Asphalt Rejuvenation for Preservation Focused Agencies
Tricor Refining, Bakersfield, California, an Ergon / SJR Company
Have you ever tried to talk to a politician about Pavement Condition and Preservation Funding?

A Way of approaching pavement preservation
Pavement Condition
Comparison of Treatments

Fog Seal
Chip Seal, Slurry Seal and Micro
Thin Lift Overlays, Crack Sealing
Mill and Fill or CIR®
FDR-EE

Pavement Condition

Curve shape determined by quality, traffic, climate, etc.

Some politicians understand but most don’t,

A Different Approach to Pavement Preservation
Marriage Condition
Comparison of Treatments

Daisy = Fog Seals
Roses = Chip Seals/Slurry Seals
Roses/box of Chocolates = Cape Seals
Date nights at nice restaurants = Thin Overlay
Diamonds = Mill & Fill or CIR
Trip to Hawaii/renewal of vows = FDR

Pavement Condition

Years
Divorce Court: Attorney fees ½ of everything you own, starting over

Curve shape determined by structural quality, environment conditions
Provided that everything is structurally sound by applying

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two daisies- .76 cents</td>
<td>Go to the bank get a loan for $50,000 buy a Diamonds.</td>
</tr>
<tr>
<td>One dozen roses $24-$125</td>
<td>Divorce $250,000 - $500,000</td>
</tr>
<tr>
<td>One dozen roses and box of chocolates $24.00 -$150.00</td>
<td>Get another loan Buy a Cheaper Diamond $5,000</td>
</tr>
<tr>
<td>25 Year Diamond's $10,000</td>
<td>Second divorce $500,000 - $1,000,000</td>
</tr>
<tr>
<td>One trip to Hawaii 7-10 days</td>
<td></td>
</tr>
<tr>
<td>$15,000</td>
<td></td>
</tr>
<tr>
<td>Totals $25,275.76</td>
<td>Total Cost $1,555,000</td>
</tr>
</tbody>
</table>

At current Funding Levels only 5 out of 10 roads can afford option 1
And only 1 and 1000 can afford Option 2, but we all live like we are 1 of 1000
Marriage Condition
Comparison of Treatments

Daisy = Fog Seals
Roses = Chip Seals
Roses + a box of Chocolates = Cape Seals
Diamonds = Mill & Fill or CIR

Trip to Hawaii renewal of vows = FDR

Curve shape determined by structural quality, environmental conditions

Years

Divorce: Court, A attorney fees. ½ of everything you own, starting over
REJUVENATORS Why You Need To Use Them

“THE SITUATION!”

HMA COMPOSITION

- Rock
- Air
- Binder

The Cost of HMA to Pavement Owners is a CONCERN!!!!!

Fact is Liquid AC cost hit $450.60 in California in Dec/10
Fact is Liquid AC cost hit $590 plus in California in Dec/11
Fact is Liquid AC cost hit $560 plus in California in Dec/12
Fact is Liquid AC cost hit $590 plus in California in Dec/13

How long will your agency wait before implementing a preservation program?
**KNOW YOUR LIFE CYCLE COSTS**

**INPUTS FOR CITY STREETS**

- Reclamite Rejuvenation = $15,000 per mile (Lasts 3-5 years)
- Chip Seal Surface Treatment = $33,000 per mile (Lasts 5-7 years)
- HMA Milling and Overlay = $187,000 per mile (Lasts 10-12 years)
- HMA Full Depth Reconstruction = $550,000 per mile (Lasts 20 Years)
- A 500 mile Local Road Network has a current worth of $175,000,000! Maybe higher!
### The Concept of Pavement Management

**APPROACH - CATCH STREETS BEFORE THEY FAIL**

<table>
<thead>
<tr>
<th>Pavement Age (Years)</th>
<th>Surface Treatment</th>
<th>RECOMMENDED TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
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<tr>
<td>20</td>
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<td></td>
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<tr>
<td>16</td>
<td></td>
<td></td>
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<tr>
<td>12</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Localized Preventive Maintenance**

- **Surface Treatment** ($0.91/SQ.YD.)
- **Overlay** ($5.57/SQ.YD.)
- **Reconstruction** ($75/SQ.YD.)

