

# PAAMA GUIDANCE ON PAVEMENT PRESERVATION

## Who is PAAMA?

The Pennsylvania Association of Asphalt Material Applicators (PAAMA) is a trade association made up of contractors, asphalt / asphalt emulsion producers, suppliers and consulting engineers. Our contractor members specialize in road preservation and maintenance using liquid bituminous products, cold-mix asphalt, hot-mix asphalt and recycling and reclaiming processes.

We promote the continued usage of Cold In-Place Asphalt Recycling, Full Depth Reclamation, Soil Stabilization, Cold Mix Paving, Ultra-Thin Bonded Wearing Course, Micro-Surfacing, Slurry Seal, Bituminous Seal Coat (Chip Seal), Crack Seal, Fog Seal and application of Tack and Prime coats at state and municipal levels as well as in the private sector.

Most of our efforts involve the education of PennDOT and local agency officials, consulting engineers and the taxpayer on the benefits of our processes.

## Pavement Preservation

The short definition of Pavement Preservation (PP) is Using the **Right Treatment** on the **Right Road** at the **Right Time** to **Extend Pavement life**.

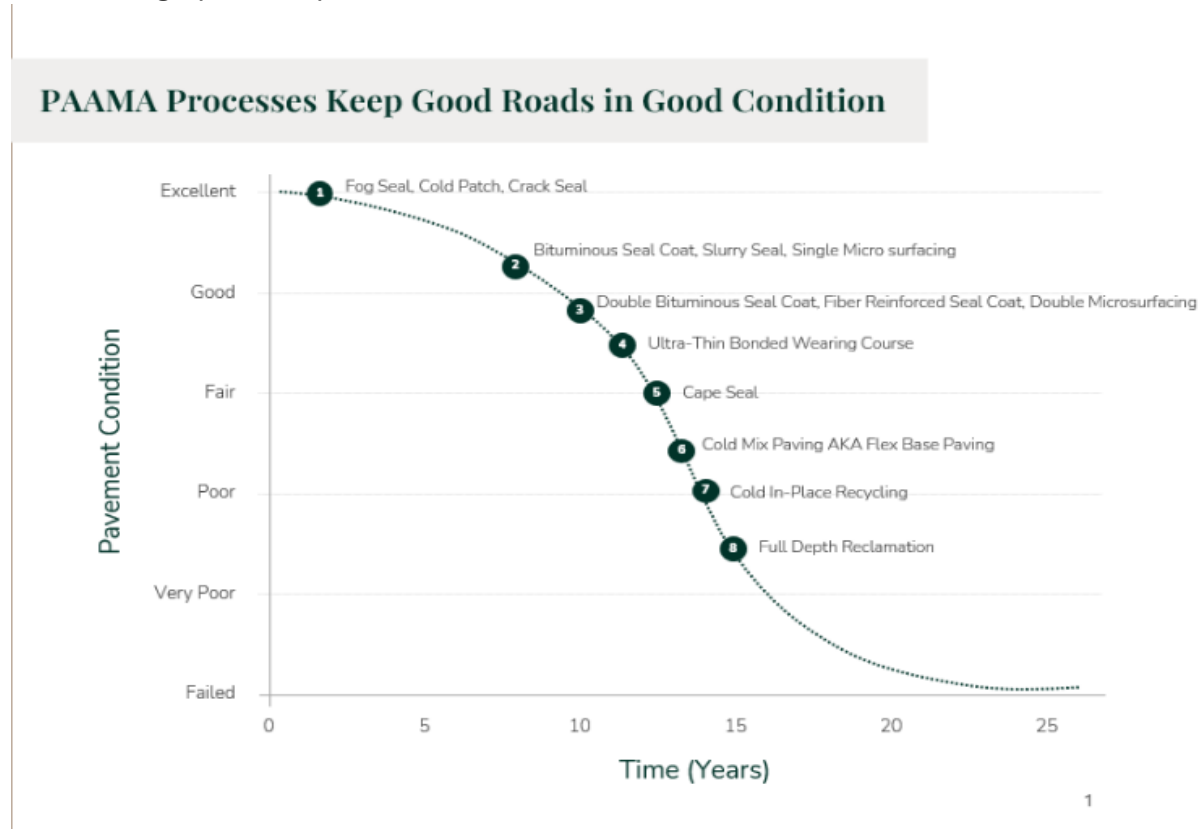
The long definition from Federal Highway (FHWA) is:

*“Programs and activities employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and improve motorist satisfaction while saving public tax dollars”.*

*The treatment must:*

- *Address pavements while they are still in good condition*
- *Reduce Aging*
- *Extend Pavement Life*
- *Restore Serviceability*

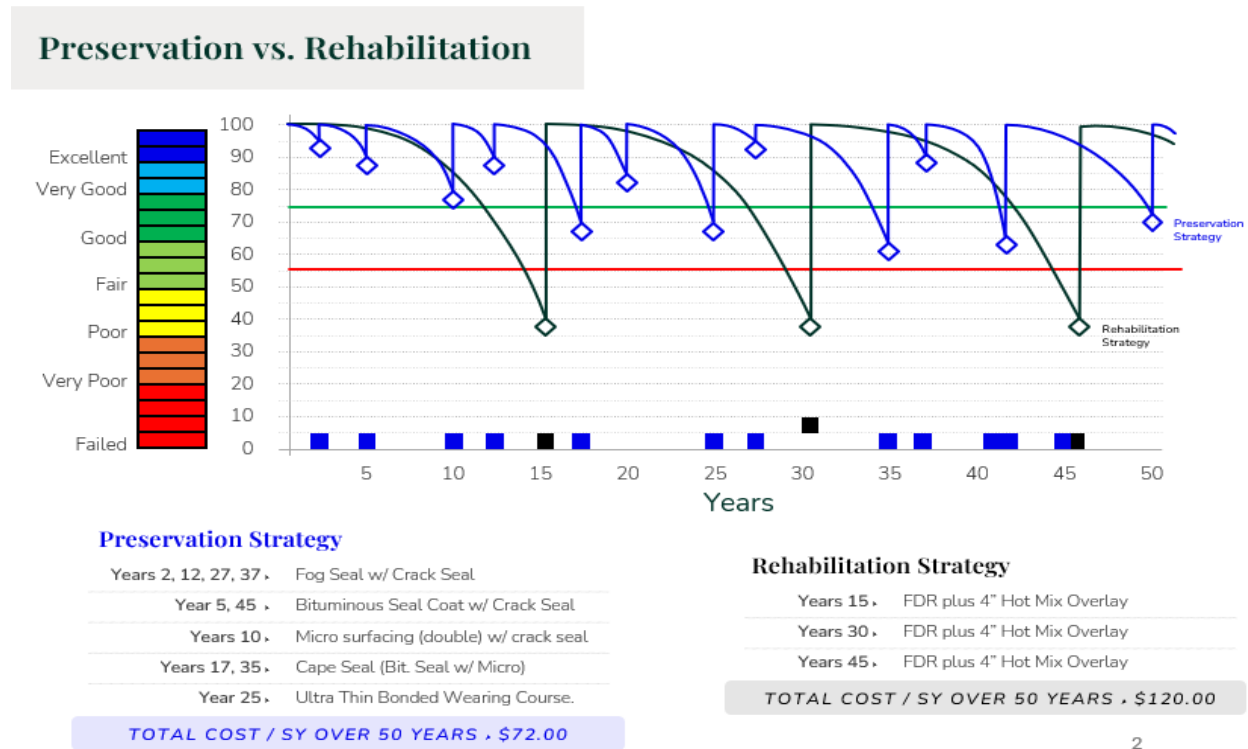
Below is a graphical representation of Pavement Preservation.



