Fog Seal and Rejuvenator Seal Benefits and Differences

Jim Brownridge – Marketing Manager – Tricor Refining
Crude oil has as many by-products as there are leaves on a tree. Sixty years ago, most of them were unknown.
The New Way We Have Always Done It

Overview of Fog Seals and How Rejuvenators Can Further Extend Pavement Life
Fog Seal Description

By Definition, an application of diluted asphalt emulsion onto an asphalt pavement surface.

Simply filling the voids in a new asphalt surface with asphalt. It will darken (make black) the surface for a short period of time and retard oxidation. Performance Life is generally 1-3 years.
Fog Seal Candidate Criteria

- Overall Good Pavement Condition
- Slows Oxidation (a UV agent or sun screen)
- Fills Some Minor Cracks
- Binds Rock to a degree to stop Raveling
- Common Emulsions: SS-1h, CSS-1h, CQS
Sealers contain some maltenes + Asphalt & Do Not Penetrate the Binder
Rejuvenators contain Maltenes Fractions in Balance & Penetrate the Binder
Scrub Seals or “Scrub/Cape Seals”

The Theory

- Adds Asphalt and Seals the Surface
- Rejuvenates existing oxidized asphalt
Theory of Scrub Seal/ Rejuvenator Benefit

**Reality:**
Rejuvenator is blended with the PG Asphalt binder and polymer in the base then emulsified adjusting viscosity of finished cationic Emulsion. Generally a little slower break or cure provides workability with the broom - “emulsion wave” than The CRS, CQS Generics

Good Storage Life - Generally
Scrub Seals Using Modified Emulsions

Used in the western United States since the late 80’s

Consists of a polymer modified rejuvenating emulsion which is scrubbed into the existing surface followed by an application of rock or texture aggregate.

California and Arizona have recently developed generic specifications for the product.
Advantages

No Crack Filling is Required
Can be applied at both low and high temps

(40° F to 120° F)

High Flexibility
(3.5 % Polymer)
Although generic specs. Have reduced %

Will work with dirty chips
Typical Applications of Scrub Seals
Polymer Modified Emulsion Chip Seals

Typically CRS-2P cationic rapid set Polymer Modified emulsion.

CHFRS-2P Cationic High Float Rapid set Polymer Modified emulsion
Improves chip retention
Santa Barbara County California
Drag and Scrub Methods from the Past
Drag and Scrub Methods from the Past
PAVEMENT PRESERVATION
TOP OF THE CURVE BENEFITS

Pavement Structural Condition w/ time

- Excellent
- Good
- Fair
- Poor
- Very Poor
- Failed

40% drop in quality
75% of life
12% of life

40% drop in quality

NOW

$1.00 for PM here
Will save $3.00 to $10.00 here

Years
5 10 15 20
The Role of an Asphalt Rejuvenator

“Maximizing the Performance of Your Road Inventory”

“Minimizing the cost of ownership of your Road Inventory”
FP2 National Sealer Binder

Study – 1st Product Test
Sections on US 95 – 40 miles north of I-40, Winslow, Arizona
• **KNOW YOUR LIFE CYCLE COSTS**
  • **INPUTS FOR CITY STREETS**

  • HMA Rejuvenator = $16,000 per mile (Lasts 3-5 years)
  • HMA Chip Seal = $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! (And some say – that is a low number)
Any agency can implement the use of Rejuvenators by simply deferring a small amount of resurfacing.
Current Statewide PCI – State of California
What are Rejuvenating Seals?

They are engineered cationic emulsions containing maltenes, saturates (light fractions)

Reclamite® is a known and proven product with a 50 plus year history of product use.

The purpose is to soften the stiffness of the oxidized AC pavement surface and co-mingle or hydrate with the asphalt binder to extend the life of the pavement surface by adjusting properties of the AC mixture.

