Prime Coat & Tack Coat Technologies

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Outline

Purposes of interlayer coating
Structural impact
Prime-coating systems
  - Overview
  - Existing products
  - VOCs
  - Vegeprime
Tack-coating systems
Purposes of Interlayer Coating

Tacking
Bonding
Waterproofing
Structural Impact

Bonding

<table>
<thead>
<tr>
<th>Surface (40 mm)</th>
<th>Binder (80 mm)</th>
<th>Base (100 mm)</th>
<th>Base (100 mm)</th>
<th>Sub-base (225 mm)</th>
<th>Sub-grade</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Full</td>
<td>Full</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td></td>
<td>Full</td>
<td>Partial</td>
<td>Full</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>Partial</td>
<td>Full</td>
<td>Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-grade</td>
<td></td>
<td></td>
<td></td>
<td>Poor</td>
<td></td>
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</table>

Interlayer Bond Condition

<table>
<thead>
<tr>
<th>Surface</th>
<th>Binder</th>
<th>Base</th>
<th>Base</th>
<th>% Life</th>
</tr>
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<tr>
<td>Full</td>
<td></td>
<td>Full</td>
<td>Full</td>
<td>100</td>
</tr>
<tr>
<td>Partial</td>
<td>Full</td>
<td>Full</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>Poor</td>
<td>Full</td>
<td>Full</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Partial</td>
<td></td>
<td>Full</td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td>Full</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Poor</td>
<td></td>
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<td></td>
<td>13</td>
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</table>
Prime-Coating Systems

Overview

Purpose

• Tacking
• Bonding
• Waterproofing

...also

• Fill surface voids and binding surface fines

Protect surface of granular base layer
Prime-Coating Systems
Overview
Effectiveness

• Viscosity
• Reactivity
• Viscosity of residual binder
• Particle size
Prime-Coating Systems
Existing products
Cutbacks

- Medium or rapid curing
  - MC-30, RC-30

- Advantages
  - Very good penetration
  - Work well in cold weather conditions

- Disadvantages
  - High VOCs
  - Low flash point
Prime-Coating Systems
Existing products
Prime-Coating Systems
Existing products
Emulsified Cutbacks

- Invert emulsions
  - SEP-1, SEP-2
- Advantages
  - Very good penetration
- Disadvantages
  - High VOCs
  - Low flash point
  - Requires some cure time
Prime-Coating Systems
Existing products
Emulsions – with solvent

- Proprietary products
- Advantages
  - Less solvent than cutbacks or invert
  - Some what good penetration
- Disadvantages
  - VOCs
Prime-Coating Systems
Existing products
Emulsions – solventless

- Proprietary products
- Slow setting emulsions
  - SS-1, CSS-1,
- Advantages
  - No VOCs
  - Lower cost
- Disadvantages
  - Not as robust
Prime-Coating Systems
Volatile Organic Compounds

Reduction of Volatile Organic Emissions from the use of asphalt emulsions.

Denis Pine
Environment Canada
Western Canada
February 5, 2013

Actions in other jurisdictions – California

• The most stringent regulations in the U.S. are those which have been promulgated by the California districts, under the California Air Resources Board (CARB). In those districts, rules are specified for rapid cure, medium cure and slow cure of cutback asphalt and emulsified asphalt.

• The following is an example from San Luis Obispo County:
  • A person shall not sell, offer for sale, use, or apply for paving, construction, or maintenance of parking lots, driveways, streets, or highways, any cutback asphalt material which contains more than 0.5 percent by volume VOCs which evaporate at 260 degrees Celsius or less.

