Bituminous Surface Treatments
Graded Aggregate Seals

J. Keith Davidson P.Eng.
Director Technology and Product Development
McAsphalt Industries Limited

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Outline

- Definition
- Purpose
- Benefits
- Design considerations
- Materials
- Equipment
- Construction
What is a graded aggregate seal coat?

An application of a High Float emulsion followed by an unwashed graded mineral aggregate.
Overall Purpose

A pavement preservation treatment to:

- Reduce aging.
- Restore serviceability.
Specific Benefits

- Improves skid resistance.
- Arrests raveling.
- Seals surface and minor cracks.
- Minor rutting.
- Cost effective.
- Good durability.
- Ease of construction.
Design Considerations

Existing surface texture:
- Select suitable rate.

Climate:
- Select suitable emulsion grade.

Traffic:
- Select suitable emulsion grade.
- Increase stone content as traffic increases.
Materials - Graded Aggregate

Desirable properties: -

- Clean, free of clay.
- Cubical and crushed stones are better than flat or round.
- More rock is better, but not all same size.
- Surface damp.
Materials - Mineral Aggregate

Effect of high and/or dirty fines -

- Emulsion tied up in dust rather than bonding to stones...stone loss, blackening of wheel paths.
### Example Gradation Specification

#### Table 508-A Gradation Limits for Graded Aggregate Seal

<table>
<thead>
<tr>
<th>Sieve size (mm)</th>
<th>% Passing by Mass by Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>12.5</td>
<td>60-90</td>
</tr>
<tr>
<td>9.5</td>
<td>40-80</td>
</tr>
<tr>
<td>4.75</td>
<td>20-60</td>
</tr>
<tr>
<td>0.600</td>
<td>0-25</td>
</tr>
<tr>
<td>0.075</td>
<td>0-7</td>
</tr>
<tr>
<td>Ratio² (9.5/4.75)</td>
<td>-</td>
</tr>
</tbody>
</table>
# Match Material to Traffic

- Harder grade as traffic increases:

<table>
<thead>
<tr>
<th>Emulsion</th>
<th>Traffic Volume (ADT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF-100S</td>
<td>$\leq$ 4000</td>
</tr>
<tr>
<td>HF-150S</td>
<td>$\leq$ 1500</td>
</tr>
<tr>
<td>HF-250S</td>
<td>$\leq$ 600</td>
</tr>
<tr>
<td>HF-350S</td>
<td>$\leq$ 400</td>
</tr>
</tbody>
</table>

- Harder grade if more truck traffic.
- Harder grade if sealing in hot weather.
- Increase stone content as traffic increase.
Materials - Emulsion

Traditional High Float emulsions:

- HF-150S, HF-250S for granular surfaces.
- HF-100S, HF-150S for AC pavements.

![Selection of HF Emulsion for Gr. Agg. Seals](image_url)
High Float Emulsion

Bitumen carried up between the particles due to the wetting property of the High Float Emulsified Asphalt.

Bituminous phase must penetrate this dust film in order to properly bind large particles into the mat. This is achieved by diluent incorporated into the high float emulsion.

Bitumen must develop the necessary bonding strength within a short period in order to retain aggregate when traffic begins to flow. The high viscosity of the residual bitumen is helpful in developing the necessary tenacity.
Use adhesion agents for certain types of aggregate:

- Promotes asphalt to stone bond, particularly for granitic, quartzite, siliceous rock.
- Available in all emulsion grades.
- Improved initial stone retention.
Materials - Emulsion

Consider adding polymers for higher traffic roads:

- HF-100P, HF-150P.
- Improve stone retention.
- Increase flexibility in winter.
- Reduced bleeding and flushing on warm days.
Equipment

Distributor

Spreader

Roller

Sweeper
Equipment

Distributor:

- Calibrate application rate.
- Clean and align nozzles.
- Correct spray bar height.
GRADE PREPARATION

• Essential to successful performance of the surface treatment
• Restore roadway in conformance with specs
• Remove unsuitable materials
• Cut pot-holes out
• Correct drainage deficiencies
• Provide sufficient depth of granular etc.
Construction

Ensure good weather:

- Adequate air and surface temperature.
- Low humidity.
- Slight breeze.
- Clear forecast.
Construction

Dealing with weather:

- Temperature and humidity affect how quickly a seal will cure.
  - May have to ‘baby-sit’ a new seal...particularly on a busy road.
- Harder grades (HF-100S and HF-100P) less prone to bleeding in hot weather.
- Adhesion additives can help resist rain damage but not a guarantee.
Apply emulsion:

- Select the right grade.
- Adjust rate for surface and aggregate used.
  - Typically 1.5-1.9 L/m²
- Suitable temperature to achieve good spray (≈60°C).
Spread aggregate:
- Immediately after emulsion.
- Correct coverage.
- Spread uniformly
Construction

Rolling:

- Embeds stones in emulsion.
- Helps “break” the emulsion.
- Maintain slow speed.
- More is better.
- Orient the stones
Construction

Traffic Control:

- Following laydown, the seal will be ‘tender’...controlling traffic will help achieve interlock.
- Pilot traffic for safety and improved seal performance.
Traffic Control:

- Increased importance in marginal weather.
- Cool, damp weather will slow cure.
- A heavy rain with high traffic can cause major stone loss or pumping of oil to surface... **bury seal with cover sand and slow down traffic.**
Construction

Sweeping:

- Clean joints for adjacent pass.
- Remove dust and excess stones and construction.
- Prevent tearing stones out...don’t sweep too early.
- First sweep should be light.
- Avoid watering to keep dust down...retards cure, retains dust longer.
Subsequent Sweeping:

- Necessary to remove any loose stones.
- Delay second and third sweeps until seal has had time to develop strength.
- From the point of view of the seal, the best time to sweep is to not sweep at all.
Construction

Final desired appearance:

- Homogeneous matrix of various sizes of stones embedded in emulsion residue.
Thank You

Questions?