CHAPTER 6 – OTHER PAVEMENT PRESERVATION TECHNIQUES - LOCAL GOVERNMENT FOCUSED

Introduction

This section summarizes other pavement preservation treatments used by local governments. The summaries will be followed by brief descriptions of best construction practices and pictures. The costs in the summaries section are approximate ranges and were gathered from surveying local agencies and vetted during Technical Assistance Panel meetings.

Identifying Feasible Preservation Treatments

As noted in Chapter 3, the treatment strategy for those pavement sections identified as candidates for pavement preservation can be determined by looking at the type and severity of pavement distresses present on the pavement. Guidelines for determining recommended and feasible treatments are provided in Figure 6.00 below.

Figure 6.00: Treatment Selection Guidelines for Flexible Pavements
600 – Rejuvenators
(Spray application for pavement preservation, does not include rejuvenators added at plant)

“Rejuvenators are products designed to restore original properties to aged (oxidized) asphalt binders by restoring the original ratio of asphaltenes to maltenes” (Pavement Interactive). Rejuvenators have potential to delay the loss of surface fines and reduce the formation of additional cracks. Rejuvenators are generally appropriate for low-volume, low-speed roads or parking lots.

Many rejuvenators are proprietary, making it difficult to offer a good generic description; rejuvenators can be categorized by their material source/manufacturing process:

<table>
<thead>
<tr>
<th>Type</th>
<th>Examples of Proprietary Product Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt based</td>
<td>CMS-1PF, ReGenX, RejuvaSeal</td>
</tr>
<tr>
<td>Maltene based (naphthenic petroleum)</td>
<td>Reclamite</td>
</tr>
<tr>
<td>Bio-based</td>
<td>Delta Mist, BioRestor, RePlay</td>
</tr>
</tbody>
</table>

The National Road Research Alliance (NRRA) has recently completed a detailed synthesis on spray on rejuvenators.

Specifications: MnDOT does not have a specification for rejuvenators. Agencies could use 2355 Bituminous Fog Seal modifying for applicable materials (2355.2) and follow manufacturer’s recommendations. The NRRA synthesis also includes a section on specifications.

Costs: $0.85-$2.00 per square yard

$5,984-7,040 per lane mile

This does not include mobilization, traffic control, and stripping.

Treatment Description: Since most rejuvenators are proprietary; products are unique to each manufacturer. Most rejuvenator products are low viscosity compared to emulsion fog seals, allowing them to penetrate further into pavement voids. They are typically applied at lower application rates to emulsion application rates. The following table is from NCAT:
Crew: A broom operator to prepare the surface, distributor operator, and traffic control as needed.

Pavement Conditions Addressed: This treatment is applicable for low-severity transverse cracking, low-severity longitudinal cracking, and low-severity raveling/weathering. RQI 3.0 to 4.0. ADT less than 2,500. An asphalt-based rejuvenator may be used on high volume roads with low speeds.

Construction Considerations: As per the NRRA Synthesis, rejuvenators must be applied only when the surface is dry. FAA Specification P632-4.2 states that the rejuvenation product must be applied when the weather forecast is in accordance with the manufacturer’s recommendations for application and curing. FPPC Specification states that the surface treatment shall not be applied when the temperature is less than 40˚ in the shade. When applying emulsions, the temperature of the surface shall be a minimum of 59˚F, and no more than 140˚F. Before choosing an application, consider asking the provider about re-application requirements (rates and frequencies).

Treatment Application Recommendations:

- The treatment may be used on higher traffic areas such as rural and urban highways and residential neighborhoods with ADT less than 2,500.
- Low severity cracking, longitudinal and transverse
- No-load related distresses
- RQI greater than 3.0-4.0

Alternatives to Rejuvenators: Fog Seal
Estimated Performance Period:

No research data specifically reporting rejuvenators’ performance period.

Local Agencies with Experience:

- City of Eagan
- City of Eden Prairie
- City of Hopkins
- City of Hutchinson
- City of Richfield
- City of St. Anthony
- City of Woodbury
- Beltrami County
- Chippewa County
- Dodge County
- Hennepin County
- Itasca County
- McLeod County
- Otter Tail County
**Step 1:** Surface is swept clean

**Step 2:** Rejuvenator is applied to pavement surface; spray application similar to fog seal. Rejuvenators that are not clear will need to be re-striped

**Step 3:** Some proprietary applications require a screening material applied and swept up 24 hours later

**Step 4:** Rejuvenators must be allowed to cure (typically 1-2 hours). Note curing includes both to prevent tracking and regain loss of friction from initial application.

