



Pavement Preservation – The Key to Achieving a 50-Year Lifecycle

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Introduction:

The Michigan Road Preservation Association is the voice of the preventive maintenance industry in Michigan. We are dedicated to promoting preventive maintenance concepts and educating users on the quality, safety features and effective uses of preventive maintenance practices.

In 1946, Professor Ben H. Petty of Purdue University observed, “just as soon as a road is built and opened to traffic, we are, from then on, faced with a continuing and increasing problem of maintenance.”

Seventy years later, as the Michigan Legislature calls on the Michigan Department of Transportation to build roads that last for 50 years, maintenance, and preventive maintenance in particular, continues to be the key to maintaining a roads serviceability.

Even when a road is constructed with a very costly 50-year design, preventive maintenance is the key to achieving the 50-year lifecycle. The Autobahn – the benchmark for road longevity – benefits from pavement preservation techniques. The same micro surfacing process used in Michigan today was tested and perfected on the Autobahn, adding a new wearing course to improve ride quality and extend pavement life on this iconic system.

All roads, from the Autobahn to the interstate and city streets, need preventive maintenance to remain serviceable. The use of the right treatments at the optimum time for a road’s condition is the most cost-effective way to achieve a 50-year lifecycle for Michigan roads.

Background – Asset Management and Pavement Condition:

In 2002, the Michigan Legislature made a commitment to preserving and extending the life of transportation assets. The Transportation Asset Management Council (TAMC) was created to advise the State Transportation Commission and promote pavement preservation to state and local governments.

This commitment to using preventive maintenance continues today. Armed with the knowledge that every \$1 spent to keep a road in good condition saves \$6 to \$14 as the road deteriorates to a more costly state of repair, MDOT and local agencies have struggled over the last decade to prioritize pavement preservation in tight budgets.

The *2014 TAMC Annual Report* found that one of every three miles of pavement on the federal-aid eligible road network is in poor condition. The 2014 ratings showed a 5 percent increase in “poor” roads – the largest single-year increase in poor roads in the last seven years and the second largest increase since TAMC began collecting data in 2006.



The non-federal aid eligible road system is in an even more abysmal condition. The 2014 TAMC data revealed that 49 percent are in poor condition and just 10 percent are in good condition.

PASER ratings submitted from 2011 to 2014 revealed that 23 percent of lane miles deteriorated while less than 14 percent improved over the 4-year period. TAMC concluded that, “the longer we postpone increased levels of investment, the longer it will take for the public to begin to see any appreciable improvement in the condition of Michigan’s roads and bridges.”

When residents and business owners demand better roads, they are looking for roads that see them about their daily

lives without bone-jarring potholes. They rarely understand if this is a newly constructed road or just a new wearing course. Preventive maintenance treatments allow the public to see visible improvements in serviceability and ride quality throughout the lifecycle of the road.

As new revenue for roads becomes available, a continued focus on preventive maintenance to preserve our road assets will allow for visible improvements to the system in the most cost-effective manner.

Innovation – Comprehensive Implementation of Pavement Preservation:

Applying the Right Fix...At the Right Time...In the Right Place

While many of the treatments used by the pavement preservation industry are not in themselves innovative, the implementation of a comprehensive pavement preservation strategy, system wide, is both an innovation and an efficiency.

Despite everything we know about the importance of pavement preservation, the ability for MDOT or local governments to fully implement preventive maintenance strategies for ALL roads has been as elusive as building roads that last for 50 to 100 years.

Why when we’ve known how cost-effective asset management can be? The answer is simple. There haven’t been enough financial resources at the state or local level for agencies to apply the right fix, at the right time, in the right place, to every mile of road needing attention.

In order to provide the highest quality transportation network for economic benefit and improved quality of life, road agencies are forced to make difficult decisions to balance available resources with the needs of the system.

When faced with a decision of rehabilitating or reconstructing a road vital to a business or community; patching potholes to keep roads safe and passable; and sealing the cracks in good roads or resurfacing a fair road, limited funds often go to “worst first” priorities.

In addition, some preventive maintenance treatments have been used in alternative ways in recent years – serving as Band aids – holding a road together until funds are available to make a more appropriate and longer-lasting repair.

If a road is properly built with appropriate drainage, environmental and geological specifications, and pavement preservation is properly implemented on the road from the time it is built, the road can maintain serviceability for 50 years!