Maximum absorbance of the rejuvenator is expected and desired.
Asphalt consists of two main fractions: “asphaltenes” which are the hard brittle component, insoluble and not affected by oxidation and the highly reactive sub-fractions: “maltenes” These maltenes are oily and resinous in appearance.
What is an Engineered Maltene Based Rejuvenator Emulsion
FUNCTION OF THE MALTENE FRACTIONS

Maltenes must penetrate into the pavement co-mingle and flux with the binder

PC + A₁

S + A₂
Reactive Components Deteriorate causing an Imbalance with the Asphaltenes

The loss of the liquid asphalt oils or maltenes in the upper 3/8’-1/2” of the asphalt pavement begin the deterioration process
City of Visalia California
City of Delano, California
Curing Rejuvenator
Sanding Operation – 1 to 2 lbs. sq yd.
Sanded and Swept
Arizona

Frank Lloyd Wright, Scottsdale
Osborn Road, Scottsdale, Arizona October 2013  No requirement to re stripe immediately
Customer: Tricor Refining – Jim Brownridge

Project: RECLAMITE® Preservative Seal – City of Visalia, California

Samples submitted:

Eight pavement core samples (4 untreated and 4 treated) identified as:

4100 East Oak Avenue @ 500 North Sol Street
2000 North Tommy Street @ 5800 West Vine Avenue
2700 North Chinowth @ 4000 West Oriole Court
3300 West Riggin Avenue @ 3000 North Leila Street

The samples were taken on 10-30-14.

Requested Testing:

Remove the top 3/8-inch layer of each core and recover the asphalt binder. Determine Dynamic Shear Rheology properties at 64°C of each sample. In addition, determine the equivalent penetration at 25°C of each sample.

Summary of Testing:

The top 3/8-inch of each core was removed for testing. The asphalt was extracted and recovered as prescribed by California Test Method 365. Viscosities were determined on the recovered asphalt binder using a sliding plate microviscometer (CTM 348). Penetrations were calculated from a nomograph. These data are reported by Table I. Dynamic Shear Rheology tests were performed at 64°C as per AASHTO T315. Test data are reported by Table II.
<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>4100 E. Oak Ave. @ 500 N. Sol St.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Untreated</td>
<td>1843</td>
<td>1363</td>
</tr>
<tr>
<td>Treated</td>
<td>138.1</td>
<td>73.63</td>
</tr>
<tr>
<td>Increase in Penetration, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease in Viscosity, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 N. Tommy St. @ 5800 W. Vine Ave.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Untreated</td>
<td>1608</td>
<td>1471</td>
</tr>
<tr>
<td>Treated</td>
<td>90.38</td>
<td>77.34</td>
</tr>
<tr>
<td>Increase in Penetration, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease in Viscosity, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2700 N. Chinowth @4000 W. Oriole Ct.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Untreated</td>
<td>1760</td>
<td>736.0</td>
</tr>
<tr>
<td>Treated</td>
<td>116.1</td>
<td>51.59</td>
</tr>
<tr>
<td>Increase in Penetration, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease in Viscosity, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3300 W. Riggin Ave. @ 3000 N. Leila St.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Untreated</td>
<td>393.8</td>
<td>313.3</td>
</tr>
<tr>
<td>Treated</td>
<td>38.64</td>
<td>22.48</td>
</tr>
<tr>
<td>Increase in Penetration, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease in Viscosity, %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Dynamic Shear Rheology

**Tricor Refining**

**City of Visalia, California**

**Top 3/8” of Core Samples**

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Dynamic Shear Rheology, 64°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$G^*$, kPa</td>
</tr>
<tr>
<td>4100 E. Oak Ave. @ 500 N. Sol St.</td>
<td>155.9</td>
</tr>
<tr>
<td>Untreated</td>
<td>23.59</td>
</tr>
<tr>
<td>Treated</td>
<td></td>
</tr>
<tr>
<td>2000 N. Tommy St. @ 5800 W. Vine Ave.</td>
<td>179.0</td>
</tr>
<tr>
<td>Untreated</td>
<td>17.75</td>
</tr>
<tr>
<td>Treated</td>
<td></td>
</tr>
<tr>
<td>2700 N. Chinowth @ 4000 W. Oriole Ct.</td>
<td>101.6</td>
</tr>
<tr>
<td>Untreated</td>
<td>22.51</td>
</tr>
<tr>
<td>Treated</td>
<td></td>
</tr>
<tr>
<td>3300 W. Riggin Ave. @ 3000 N. Leila St.</td>
<td>73.09</td>
</tr>
<tr>
<td>Untreated</td>
<td>13.10</td>
</tr>
<tr>
<td>Treated</td>
<td></td>
</tr>
</tbody>
</table>
Lab report results of core test data in Texas.