*Figure 6.02: General Rejuvenator Construction Steps*
601 – Cape Seal

A cape seal is used to both seal the road surface from moisture intrusion and improve ride. It is a two-step roadway surface treatment consisting of a chip seal covered by a slurry seal or micro-surfacing treatment. Chip seals are sometimes less desirable by the public because of the rougher pavement surface texture and ride is not improved. With the addition of the top treatment (slurry/micro), the road ends up with a smoother surface.

Primary benefits of a cape seal include sealing of the road surface to prevent moisture intrusion, protecting the pavement from oxidation, preventing raveling, and filling wheel path ruts and cupped cracks. Additionally, cape seals improve ride and skid resistance.

Specifications:

Currently, MnDOT does not have an explicit specification for cape seal. However, there are specifications for:

- Seal Coat layer
  - 2356 Bituminous Seal Coat
    An additional resource is: MnDOT’s Seal Coat Design Program and Handbook
- Slurry seal/micro surfing layer:
  - MnDOT does not have a specification for slurry seals. An alternative source is the Recommended Performance Guideline For Emulsified Asphalt Slurry Seal (please note, these are guidelines, not specifications).
  - 2354 Micro Surfacing

ADA Considerations: Compliance with the Americans with Disabilities Act is required. Therefore, curb ramps will need to be brought to current standards of ADA requirements with the use of this type of treatment.

Costs: $4.60-$5.50 per square yard

$32,384-38,700 per lane mile

$4,628-5,531 per lane mile year

This does not include mobilization, traffic control, and stripping.
Treatment Description: (copied from Road Resource.org)

A cape seal is a process that includes placing a chip seal on the existing pavement surface. Then after a few days, a slurry seal or micro surfacing layer is placed on top of the chip seal.

To place the chip seal, an asphalt distributor provides application of the binder to the pavement surface. A chip spreader immediately applies a uniform, predetermined rate of aggregate onto the binder. These two operations are at the heart of constructing a surface that is one stone thick and has enough asphalt to retain the aggregate, but not an excess amount of binder that causes the surface to bleed. Depending on the binder, aggregate, and actual type of chip seal being constructed, various rollers will be used to orient the aggregate to achieve appropriate embedment. Pneumatic rollers are typically found on all chip seal projects. The rollers are followed by the brooms that remove excess aggregate from the finished surface.

Slurry seal consists of a carefully designed mixture of asphalt emulsion (which may be polymer-modified), mineral aggregate, water and additives; which are proportioned, mixed and uniformly spread over a properly prepared surface at a single stone thickness. Slurry seal is applied as a homogenous mat which adheres firmly to the prepared surface and has a skid-resistant texture throughout its service life. Slurry seal is a quick-traffic system that allows traffic to return shortly (from one to four hours) after placement.

Micro surfacing consists of a carefully designed mixture of polymer-modified asphalt, mineral aggregate, water and additives, proportioned, mixed and uniformly spread over a properly prepared surface which is typically greater than one stone thick. Micro surfacing is applied as a homogenous mat which adheres firmly to the prepared surface and has a skid-resistant texture throughout its service life. Micro surfacing is a quick-traffic system that allows traffic to return shortly (typically less than one hour) after placement.

Crew:

Chip Seal: An emulsion distributor operator, an operator for the chip spreader, 3-4 pneumatic tire roller operators, 3-4 broom operators, trucks as needed to bring aggregate to the project, and traffic control as needed. At the pit there will be a loader operator to load the trucks with chips.
**Slurry/Micro surfacing:** A broom and operator, 2 people on front of the continuous machine to hook the hose of the emulsion and water trucks to the machine. A slurry/micro surfacing continuous machine driver, a pug mill operator, 2 crew members on the back of the box, 1-2 people on the ground with a lute, 1 person adding the mineral filler at the top of the machine, a distributor truck operator for tack placement. Traffic control as necessary for the job.