  • A person shall not sell, offer for sale, use, or apply for paving, construction, or maintenance of parking lots, driveways, streets, or highways, any emulsified asphalt material which contains more than 3.0 percent by volume VOCs which evaporate at 260 degrees Celsius or less.
Prime-Coating Systems
Bio-solvents
Petroleum-based solvents vs. bio-solvents
Do not evaporate or produce VOCs
Becomes part of the final residual binder
Increased dissolving power
Vegeflux® is an engineered bio-solvent that provides rapid cohesion/adhesion
Not all bio-solvents are equal
Prime-Coating Systems
Vegeprime
Maximum penetration
Vegeflux® based
Low VOC
Very robust
Competitive with existing primes

• Retention of bio-solvent
Prime-Coating Systems

Vegeprime

Vegeprime

Solvent-less Prime

SS-1

MC-30
## Prime-Coating Systems Comparison

<table>
<thead>
<tr>
<th>Type of Prime</th>
<th>Robustness</th>
<th>Low VOC</th>
<th>Safety</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Cutback Asphalts</td>
<td>****</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>Emulsified Cutbacks</td>
<td>****</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Emulsion (solvent-based)</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Emulsion (solventless)</td>
<td>*</td>
<td>****</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Emulsion (biosolvent-based)</td>
<td>****</td>
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<td>****</td>
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</table>
Tack-Coating Systems
Overview

Tack-coat

• As per BS 434 (European)
  • 0.2 to 0.4 kg/m² residual binder
  • Cationic, rapid breaking, 40% unmodified binder
  • Fluid emulsion for fine spray
  • Provides tacky surface to initiate gripping of upper layer

• As per AI, MS-19 (North America)
  • 0.1 to 0.3 kg/m² residual binder
  • Cationic or anionic, slow breaking, unmodified binder
  • Diluted 50/50 for fine spray
  • Provides tacky surface to initiate gripping of upper layer
Tack-Coating Systems

Overview

Bond coat (proprietary)

- 0.3 to 0.65 kg/m² residual binder
- Provides tacky surface for gripping of upper layer
- Highly cohesive binders
- Applied high rates for adhesion & waterproofing
Tack-Coating Systems

Trackless systems

Novachip approach

- Thin surfacing system developed by SCREG in France
- Only 15-20 mm thick & system relies heavily on thick bond coat
  - 0.45 to 0.6 kg/m² residual binder (modified)
Tack-Coating Systems

Trackless systems

Conventional spraying approach

- Alternative to high cost & operational difficulties of paver integrated sprayer

- Many proprietary products
  - Colbond in the UK
  - Neoclean and Colnet in France
  - Trackless Ta
Trackless Coating Systems
Tack-Coating Systems

Engineering factors

Fast breaking

- *Formulation of emulsion (spraying vs. mixing emul.)*

Shelf life

- *Formulation of emulsion (spraying vs. mixing emul.)*

Tracklessness

- *Selection of residual binder hardness*

  - *Spraying system (Novachip)*

Substrate bonding issues

- *Formulation of emulsion (spraying vs. mixing emul.)*

  - *Condition of substrate (milled surface, hot temp., old vs. new)*

Overlay thickness

- *Residual binder characteristics (cohesion)*
### Tack-Coating Systems

#### Engineering Factors

<table>
<thead>
<tr>
<th>Type of Prime</th>
<th>Residual (kg/m²)</th>
<th>Fast Breaking</th>
<th>Shelf life</th>
<th>Trackless</th>
<th>Substrate Bonding Issues</th>
<th>Overlay Thickness</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Tack-Coat (European)</td>
<td>0.2 to 0.4</td>
<td>yes</td>
<td>limited</td>
<td>no</td>
<td>some</td>
<td>≥ 40 mm</td>
<td>**</td>
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<tr>
<td>Tack-Coat (North-America)</td>
<td>0.1 to 0.3</td>
<td>no</td>
<td>excellent</td>
<td>no</td>
<td>no</td>
<td>≥ 40 mm</td>
<td>*</td>
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<tr>
<td>Bond Coat</td>
<td>0.3 to 0.65</td>
<td>yes</td>
<td>limited</td>
<td>yes</td>
<td>no</td>
<td>≤ 40 mm</td>
<td>***</td>
</tr>
<tr>
<td>Trackless Systems (Novachip)</td>
<td>0.45 to 0.6</td>
<td>yes</td>
<td>limited</td>
<td>yes</td>
<td>-</td>
<td>≤ 25 mm</td>
<td>****</td>
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<td>Trackless Systems (Conventional)</td>
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<td>-</td>
<td>-</td>
<td>yes</td>
<td>-</td>
<td>-</td>
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