**Pavement Condition Index (PCI)**

- **VERY GOOD** I
- **GOOD** II/III
- **POOR** IV
- **VERY POOR** V

**Approach - Catch Streets Before They Fail**

**Focus Budget Here Before**

- Overlay Is Required
- Reconstruction Is Required

**SaveMyRoad.com**
Reclamite is the most cost-effective pavement preservation product available.
The Role of an Asphalt Rejuvenator

“Maximizing the Performance of Your Road Inventory”

“Minimizing the cost of ownership of your Road Inventory”
Any agency can implement the use of Rejuvenators by simply deferring a small amount of resurfacing.

<table>
<thead>
<tr>
<th>Miles of HMA Overlay</th>
<th>FOR</th>
<th>Miles of Rejuvenator</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Miles</td>
<td></td>
<td>50 Miles</td>
</tr>
<tr>
<td>2 Miles</td>
<td></td>
<td>20 Miles</td>
</tr>
<tr>
<td>1 Mile</td>
<td></td>
<td>10 Miles</td>
</tr>
<tr>
<td>½ Mile</td>
<td></td>
<td>5 Miles</td>
</tr>
</tbody>
</table>
Think of Asphalt Rejuvenators as “Top of the Curve Preservatives

Rejuvenators are the first step to consider in your pavement preservation program
Rejuvenator used 2003, 2006, 2009

Crack Sealed in 1999 and Patched in 2000

Austin Drive
INDIANA STREET EXAMPLE

Cost Comparison Over Time

- **Traditional Method Cost**
- **Rejuvenator Method Cost**
- 39% Cost Savings
Net Present Cost of Repave vs. Rejuvenator

• Assume 4% Rate of Return

\[
\text{NPC to Rejuvenate Roads} = 0.61
\]

NPC to Overlay and Repave Roads

• This Means a 39% Reduction in Cost!
What is a Rejuvenating Seal?

- **Asphaltenes are the stable component of asphalt binder** unaffected by oxidation, air, UV rays, water, temperature change, etc.

- **Maltenes are the unstable component of asphalt binder** affected by air, UV rays, water, temperature changes, etc.

- **Loss of the maltenes from the asphalt binder in the upper 3/8”-1/2” of asphalt pavements is representative of the asphalt deterioration process.**
WHAT IS AN ENGINEERED ASPHALT REJUVENATOR EMULSION?

INFLUENCE OF CHEMICAL COMPOSITION OF ASPHALTS ON PERFORMANCE, PARTICULARLY DURABILITY

By
FRITZ S. ROSTLER
Director of Research
and
RICHARD M. WHITE
Research Chemist
Golden Bear Oil Co.
Bakersfield, Calif.

Components of asphalt.

First acidaffins
Second acidaffins
Saturated hydrocarbons
Polar compounds
Asphaltenes

Reprinted from AMERICAN SOCIETY FOR TESTING MATERIALS
Special Technical Publication No. 277, pp 64-88
1959
Components of asphalt:

- First acidaffins
- Second acidaffins
- Saturated hydrocarbons
- Polar compounds
- Asphaltenes
Criteria for a Rejuvenator?

Penetrate

Contain Maltene Fraction AND Replace Lost Maltene Fraction

Flux with Binder to Adjust Viscosity & Penetration Values

DEVELOPMENT OF THE “ROSTLER ANALYSIS” OR ASTM D-2006
ASPHALT PAVEMENT

94% Sand & Stone

6% Asphalt Cement (liquid)
What is a MALTENE BASED REJUVENATOR?

Replace the Lost Maltene Fractions
Comparison: SS1h & Rejuvenator
This is why a new pavement looks like this........
a one year old pavement looks like this........
a 10 year old pavement looks like this.........
and a 15 year old pavement looks like this!
The loss of the liquid asphalt oils – the maltenes in the upper 3/8’-1/2” of the asphalt pavement begins the deterioration process.
Rejuvenator versus Sealer

- Rejuvenator Comprised of Maltenes Fraction & Penetrates Binder
- Sealer Comprised of Maltenes + Asphaltene Fractions

Does Not Penetrate Binder
Binder Aging is helped in part by adjusting the viscosity and penetration of the existing asphalt pavement.