**Pavement Conditions Addressed:** Although cape seals do not add structural capacity, it can provide benefits to pavement distresses including low-severity transverse cracking, low-severity longitudinal cracking, low-severity block cracking, and low and medium-severity raveling/weathering.

**Construction Considerations:**

For the chip seal, the surface must be clean and dry. Treatment should be placed during warm, dry weather. The chip spreader must be immediately behind the asphalt distributor, with the rollers closely behind the spreader. Pneumatic tire rollers should make a minimum of three passes immediately after chip placement. Typically, seal coats are placed from May 15 to August 10 in the northern part of the state and May 15 to August 31 in the southern portion of the state. The pavement and air temperatures must be 60°F and rising. Construct only in daylight hours. Roads may be damp, but there must be no standing water. Do not construct in rain or foggy weather.

Sweep all pavements the same day as application. Re-sweep the following day to remove all additional loose rock. A cape seal may be used when a slurry or Micro surfacing treatment alone will not address the pavement surface distresses adequately.

For the slurry/micro, the material shall be placed only when the air and pavement surface temperature is above 50°F (10°C) and rising. The weather also may not be foggy or rainy. No material shall be placed when there is a danger that the finishing product will freeze within 48 hours and shall not be placed after September 15.

For micro, a 1,000-foot nighttime test strip is to be completed prior to placement of the micro surfacing, no matter if the treatment is to be constructed in daytime hours. The test strip needs to be able to carry traffic within one hour of placement. Full production may begin after the test strip is approved by the Engineer.

**FHWA Construction Inspection Checklist:**

The [FHWA Cape Seal Pavement Preservation Checklist](#) provides a concise list of important components that go into a successful project.

**Treatment Application Recommendations:**

- The treatment may be used on higher traffic areas such as rural and urban highways and residential neighborhoods with ADT less than 2,500 to over 10,000.
• Rutting measured in less than 0.10 of one-mile section and is 0.5 inches or less in the left wheel path.

• Not a good crack seal or crack fill candidate (see Figures 4.01 and 4.02); prior to the application, larger cracks and potholes must be addressed.

• Little or no-load related distresses
  
  o less than 20’ of alligator cracking in 500’ section
  
  o less than 100’ high severity longitudinal cracking in 500’ section
  
  o less than 10’ high severity transverse cracks in 500’ section (crack spacing of 50’ or more)
  
  o less than 100’ of multiply cracking in a 500’ section

• RQI greater than 2.0

**Alternatives to Cape Seal:**

• UTBWC

• Thinlay

**Estimated Performance Period:** 6 to 8 years.
### Step 1. Prepare surface. Surface must be clean.
All structures (manholes, valve boxes, etc.) need to be protected prior to placement. Striping may be pre-treated (as shown here) with emulsion. Large pavement messages (turn arrows, RR Xing, etc.) should be removed.

### Steps 2 & 3. Emulsion and chip application.
The asphalt emulsion is applied to the surface with a distributor truck. Chips are spread from a self-propelled, pneumatic tired unit with a hopper on the front from which the chips are placed onto the roadway.

### Steps 4 & 5. Rolling and sweeping.
After the application of the aggregate, the surface is rolled with pneumatic tired rollers and swept to remove excess aggregate.

### Step 6. Prepare surface. Surface must be clean. All structures (manholes, valve boxes, etc.) need to be protected prior to placement.

### Step 7. Micro surfacing placement.
This photo shows the placement of material using a micro surfacing spreader box.

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**Figure 6.03: General Cape Seal Construction Steps**
602 – Scrub Seal

“A scrub seal is an application that is very similar to a chip seal treatment. The only difference is that the asphalt distributor pulls a broom sled that holds a series of brooms placed at different angles. These brooms guide or "scrub" the emulsion into cracks that ensure the road will be sealed”. (Road Resource.org)

A polymer modified rejuvenating emulsion (PMRE) used as a chip binder adds flexibility, toughness, and durability by restoring the asphaltenes and maltenes balance. This allows the process to be used on pavements further down on the deterioration curve where chips seals are normally applied. Scrub seals are similar to chip seal treatments. The main difference is the rejuvenating polymer modified asphalt emulsion is scrubbed into the road surface defects with a series of brooms or squeegees mounted to a trailer.

Specifications:

NRRA has a prototype Scrub Seal Supplemental Specification for agencies to use.