Army Corp of Engineers success levels:
- 45% reduction in viscosity
- 25% increase in penetration
- 167% increase in penetration
- 89% reduction in viscosity
- 88% reduction in viscosity
Program started in 1999, budget was limited and maintenance activities were trial and error experiments.

By 2003, processes were fine tuned and by 2005 results started to look positive.

PASER AVERAGES 1999-2013

- PASER 1999 – 7.29
- PASER 2004 – 7.23
- PASER 2008 – 7.53
- PASER 2013 – 7.71
ANALYSIS REVEALS RESULTS OF ROAD PRESERVATION TIMING

Town of Avon Historic PASER Ratings - 4 Streets Example

- Rejuvenator Added – White Oak
- Rejuvenator Used – White Oak

White Oak Dr (East Leg)
ANALYSIS REVEALS RESULTS OF ROAD PRESERVATION TIMING

Town of Avon Historic PASER Ratings - 4 Streets Example

Corsican – No Rejuvenator till 2006

Corsican – Overlaid in 2010
ANALYSIS REVEALS RESULTS OF ROAD PRESERVATION TIMING

Town of Avon Historic PASER Ratings - 4 Streets Example

- Harvest Ridge Drive
- Harvest Ridge – HMA Overlay
ANALYSIS REVEALS RESULTS OF ROAD PRESERVATION TIMING

Town of Avon Historic PASER Ratings - 4 Streets Example

Austin Drive
Rejuvenator used 2003, 2006, 2009
1 Paser Point Decrease
Where Rejuvenators Used the Degradation Slowed

Typical Degradation on Non-Treated Roads

ANALYSIS REVEALS RESULTS OF ROAD PRESERVATION TIMING
ANALYSIS REVEALS RESULTS OF ROAD PRESERVATION TIMING

Cost Comparison Over Time

- Traditional Method Cost
- Rejuvenator Method Cost

39% Cost Savings

Cost:
- $0
- $50,000
- $100,000
- $150,000
- $200,000
- $250,000
- $300,000
- $350,000
- $400,000
- $450,000
- $500,000

Time:
- 1
- 5
- 9
- 13
- 17
- 21
- 25
- 29
- 33
- 37
- 41
- 45
- 49
- 53
- 57
- 61

- HMA Seal Maintenance
- HMA Overlay
Where and When to Use a Rejuvenerating 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 should be considered on pavements exhibiting more distress than a straight maltene rejuvenator seal could address.
Colorado

Arapahoe County, Co. Easter Road
Before Reclamite Application
Photo - August 2010

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

Pike Peak Highway - Before Treatment
Photo - August 2010
Pikes Peak Highway Colorado After Reclamite® Application

Asphalt Mat Tighter
10 Weeks After Application

Pikes Peak Highway- Photo October 2010
After Reclamite Treatment
Benefits of an Asphalt Rejuvenator:

1. Increases penetration value of the asphalt cement in the top portion of the pavement which extends the pavement’s lifecycle.

2. Seals pavement against intrusion of air and water, thereby slowing oxidation, preventing stripping and raveling and protects the pavement in-depth.

3. Increases the durability of the asphalt in the top portion of the pavement by improving the chemical composition of the asphalt cement.
Alabama

Unsealed

Sealed
Tennessee

SR62 Rejuv Test - 05-30-03

SR62 Rejuv Test - 052903 - Close-up
Reclamite, no need for immediate restriping of thermo paint
Ring Test Appearance
Which roads make GOOD rejuvenator candidates?

Aged dense graded HMA showing aggregate loss

Open Grade HMA

Chip seals (lose of rock)
Which roads make BAD rejuvenator candidates?

- Tight Surface
  - Not suitable

- Rich Surface
  - Not suitable
Thank You – Questions Welcome

Jim Brownridge
Marketing Manager

Direct Phone: 661.337.9979

www.tricorrefining.com