being exposed to heavy trucks for 7 to 10 years. For construction of a Cape seal, the microsurfacing can be applied in two ways:

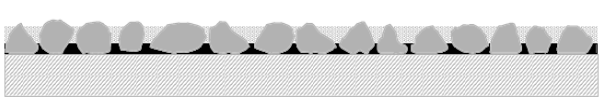
1. Applying at a rate low enough to only fill the voids between the aggregates (this is possible for Grade 3 and Grade 4 aggregate). In this way, the microspreader box squeegees are adjusted so that the voids between the stones are filled, though no overlay is formed. This results in a nodular effect, with the tops of the stone exposed and provides a greater nonskid treatment.

2. Applying at a rate to form a layer of microsurfacing at the top of the stones. In this case, it is recommended that the rate be high enough to create a thin layer of microsurface on the top without excess.

Generally, there is no preference as to which method to use, but it is recommended that the microsurfacing be applied at a rate low enough either to only fill the gaps or to just create a thin layer over the seal coat. The microsurfacing should have sufficient fluidity to fill the voids between the stones. Filling the voids will cause the seal coat and microsurfacing to be well integrated and will prevent slippage of the microsurfacing over the seal coat. The experience of the construction crew in the application of microsurfacing and the proper use of squeegees is very important to the quality of the final product.



Cape Seal with Slurry as Overlay



Cape Seal with Nodular Slurry (No Overlay)

Twenty Cape seal projects were evaluated for performance by the Center for Transportation Research at the University of Texas. Most of the projects used a Grade 5 seal coat In one case a Grade 3 was used and three projects used a Grade 4. Emulsions, unmodified binders, polymer-modified binders and tire rubber asphalt were all used for these projects. Most of these projects had average performance or better.

Chapter 3: Design and Selection Guidelines

Microsurfacing stands as one option in an array of pavement preservation practices. The idea of pavement preservation is relatively new and is therefore not fully understood by many maintenance professionals. This course is part of a nationwide effort to increase public awareness of the benefits of pavement preservation practices.

Pavement preservation programs are defined by the Federal Highway Administration (FHWA) as programs that employ a network-level, long-term strategy that enhances pavement performance using an integrated, cost-effective set of practices that extend pavement life, improve safety, and meet motorist expectations. These programs use both preventive and routine maintenance, though the emphasis definitely lies with prevention. Basically, pavement preservation works because maintaining a road in good condition is easier and less expensive than repairing one in poor condition.

Pavement preservation is a very effective strategy for many reasons. It extends pavement life and arrests or retards deterioration and progressive failure. Pavement preservation keeps the road in good condition, which improves safety conditions and ride quality and increases road user satisfaction. Furthermore, the financial savings from using preventive maintenance as opposed to reactive maintenance are substantial.

The main philosophy behind pavement preservation can be summed up as “the right treatment for the right road at the right time.” This catchphrase highlights the importance of careful planning in a preservation strategy. The best time and location for treatment must be identified, which often means selecting a pavement that does not have extensive or even minor visible damage. Once a project is chosen, maintenance professionals have to decide on the most effective treatment for the conditions at hand, including traffic levels, climatic conditions, treatment cost, and distress type and extent.

Because pavement preservation is a fairly new concept, many road agency personnel lack sufficient knowledge of when and where to apply a preventive maintenance treatment, what materials to use, and which methods are preferable. Unfortunately, there is currently only a limited number of resources providing formal training on preventive maintenance. This problem must be corrected, as education on pavement preservation is needed at all levels. Policymakers, field personnel, engineers and taxpayers all affect road maintenance decisions, so all must learn about the advantages of pavement preservation. One aim of this course is to improve the current state of pavement preservation knowledge.

The course "Guidelines on the Use of Microsurfacing," MNT 705, provides guidelines on the use of microsurfacing. So how does microsurfacing work? Microsurfacing preserves structural capacity, decreases pavement permeability, and provides surface friction. It can also be used with some success in correcting moderate flushing and bleeding. As for the sealing capability of microsurfacing, it has a similar permeability to fine-graded HMAC, but is less permeable than a Type C. Permeability associated with constructed density is not a factor for microsufacing as in HMAC.