**Viscosity** - “How fluid the oil is”

**Penetration** - “Softness”
Lab report results of core test data in Texas.

Army Corp of Engineers success levels:
- 45% reduction in viscosity
- 25% increase in penetration

### Lab Reports

**Report:** 09-0728  
**August 4, 2009**

**Customer:** Pavement Restoration, Inc. – Rob Wiggins  
**Project:** Reclamite® Preservative Seal–City of Lubbock, TX  
**Samples submitted:** 16 pavement core samples (8 before and 8 after treatment) identified as follows:

- Jason & 10th
- Harvard/Bangor
- CNR 100/Fulton
- Itasca/Slide
- Kelsey
- N Vale

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Microviscosity, 25°C, MP</th>
<th>Equivalent Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05 sec⁻¹</td>
<td>0.001 sec⁻¹</td>
</tr>
<tr>
<td>Jason &amp; 10th</td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td></td>
<td>79.00</td>
<td>9.65</td>
</tr>
<tr>
<td></td>
<td>89.60</td>
<td>9.80</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>CNR Itasca/Harvard</td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td></td>
<td>48.92</td>
<td>18.39</td>
</tr>
<tr>
<td></td>
<td>58.96</td>
<td>22.83</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>8.45</td>
<td>13.85</td>
</tr>
<tr>
<td></td>
<td>13.91</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>14.95</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>18.25</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>9.94</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>13.81</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>11.45</td>
<td>12</td>
</tr>
</tbody>
</table>

167% increase in penetration
89% reduction in viscosity
88% reduction in viscosity
The benefit of an asphalt rejuvenator is to increase the durability of the asphalt in the top portion of the pavement by improving the chemical composition of the asphalt cement, restoring the maltene, saturate components.

Durability being restoration of the maltene, saturate components oxidizing from the binder.

Seal the pavement against intrusion of air and water, thereby slowing oxidation, preventing stripping and raveling and protects the pavement in-depth. This is done by the maltenes co-mingling and fluxing with the existing asphalt binder.
MALTENES Chemical Reactivity
ASPHALT FRACTIONAL COMPONENTS
TYPICAL ASPHALT BINDER

- ASPHALTENES
  - FUNCTION AS BODYING AGENT
- POLAR COMPOUNDS
  - PEPTIZER
    - HIGHLY ACTIVE RESINS
- 1ST ACIDIFFINS
  - ACTIVE SOLVENT FUNCTION
    - RESINOUS HYDROCARBONS
- 2ND ACIDIFFINS
  - SOLVENT FUNCTION
    - UNSATURATED HYDROCARBONS
- SATURATED HYDROCARBONS
  - JELLING AGENT FUNCTION
    - SATURATED HYDROCARBONS
- MALTENES
# Asphalt Rejuvenating Agent Specifications

## Tests

<table>
<thead>
<tr>
<th>Test on Emulsion:</th>
<th>Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viscosity @ 25°C, SFS</strong></td>
<td>ASTM D-244</td>
<td>Min.: 15</td>
</tr>
<tr>
<td></td>
<td>ASTM T-59</td>
<td>Max.: 40</td>
</tr>
<tr>
<td>Residue, % w(1)</td>
<td>D-244 (mod) T-59 (mod)</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65</td>
</tr>
<tr>
<td><strong>Miscibility Test(2)</strong></td>
<td>D-244 (mod) T-59 (mod)</td>
<td>No Coagulation</td>
</tr>
<tr>
<td><strong>Sieve Test, % w(3)</strong></td>
<td>D-244 (Mod) T-59 (mod)</td>
<td>---</td>
</tr>
<tr>
<td><strong>Particle Charge Test</strong></td>
<td>D-244</td>
<td>T-5</td>
</tr>
<tr>
<td><strong>Percent Light Transmittance(4)</strong></td>
<td>GB</td>
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<tr>
<td><strong>Tests on Residue from Distillation</strong></td>
<td>GB</td>
<td>30</td>
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<tr>
<td><strong>Flash Point, COC, °C</strong></td>
<td>D-92</td>
<td>T-48</td>
</tr>
<tr>
<td></td>
<td>196</td>
<td>---</td>
</tr>
<tr>
<td><strong>Viscosity @ 60°C, cSt</strong></td>
<td>D-445</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td><strong>Asphaltenes, % w</strong></td>
<td>D-2006-70</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>---</td>
</tr>
<tr>
<td><strong>Maltene Distribution Ratio</strong></td>
<td>D-2006-70</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>PC + A1(5)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>S + A2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC/S Ratio(5)</strong></td>
<td>D-2006-70</td>
<td>--0.5</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Saturate hydrocarbons, S(5)</strong></td>
<td>D-2006-70</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>---</td>
</tr>
</tbody>
</table>