Preservation processes work best at the top of the deterioration curve. The goal is to use less expensive treatments to flatten the curve and extend pavement life by treating the surfacing and protecting the underlying layers of pavement. Oxidation of the asphalt cement is the main killer of asphalt pavements. Oxidation causes the asphalt to become brittle and hard. The first effects of oxidation are a loss of aggregate fines on the surface, as oxidation progresses the surface loses larger and larger particles which allow additional oxidation to travel deeper into the surface. At the same time, hardening asphalt can cause weather and / or fatigue cracking which allows moisture into the pavement and accelerates wear. As deterioration continues, the road requires heavier and more expensive treatments to correct surface distresses and if left untouched will require rehabilitation. Rehabilitation is anything that removes or reworks the sub-surface asphalt or base materials.

Traditionally, agencies used a “worst first” or rehabilitation strategy when dealing with their pavements. They did little or no preservation and allowed the pavement to completely deteriorate before spending a large percentage of their budget to fix the entire structure. This strategy used to work “OK” when our new asphalt pavements lasted 20 + years before requiring an overlay or other rehabilitation. Unfortunately, some of today’s asphalt pavements are only getting 10 to 12 years of life.

Here is a different deterioration curve that overlays the Preservation Strategy over a Rehabilitation or Worst First Strategy.



The two main takeaways from this graph are cost and driver satisfaction. The preservation strategy saves about 40% over the life of the pavement. The green line signifies a “Good” pavement, one that taxpayers like to drive on. The red line signifies a “Poor” pavement. We call the red line the complaint line. Notice how often the rehabilitation strategy forces the pavement below the complaint line.

### Comparison of Preservation and Preservation Maintenance

PAAMA encourages road managers to use a combination of Preservation and Preservation Maintenance. The basic difference between the two is that preservation should be applied as a preventative measure before any surface deterioration is visible. Preservation maintenance is applied to pavements that show some surface deterioration and are used to correct / mitigate the deterioration and protect the surface from further deterioration. Many PAAMA processes are effective at both preservation and preservation maintenance.

While PAAMA processes are mostly aimed at asphalt pavements, it is important for road managers to understand that concrete pavements also require preservation and preservation maintenance.

## **Preservation of Asphalt Pavements**

The goal of any asphalt preservation treatment is to prevent surface damage due to oxidation and weathering. Oxidation in asphalt is primarily caused by exposure to oxygen, ultraviolet (UV) radiation from the sun, and heat. Moisture infiltration accelerates the damage by carrying oxygen deeper into the asphalt layers while also increasing damage due to freeze/thaw cycles. The consequences of asphalt oxidation include increased stiffness, and reduced flexibility. Over time, these changes can lead to the development of cracks, raveling, and other forms of pavement distress.

### **Preservation Processes**

Starting at the top of the curve and working down; less expensive to more expensive.

**Rejuvenators** – A rejuvenator is designed to slow or lessen the effects of oxidation. Some rejuvenators make the top layer of asphalt more flexible and can replace chemical components which are lost due to oxidation. A rejuvenator would be placed very early in the life of the pavement, somewhere between 0 and 3 years, and can be repeated at around 3-year intervals. Rejuvenators are spray applied, usually from an asphalt distributor.



**Fog Seal** – another spray applied product. A fog seal is an asphalt emulsion that is sprayed on the surface of the road to act as a sacrificial layer that protects the asphalt cement in the mix from oxidation. Unlike rejuvenators, Fog Seal does not change the surface or replace chemicals, it only protects. Think of it as house paint. Drivers love the dark black color. Note: people get concerned when a fog seal starts to lose its color and wear off the top of the rock. Remember, these treatments are there to protect the asphalt cement in the mix, not the rock.