The general pavement selection guidelines are as follows: pavement should be structurally sound and suitable for future traffic throughout the expected life of the surfacing. The structural adequacy can be verified with a Falling Weight Deflectometer. Deflections should be less than 30 mils. Transverse cracks should be sealed. Localized areas of fatigue cracks should be repaired prior to placement of microsurfacing.

Use of microsurfacing as a surface treatment reduces deterioration caused by weathering, raveling, and oxidation. Microsurfacing provides good skid resistance, reduces entry of air or water into pavement, and seals small, nonworking cracks. Some other characteristics include minimization in loss of curb weight, reduction in rock loss/windshield breakage, and an increase in visibility of the pavement surface at night.

Microsurfacing should be used instead of seal coats at approaches to major intersections, on urban arterials and interstate pavements with an asphalt surface, and on other high traffic asphalt surface pavements. When traffic volumes are too high and there are too many turning and stopping movements for seal coats, microsurfacing is a better option. On low volume and FM roadways microsurfacing should be used to create a uniform surface when multiple seal coats or patching have resulted in a nonuniform surface making it difficult to construct good seal coat.

High Traffic Roadway after Microsurfacing Application

When applied, material thickness should be slightly greater than the maximum size of mixture aggregate. The amount of material needed depends on surface condition. For badly raveled or coarse and open surfaces, more material is needed than for nearly smooth or almost flushed surfaces. Typical application rates are 20-30 lbs per square yard. If existing texture is nonuniform, the surface of the microsurfacing will be nonuniform, so a scratch coat will be needed.

Microsurfacing should not be used to add structure, fill deep ruts, stop reflection cracking, and correct excessive longitudinal roughness problems. Treating fatigue or alligator-cracked pavements with microsurfacing is also not appropriate. Microsurfacing can be used as rut filler when some requirements are met. Pavement is structurally sound for the future traffic over the expected life of the microsurfacing. The ruts were caused by mechanical compaction of the pavement structure. Use microsurfacing when ruts are flat, not sharp, or showing dual wheel marks and when ruts are indentations only, not an indentation between upward heaves. For rut depth of greater than half an inch, a special rut filling spreader box (rut box) should be used to fill the ruts before final surface is placed; for depth of less than ½ inch, full-width scratch coat pass should be used to level the surface before the final surface is placed. For depths greater than 1 inch, use multiple placements of microsurfacing using the rut box to fill the rut.