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1. ASTM D-244 Evaporation Test for percent of residue is made by heating 50 gram sample to 149°C (300°F) until foaming ceases, then cool immediately and calculate results.
2. Test procedure identical with ASTM D-244 60 except that .02 Normal Calcium Chloride solution shall be used in place of distilled water.
3. Test procedure identical with ASTM D-244 60 except that distilled water shall be used in place of two percent sodium oleate solution.
4. Test procedure is attached.
5. Chemical composition by ASTM Method D-2006-70:
   - PC = Polar Compounds,
   - A1 = First Acidaffins,
   - A2 = Second Acidaffins,
   - S = Saturated Hydrocarbons.

Note: For gal/ton conversion use 242 gal/ton.

Note: Data presented are typical. Slight variation may occur from lot to lot.
Reclamite® Application @ .08 gallons sq. yd., 2:1 with water diluted emulsion
PINK COLOR DISAPPEARS INDICATING ABSORPTION PENETRATION
Colorado Applications:

Arapahoe County
Larimer County

City of Lakewood
Greenwood Village
Sanding/Sweeping Operation
Utah Applications:

Curing of Rejuvenator
Sanded and Swept
Osborn Road, Scottsdale, Arizona October 2013  No requirement to re stripe immediately
Reclamite, no need for immediate restriping of thermo paint
Arapahoe County, Denver, Colorado Easter Road
Before Reclamite Application
Photo - August 2010

Arapahoe County, Denver, Colorado Easter Road After Reclamite

Arapahoe County, Co. Easter Road
Photo After Treatment - October 2010
Pikes Peak Highway, Colorado Springs Before Reclamite® Application

Pike Peak Highway- Before Treatment
Photo- August 2010

Asphalt Mat Tighter
10 Weeks After Application

Pikes Peak Highway- Photo October 2010
After Reclamite Treatment
Reclamite Appearance Between Sealed and Unsealed – St. Louis County, MO

Before

After
Clark County, Washington (Portland, OR)

Reclamite
sealed 1979

Photo: 1994

Appearance
15 years after application

Sealed

Unsealed Seal ed
Montana Yellowstone Park area (from the 1970s)
Northern California
1970’s
SR62 Rejuv Test - 05-30-03

SR62 Oakridge Tennessee Shoulder Application
SR62 Oakridge Tennessee Shoulder Application
Photo: October 19, 2006, Placed 2001
Sealed for 5 Years

Reclamite®
Engineered Emulsion Hwy 95
40 miles north of I-40
Winslow, Arizona
FP2 Sealer Binder Study
Reclamite Long Term Appearance

CA 78 – Salton Sea, CA (Palm Springs area)
CA 78 – Salton Sea, CA
8 Years After 1 Treatment

9 Years After 1 Treatment
Clay Filled, Solvent, Distillate Blended non-emulsion sealers. What a maltene based rejuvenator Does NOT Do.

Reason: Solvent absorption is damaging binder.
Where and When to Use a Rejuvenating Seal?

- Construction seal to new asphalt pavements.
- Rejuvenating seal to pavements to extend pavement life before the use of a wear course seal is required.
- To correct pavements exhibiting minor segregation, raveling, poor compaction.
- Note: A rejuvenating scrub seal such as PASS CR should be considered on pavements exhibiting more distress than a straight maltene rejuvenator seal can address.
Which roads make **GOOD** rejuvenator candidates?

- Aged dense-graded HMA
- Open/gap graded HMA
- Chip seals (loss of rock)
Which roads make **BAD** rejuvenator candidates?

- Dense tight Surface
- Not suitable

Dense tight rich surface
Not suitable
Reclamite® postpones overlays and the need for other high-carbon, high-aggregate rehabilitation methods.

The “Fountain Of Youth” for your roads.
Province of Ontario, Canada

theroadauthority.com

Ontario Good Roads Association

Approved for Use - A
Marriage Condition
Comparison of Treatments

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Years
Divorce Court: Attorney fees
½ of everything you own, starting over
Jim Brownridge
Marketing Manager
Phone: 661.337.9979
www.reclamite.com

Questions Welcome