**Rejuvenating Fog Seal** – this is a combination of the top two products. It is an asphalt emulsion that is blended with a rejuvenator. The term normally used is PMRE or Polymer Modified Rejuvenating Emulsion. PMRE gives the road a rich black color, protects from further oxidation and adds chemical fractions back into the surface.

**Bituminous Seal Coats (Chip Seal)**– are the workhorse of Pavement Preservation. It involves spraying a thin film of either asphalt emulsion or asphalt cement onto the road surface and then immediately covering it with a clean, hard cubicle shaped aggregate chip. A chip seal does many things; it seals the road from oxidation and moisture, fills and seals minor cracks, provides a skid resistant driving surface and also



can be used as an interlayer before a HMA overlay or Micro surfacing. Crushed recycled asphalt (RAP) can also be used as the aggregate source on low volume roads.



**Slurry Seal / Micro surfacing (Slurry Surfacing)**– a mixture of fine aggregate, asphalt emulsion, water and other additives is designed to be a thin asphalt seal placed to prevent moisture intrusion and oxidation while providing a skid resistant surface. The materials are hauled, mixed and spread with a specially designed paver. A single lift Slurry Surfacing, either Slurry Seal or Micro surfacing can be used as a preservation treatment, especially in areas where a Bituminous Seal Coat may not be the best choice. Each of these processes are designed to protect the pavement from oxidation while providing a safe, skid resistant surface. They should be placed early in the life of the pavement before deterioration is visible.

## **Preservation Maintenance**

The goal of a preservation maintenance treatment is to repair surface damage **and** protect the asphalt pavement from oxidation and moisture intrusion. While true preservation is time based, preservation maintenance is time and condition based. The process should be applied as early as possible when defects occur. This early application will increase service life by slowing oxidation and repairing the surface defects thus saving money.

As the surface deterioration increases and ride quality decreases, preservation treatments tend to become more aggressive and more expensive.

## **Preservation Maintenance Processes**

**Crack Treatments** – Whether as a standalone application or combined with other preservation treatments, crack treatments are proven to extend the life of asphalt pavements. These treatments have two main purposes: 1) keep water from entering the base and sub-base, 2) Keep debris or incompressible material out of the crack, as cracks move together in warmer temperatures. This debris will cause damage and produce potholes.



Recent data from the National Center for Asphalt Technology (NCAT) Preservation study is proving that some form of crack treatment offers significant life extension benefits to asphalt pavements. In addition, preservation surface treatments last longer and perform better when preceded by crack treatments. A copy of the NCAT study by Dr. Adriana Vargas can be found at this link - <https://doi.org/10.1177/0361198120902703> . PAAMA recommends that



cracks over 1/8” wide be treated with some sort of crack treatment prior to the application of any surface treatment.

Crack treatments include crack sealing / filling for smaller cracks less than 1.5” in width and Mastic fillers for cracks and deterioration greater than 1.5” in width.

**Bituminous Seal Coat (Chip Seal)** – This versatile process can be modified to handle higher distress levels. Modifications can include specifying double applications, applying scrub seals or Fiber Mat as a mass crack filler and the use of hot-applied asphalt.



**Micro surfacing** – As with Chip Seal, Micro surfacing can be designed to handle higher distress levels. Multiple lifts can be specified to level transverse rutting, fiber and/or highly modified (Hi-MA) emulsions can be used to increase toughness and resistance to cracking.

**Ultra-Thin Bonded Wearing Courses** - Ultra-Thin Bonded Wearing Course (UTBWC) is designed for use as a high-performance ultra-thin overlay which seals the existing road surface and provides a skid-resistant, smooth, and thin (3/4 inch) gap graded hot mix asphalt wearing course in a single operation. This Pavement Preservation treatment is ideal for structurally sound asphalt or concrete pavements which are exhibiting signs of surface



oxidation, raveling, cracking, or minor rutting.

Pavement Condition A, B or C (PCI 65 or greater)

UTBWC provides the sealing qualities of a Bituminous Seal Coat with the leveling and advantages of a thin hot mix overlay with a lower cost and environmental impact of a mill and overlay.