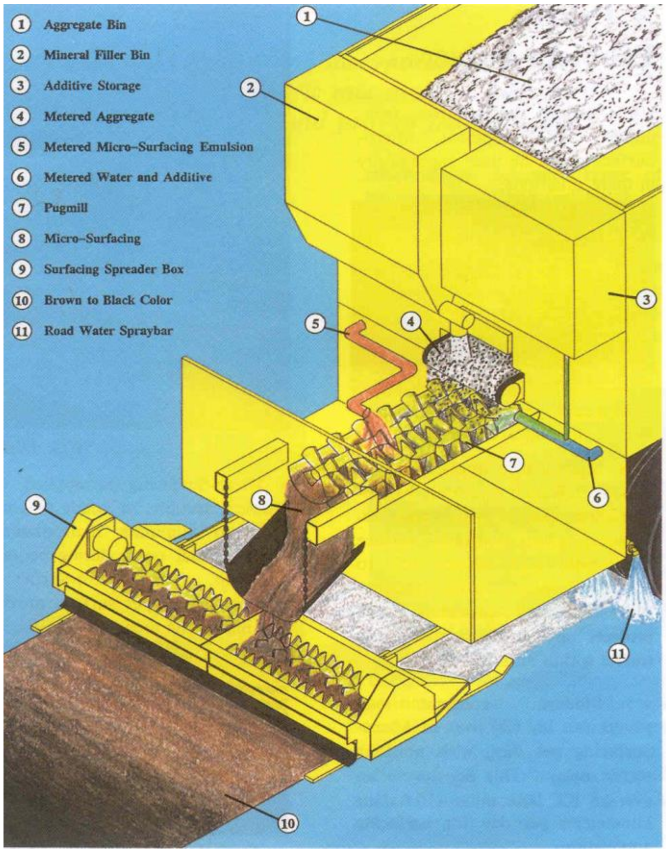
Rutting Addressable with Microsurfacing

Cape Seal Guidelines

Either emulsions or hot AC is acceptable for seal coat binder. Polymer modified binders are recommended. Seal coat aggregate should be clean, precoated for hot AC and non-precoated for emulsion. Grades 3, 4, and 5 are acceptable, and grades 3 and 4 are recommended. More binder should be used for sealing cracks. Grade 5 is very sensitive to asphalt application rate.

Seal coat should be exposed to traffic from 2 to 7 days prior to application of microsurfacing. Any problems, which occur in the seal coat, must be repaired prior to microsurfacing. Seal coat aggregate must have adequate embedment. In areas where possibility of freezing exists, the cape seal should be applied after a good period of dry weather. Cape seals should be used in situations where the benefits of both seal coating and microsurfacing are sought. A seal coat will provide a smooth, quiet ride.

MNT 706: Best Practices of Miscrosurfacing



Microsurfacing Diagram

"Best Practices of Microsurfacing" is a course that is intended to provide guidelines for planning, design and construction of microsurfacing. More specifically, this course covers the following topics: the components of microsurfacing, how microsurfacing works as a surface treatment, guidelines for quality assurance and possible problems that may occur. The course is organized in three chapters, starting with an introduction to microsurfacing. Chapter 2 deals with the guidelines for quality assurance, while the last chapter gives an overview on the possible problems in microsurfacing application. The first chapter covers the same material as the first chapter in MNT 705 course, Guidelines on the Use of Microsurfacing; therefore the summary of this course will begin with the second chapter.

Chapter 2 – Guidelines

This chapter provides direction for the checks and tests that are necessary during microsurfacing application. It explains the laboratory tests for quality assurance before and during microsurfacing construction. It also shows the checks to be conducted by TxDOT inspectors throughout the process, as well as how to apply the field observation checklists.

As mentioned above, the performed tests may be classified as ones performed before construction or during the process. The pre-construction tests are mostly related to material acceptance tests, which include tests for polymer-modified emulsified asphalt concrete, aggregate, mineral filler, water used, or other additives. The aggregate must undergo several testing procedures in order to be suitable for the final application mixture. These aggregate testing requirements include:

1. Sand equivalent - which is used to determine the relative proportion of detrimental fine dust or clay-like particles in soils or fine aggregates. It is performed on the gradation to be used on the project. More details about the procedure, apparatus to be used and calculations can be found under TxDOT designation TEX-203-F.

2. Soundness of aggregate - using sodium sulfate or magnesium sulfate is a testing procedure to measure the aggregate resistance to disintegration. It shows the maximum weight loss when subjected to five cycles of conditioning using magnesium sulfate solution. TxDOT Designation: Tex-411-A

3. Accelerated Polish Test for Coarse Aggregate is performed on the parent rock to estimate the relative wear of coarse aggregate. TxDOT Designation: Tex-438-A.

4. Washed sieve analysis gradation requirements - Part II of TxDOT designation Tex-200-F. It is used to determine a weight-based sieve analysis for an aggregate sample, requiring a washed sieve analysis.

Aggregate Comparison at TxDOT

Besides the materials, the mixture itself must meet the design testing requirements before application. These tests include:

1. Mixing time test – determines the minimum water content that gives 120 seconds mix time. The specified 120 seconds mix time is to ensure adequate time to mix and place the slurry.

2. Modified cup flow test – used to measure the water content where separation of fluids and solids occur on a 15° inclined plane and to select the optimum water content.