Costs: $1.41-$2.85 per square yard

$9,926-20,064 per lane mile

$1,527 -3,086 per lane mile year

This does not include mobilization, traffic control, and stripping.

Treatment Description: (copied from Road Resource.org)

A scrub seal is an application that is very similar to a chip seal treatment. The only difference is that the asphalt distributor pulls a broom sled that holds a series of brooms placed at different angles. These brooms guide or "scrub" the emulsion into cracks that ensure the road will be sealed.

The scrub seal is a process by which a unique polymer modified asphalt rejuvenating emulsion is applied to a pavement surface by an asphalt distributor. The emulsion is scrubbed into the cracks and voids with a broom sled before a layer of aggregate is applied over the asphalt. The scrub seal is then rolled with a pneumatic tire roller and is usually ready for controlled traffic in 1 hour or
The scrub seal process is intended to rejuvenate dry, oxidized, and cracked asphalt pavements in lieu of a microsurfacing, chip seal or asphalt overlay.

Scrub seals bridge the gap between when chip seals are no longer effective and performing a mill and fill asphalt overlay is too expensive for the current budget. The expectation is that by employing a simultaneous emulsion application and scrub method, one can eliminate mass cracking and improve the quality and durability of more highly distressed pavements.

Crew: A computerized asphalt distributor, variable nozzles, scrub broom sled, aggregate spreader, rollers, sweeping equipment (rotary brooms, pickup sweepers, vacuum sweepers), front end loader, haul truck.

Pavement Conditions Addressed: This treatment is applicable for low and medium-severity transverse cracking, low-severity longitudinal cracking, low-severity block cracking, and low and medium-severity raveling/weathering. RQI 3.0 to 4.0. ADT less than 2,500. Pavements with poor friction.

Construction Considerations:

The surface must be clean. Treatment should be placed during warm, dry weather. Immediately following application of the polymer modified bituminous rejuvenating emulsion binder to the roadway surface, the material shall be scrubbed with the scrub broom for the purpose of forcing the emulsion into the existing surface voids and distributing the emulsion over variable roadway surface textures and conditions. The specified aggregate shall be spread uniformly onto the bituminous binder prior to the emulsion breaking and as agreed to by the Engineer and contractor in the field. Sweeping of the completed surface shall be accomplished prior to unrestricted traffic use. The entire surface shall be clean of all loose material within 24 hours and prior to placement of any surface course.

FHWA Construction Inspection Checklist:

The FHWA Scrub Seal Checklist provides information on the details necessary for a successful project.

Treatment Application Recommendations:

- The treatment may be used on ADT less than 2,500.
- Good treatment for low and medium severity cracks (both transverse and longitudinal).
- Little or no load related distresses
  - less than 20’ of alligator cracking in 500’ section
- less than 100’ high severity longitudinal cracking in 500’ section
- less than 10’ high severity transverse cracks in 500’ section (crack spacing of 50’ or more)
- less than 100’ of multiply cracking in a 500’ section
- RQI greater than 3.0

**Alternatives to Scrub Seal:**

- Slurry Seal
- Micro surfacing
- Thinlay

**Estimated Performance Period:** 6 to 7 years (From Road Resource.org)

**Local Agencies with Experience:**

- City of Duluth
- Carlton County
- Itasca County
- St. Louis County
- Wabasha County (County has developed a specification, contact directly for copy)
- MnDOT District 3 (test sections near Milaca)
**Step 1.** Prepare/clean surface. All structures (manholes, valve boxes, etc.) need to be protected prior to placement. Striping may be pre-treated with emulsion.

**Step 2.** The asphalt emulsion is applied to the surface with a distributor that pulls a sled that houses a series of brooms placed at different angles. These brooms guide or "scrub" the emulsion into cracks.

**Step 3.** Chips are spread from a self-propelled, pneumatic tired unit onto the roadway.

**Step 4-5.** Rolling and sweeping. After the application of the aggregate, the surface is rolled with pneumatic tired rollers and swept to remove excess aggregate.

**Figure 6.04: General Scrub Seal Construction Steps**
603 – Slurry Seal

Slurry seals are surface treatments effective at correcting or inhibiting raveling and oxidation of the pavement surface, improving surface friction, sealing the pavement surface, and filling minor surface irregularities and wheel ruts.