**Cape Seals and Combination Treatments** – Preservation treatments can be combined to enhance the preservation value and extend the life of the pavement even further. A common combination treatment is a Cape Seal. A Cape Seal combines a Bituminous Chip Seal (standard, scrub seal or fiber mat) with a Micro surfacing course on the top. This combination of processes gives the crack filling and waterproofing of the seal coat with “new” asphalt look and feel of Micro surfacing.



## **Benefits of Early Application of Preservation Treatments**

New research studies are proving that preservation treatments do the best when placed early in the life of the pavement.

The Minnesota Department of and the Asphalt Institute have completed or are in the process of completing studies on the effectiveness of early preservation applications. For these studies, early means within 3 months to 3 years of initial application of the asphalt surface.

MnROAD - [Early Preventive Maintenance Extends Asphalt Pavement Life | MnDOT Digital Library](#)

Asphalt Institute - [Early preventative maintenance extends asphalt pavement life - Asphalt magazine](#)

Each study looked at the benefits of applying a Chip Seal to a newer section of HMA paving to determine if early application delayed aging and cracking as compared to application on older pavements. Early results from the Asphalt Institute conclude; “early sealing of the pavement appears to greatly slow the rate of hardening of the binder in the mix”.

Wyoming and Montana DOT’s routinely Chip Seal new HMA pavements within the first year and often prior to final striping. Unfortunately, there doesn’t appear to be any research confirming the effectiveness of this early application of Chip Seal, but the practice has been ongoing for several years.

## **Benefits of Preservation and Preservation Maintenance**

There are many studies and articles that endorse the use of pavement preservation and preservation maintenance, however, none prove it more effectively than the ongoing NCAT Preservation Group Study (PG)- [Pavement Preservation \(auburn.edu\)](#) . This long-term (10+ year) study with research sections in Alabama and Minnesota proves the life extending benefits on many commonly used preservation treatments.

## **PAAMA Recommendations**

One of the main takeaways from the PG Study is that preservation treatments placed on “Good” roads last significantly longer than if a department waits until a pavement drops into the fair or poor category. This matches the Right Treatment, Right Road, Right Time mantra from FHWA.

For pavement preservation to be most effective, a preservation treatment should be applied before a pavement reaches 30 months of age. The exact time and process to be used would be chosen based on traffic counts, local climate and the amount of recycled asphalt (RAP) used in the HMA mix. fog seals, rejuvenating fog seals and bituminous seal coat would be the recommended processes for most pavements with Micro surfacing being recommended on high traffic sections.

A second preservation or preservation maintenance treatment should be scheduled within 60 months of the initial preservation treatment. As above, the exact time and process would be chosen based on existing conditions. Crack Treatments, Bituminous seal coat, Micro surfacing and Ultra-Thin Bonded Wearing Courses would be the available processes.

Note, it is important that the agency doesn’t wait for 60 months and then think about preservation. The plan should be in place and the money should be budgeted so that the chosen process can be applied prior to the 60-month timeline to ensure that the treatment is placed on a “Good” pavement. This cycle would then be repeated until the pavement condition requires recycling or other rehabilitation.

PAAMA would like to partner with Pennsylvania agencies to develop a full Pavement Preservation Programs based on these suggestions that is backed up with research and accurate Remaining Service Life and Life-Cycle Cost calculations.

PAAMA also promotes processes such as pavement recycling, full depth reclamation and cold-mix asphalt overlays that are designed to be used on pavements that are further down the deterioration curve. These rehabilitation treatments will be addressed in a separate document.

To learn more, please visit [www.PAAMA.org](http://www.PAAMA.org) and [www.RoadResource.org](http://www.RoadResource.org) .

You may also contact PAAMA at [director@paama.org](mailto:director@paama.org) for additional information.