3. Wet cohesion test – used to select the percent of Portland cement for a given micro-surfacing system.

4. Wet track abrasion test – determines the minimum asphalt content for a given micro-surfacing system.

During construction, materials tests include: polymer-modified emulsified asphalt concrete, aggregate tests, mineral cap filter, water, and additives. Besides the material tests, there are mixture composition and tolerance tests conducted on samples of the microsurfacing mixture taken from the microsurfacing application machine.

Field Observation Checklist

A number of checklists have been developed from different DOTs in trying to help engineers and workers during the process. The materials needed for the quality checks are: ruler or measuring tape capable of measuring to nearest 1/16 inch, a 4ft straightedge, string-line 100 ft. or longer, and 100 ft. measuring tape or measuring wheel.

Microsurfacing Handwork

The first checklist is related to weather limitations which, as the name implies, consists in making sure that the weather conditions are appropriate for microsurfacing. By checking the minimum and maximum temperature and raining situation it is made sure that the optimal condition is met. Microsurfacing should not be applied in cases where the air temperature is below 50°F, or when freezing temperatures are expected in the range of 24 hours. Humidity is another parameter which needs to be checked. If humidity exceeds 80% it might influence the quality of the process. Similar checklists exist about surface preparation, surface marks and loss, handwork, joints, ruts and edges. These checklists serve as guidelines through the project, making sure that every specification requirement is taken into account. Opening to traffic is another issue asking for attention. A set of tests might be applied to the treated pavement in order to asses if it is ready for traffic flow. The stick test is a simple and common test in these situations where you draw a stick through the mixture and attempt to repair the resulting tear by smoothing it back with the stick. If the tear can be repaired, it means that the emulsion has not been broken, otherwise it has.

Chapter 3 – Possible Problems

In In this chapter there are explained problems that arise during microsurfacing application and explains how to determine corrective actions for these issues. If the existing pavement is in relatively good condition, the treatment by microsurfacing might result in a 7 to 10 years life extension. Although on average, the life expectancy of a microsurfacing treatment is 5 to 7 years.

The main mechanism of microsurfacing failure is wear as the surface oxidizes and abrades over time. Workmanship and pavement conditions at the time of microsurfacing application affect its overall performance. In this context, surface preparation should be carried out carefully in order to assure the quality of the whole process. The purpose of surface preparation is to furnish a clean and sound surface on which the new microsurfacing is installed and to which it will bond. It may also include crack sealing and even patching, if necessary. Before microsurfacing, the road needs to be swept clean of any foreign material. In case remaining contaminants are present before microsurfacing is applied, it may lead to delamination of the treatment in the contaminated areas. Road markings should also be removed or abraded to produce a rough surface before microsurfacing

After microsurfacing is applied other problems might arise, such as emulsion braking too fast. It should be checked that the finished microsurfacing has a uniform texture free of excessive scratch marks, tears, or other surface irregularities. Scratch marks and tears might result from the usage of oversized aggregate in the mixture, placing the material in too thin overlays, or not using enough additives. Another problem of finished surface is the way joints at different parts of application meet each other. Anytime, the transverse and longitudinal joints need to appear neat and uniform. No gaps should be allowed between applications. The main causes leading to these problems are related to workmanship issues. Transverse joints need to be constructed using roofing felt, metal strips, or something similar, at the start of the placement pass. While in longitudinal joints, problems might result as the placement machine does not have driving controls on both sides of the equipment, for the operator to follow existing edge markings or string lines. Mostly this type of problem is due to poor planning of the application process from the contractor. At the end, before opening to traffic, weather conditions should always be checked as damages might result from early traffic.

Different procedures are present serving as post-construction treatments which can be used to achieve a better and more efficient last result. Some of these procedures include: rolling, sweeping and sanding. Rolling limits the amount of stone loss. It is carried out using a pneumatic roller. Sweeping should be done just prior to opening to traffic and at periods determined by the level of stone loss to avoid windshield damage. Finally, sanding may be used to reduce the times that cross streets or intersections are closed, thus opening sooner for traffic.