A slurry seal is very similar to micro surfacing; the main difference is that slurry seals do not contain an additive that causes the chemical “breaking” action. Also, slurry seals cure through a thermal process resulting in longer cure times.

Specifications:

Currently, MnDOT does not have a specification for slurry seals. An alternative source is the Recommended Performance Guideline For Emulsified Asphalt Slurry Seal (please note, these are guideline, not specifications). Additionally, the National Center for Pavement Preservation has a generic specification.

Costs: $2.50-$3.50 per square yard

$17,600 – 24,640 per lane mile

$2,933-4,106 per lane mile year

This does not include mobilization, traffic control, and stripping.

Treatment Description: (Summarized from Road Resource.org)

Slurry seal consists of a carefully designed mixture of asphalt emulsion (which may be polymer-modified), mineral aggregate, water and additives; proportioned, mixed and uniformly spread over a properly prepared surface at a single stone thickness. Slurry seal is applied as a homogenous mat, which adheres firmly to the prepared surface and has a skid-resistant texture throughout its service life. Slurry seal is a quick-traffic system that allows traffic to return shortly (from one to four hours) after placement.

The treatment is favorable due to the reasonable application times and disruption to traffic and does not produce loose chips, therefore, eliminating the risk of potential vehicle damage.
**Crew:** A broom and operator, 2 people on front of the continuous paving machine to hook the hose of the emulsion and water trucks to the machine, a slurry seal continuous machine driver, a pug mill operator, 2 crew members on the back of the box, 1-2 people on the ground with a lute, a distributor truck operator for tack placement, and traffic control as necessary for the job.

At the pit you will see a loader operator placing aggregate in as many trucks as needed to keep the operation moving and a crew member filling the emulsion truck.

**Pavement Conditions Addressed:** Slurry seals do not add structural capacity but may provide protection against surface distresses like low severity cracking, raveling/weathering (loose material must be removed), minor roughness, friction loss, and moisture infiltration. Slurry seals will also temporarily seal cracks (if severity is low) and can serve as a rut-filler (if the existing ruts are stable). Prior to treatment placement, it may be necessary to perform other treatments to address other issues, such as rut filling, patching, or crack treating.

This treatment is applicable for low-severity transverse cracking, low-severity longitudinal cracking, low-severity block cracking, and low and medium-severity raveling/weathering. RQI 3.0 to 4.0. ADT less than 2,500. Pavements with poor friction.

**Construction Considerations:** Slurry seals should be placed only when the air and pavement surface temperature is above 50°F (10°C) and rising. The weather also should not be foggy or rainy. No slurry seals shall be placed when there is a danger that the finished product will freeze within 48 hours. Should not be placed after September 15.

**FHWA Construction Inspection Checklist:**

The [FHWA Slurry Seal Checklist](#) provides a list of key components that are necessary for a successful project. is a collection of inspection checklists for different pavement preservation treatments. They are designed to help guide an Inspector or Project Engineer in the field.

**Treatment Application Recommendations:**

- Traffic less than 2,500 ADT
- 7 or more years since last rehabilitation and last rehabilitation not a surface treatment
- Rutting measured is less than 10% of mile section and is 0.5 inches or less in the left wheel path
- Not a good crack seal or crack fill candidate (see Figures 4.01 and 4.02)
- Little or no load related distresses
  - less than 20’ of alligator cracking in 500 feet section
- less than 100’ high severity longitudinal cracking in 500’
- less than 10 high severity transverse cracks in 500 feet (crack spacing of 50’ or more)
- less than 100’ of multiply cracking in a 500’ section
- RQI greater than 3.0

**Alternatives to Slurry Seal:**
- Sealcoat
- Scrub Seal
- Microsurfacing
- Thin Overlay

**Estimated Performance Period:** 5 to 7 years

**Local Agencies with Experience:**
- City of Duluth
- City of Eagan
- City of Hastings
- City of Monticello
- Olmsted County

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**Step 1.** Prepare surface. Surface must be clean. All structures (manholes, valve boxes, etc.) need to be protected prior to placement.

**Step 2.** Slurry seal placement. This photo shows the placement of material using spreader box.

**Figure 6.05: General Slurry Seal Construction Steps**
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