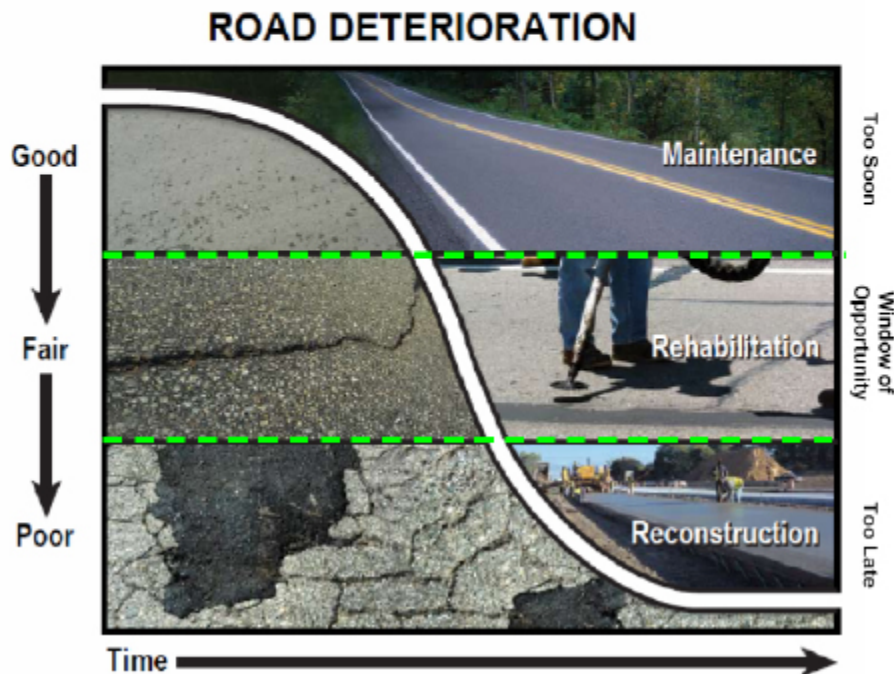
The Window of Opportunity:

Asset management in Michigan uses a system known as PASER to rate all roads as good (8-10), fair (5-7) or poor (1-4). Based on the PASER (condition) rating of the road, the average daily traffic volumes and other factors, a mix of fixes is applied along the deterioration curve.

The illustration below, from the 2012 TAMC Annual Report, demonstrates the window of opportunity when applications work best to keep a road in good, fair or poor condition. Specific treatments are recommended at various points along the deterioration curve.

“Window of Opportunity”

Figure 3 below illustrates the concept in which certain types of treatments are more feasible to use than others. The curved line show how a pavement deteriorates over time. There are certain points along the curve where different types of work activities no longer are feasible. These points define the “window of opportunity.”



Keeping Good Roads Good:

A brand new road will receive a rating of 10, but as a road experiences exposure to sunlight, traffic, and routine maintenance such as salt applications and snow plowing, it will eventually start to show signs of cracking and distress.

The first application along the curve, and perhaps the most important to achieving maximum lifecycle, is to prevent water from seeping into the pavement where it can do additional damage.

Crack Sealing is the first treatment along the curve. It prevents water from damaging the base and subbase. Unsealed cracks can allow sand, stones, dirt and other substances to enter the crack in the pavement, weakening the pavement and further enhancing the chance for heaving, creation of additional distress cracking (alligator or crocodile cracks), development of potholes and more. Cracks that are sealed are typically less than $\frac{3}{4}$ inches wide.

Overband Crack Sealing is the placement of asphalt cement and fibers into and above working cracks and results in a strong yet flexible seal that bonds well to the crack walls, sealing out water and other substances.

Routing with Overband Crack Sealing involves making cuts along the crack to create uniform and smooth edges. This allows the sealant to adhere better to the walls of the crack and allows for better expansion during the freeze/thaw cycle. This is a definite benefit in Michigan's southern regions which experience several weeks of consistent freeze thaw pattern. A routed crack typically lasts twice as long as a crack that is just cleaned and sealed.

Fog Seals are currently used by MDOT in conjunction with chip seals as an "overcoat" to aid in stone retention. Fog seals are a thin application of a diluted asphalt emulsion. They can be a cost effective stand-alone treatment very early in a pavements life as well.

Many states are using a form of fog seal on newly cut corrugations to help combat their early deterioration which are often times in the longitudinal cold joint. Other states have also found benefit in using fog seals to treat HMA shoulders as a low cost treatment to preserve the less travelled shoulder. When used as stand-alone treatments, they should be used much higher on the deterioration curve to get the most benefit, anywhere from a new construction (10) or good pavements down to a 7.

As a Road Begins to Age – Treatments for Fair Roads:

Micro Surfacing is a "***Polymer-Modified Cold-Mix Paving System.***" When applied on the right road at the right time, micro surfacing is one of the most cost-effective means of preserving long life pavements as well as restoring their surface properties. Used primarily to extend pavement service life, micro surfacing also provides a safe, durable and skid-resistant surface compared to similar overlay methodologies. This product is currently available in MDOT's Capital Preventive Maintenance Program and is routinely contracted as a warranty project. This product was originally developed in Germany to restore the surface properties on the Autobahn. The German road authority needed a very thin, environmentally friendly means of sealing, restoring skid properties and addressing the rutting on their long life pavements. Raschig AG developed the process for the German Autobahns and the product spread around the world from there.

In some cases micro surfacing is being used in Michigan to preserve a good pavement but in other instances it is being used simply to extend the life of a marginal pavement. As Michigan leans towards longer-life pavement designs micro surfacing will be instrumental in preserving these assets. To secure maximum effect, it should be applied to pavements with conditions in the 7 to 8.5 range.

Chip Seals are the most commonly used surface treatment by both state and local agencies on Hot Mix Asphalt (HMA) roads. This product is a part of MDOT's Capital Preventive Maintenance program and is routinely contracted as a warranty project. It is the application of an emulsified asphalt binder followed by the application of a fractured cover aggregate. The asphalt emulsion acts as a sealant to not only repel water but to also preserve the qualities of the original asphalt in the HMA road surface. The aggregate provides a skid resistant wearing course.

With part of the intent of the process being to preserve the good qualities of the HMA, it is important to utilize this treatment while the qualities of the HMA are still in good to fair condition. The benefits of the treatment are greatly increased the higher the pavement is on the deterioration curve when placed (6 to 8 on the PASER scale). Though designed to be a preventive measure, limited finances have stretched what chip seal was intended to do to act as "Band-Aid" on questionable pavements where service life has greatly diminished.

Double Chip Seals are effective when there is excess cracking. The process can be used locally, full width, or isolated to wheel paths or shoulders only (**Bar Seals**).

Cape Seal is the practice of following a layer of chip seal with a micro surface. Cape seals maximize the positive aspects of chip seal and micro surface treatments by applying them together. A cape seal is typically applied when the deterioration is greater than what slurry or micro seal is designed to correct, but before the pavement requires an expensive asphalt overlay. Used with crack sealing and surface patching, the chip seal layer prevents water from seeping into the road bed and the micro surface provides a new wearing course. Cape seal is one of the most economical treatments for addressing fair to moderately cracked pavements, while providing a smooth, dense surface, one having good skid resistance and long service life.

Increasing Serviceability of Fair to Poor Roads:

The **Scrub Seal** system is a one-step crack-filling, sealing and rejuvenating application for moderate to severely distressed asphalt surfaces. Scrub seal consists of spraying a designed quantity of emulsion on the roadway in conjunction with a mechanized scrub broom that forces the emulsion in the cracks. It is immediately followed by an aggregate chip spreader which applies an even layer of single size cover aggregate over the emulsion. The aggregate is then rolled into the emulsion to achieve sufficient bonding and embedment, then the surface is swept to remove excess aggregate.

Scrub seal is similar to a chip seal but the thicker, highly polymerized emulsion makes it an ideal treatment on a road that is already showing signs of cracking, raveling, "alligatoring" or more severe surface deterioration. This treatment has resulted in 5-10 year increases in the lifecycle of a road, without having to seal the cracks prior to application and is effective in mitigating reflective cracking. The addition of a fog seal gives the appearance to the motoring

public of a new road. It is highly effective as a “Stress-Absorbing Membrane Interlayer (SAMI) for any type of surface treatments such as micro surfacing, slurry or thin-lift overlays.

Additional Innovative Products and Techniques:

Fiberized Bituminous Membrane Interlayer consists of a combination of polymer-modified asphalt emulsion, chopped **fiberglass strands** and quality crushed aggregate. For the same reason fiberglass is specified in today’s concrete and asphalt mixes, the realized benefit of the fiberglass is the superior tensile strength which absorbs and bridges pavement distresses, as well as helping to reduce reflective cracking. It is a pavement preservation technique which produces sufficient tensile strength and flexibility to absorb movements in the pavement structure and can delay the pavement cracking.

This product is in MDOT’s Emerging Technology Treatment program and has been applied on at least 13 department projects. Most notably in the Superior Region on I-75. The product is applied over existing pavements prior to asphalt overlays to provide a crack relief layer and to provide a superior bonding layer so the new overlay does not de-bond from the existing pavement. The product was developed by Colas SA for use on French roadways and was brought to the US market in the last 10 years. Ideally the fiberized interlayer would fall somewhere between 5 and 7.5 under asphalt overlays and 6.5 to 7.5 under micro surfacing.

Conclusion:

Since the State of Michigan first made a commitment to adopting asset management and promoting preventive maintenance strategies, the road funding picture has tied the hands of officials to fully implement their pavement preservation plans.

State and local agencies have made the best decisions possible with available revenues to preserve the system. When exploring a perfect world scenario of what it takes to make a road last for 50 years, it’s important to realize that many of our roads are already at 50 or more years in their life cycle. Creative use of preventive maintenance techniques have held the system together with Band-Aid approaches.

Depending on the treatment, preventive maintenance improvements typically last 5 to 10 years. A quality built and designed road, with appropriate environmental drainage and geological considerations, along with the proper use of pavement preservation methods will result in long-lasting, safe and reliable roads for Michigan residents.

The use of the right preventive maintenance treatments at the optimum time for a road’s condition is THE most cost-effective way to achieve a 50-year lifecycle for Michigan roads!

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