Asphalt Rubber Surface Treatment & SAMIs in Pavement Preservation

62nd School for Highway Superintendents
Cornell Local Roads Program

June 5, 2007
By Rod Birdsall, P.E.
Resources

- [www.fp2.org](http://www.fp2.org)
- [www.pavementpreservation.org](http://www.pavementpreservation.org)
- [www.allstatesasphalt.com](http://www.allstatesasphalt.com)
- [www.rubberpavements.org](http://www.rubberpavements.org)
- [www.dot.ca.gov](http://www.dot.ca.gov) type in crumb rubber
WHY Pavement Preservation?

1. Keep ‘GOOD’ pavements in “Good” Condition.
2. Corrects surface deficiencies.
3. Preserves the pavement system.
4. Retards future deterioration.
5. Maintains or improves the functional condition of the pavement system.
PHILOSOPHY OF ASPHALT RUBBER
PREVENTIVE MAINTENANCE
RIGHT TREATMENT
RIGHT PAVEMENT
RIGHT TIME

BE PROACTIVE ‘NOT’ REACTIVE!
Life of a Pavement

$1 of preventive maintenance here...

Eliminates or delays spending $8 - $10 on rehabilitation here.

Total Reconstruction $40 +

40% Drop in Quality

75% of Life

40% Drop in Quality

12% of Life
TRAFFIC

4 Million Miles of Road
2.4 Million is Paved

- 1980 – 1999
  1.5% Newly Constructed Road
  76% More Vehicles

WORK ZONES ~
482,000,000 hours of delay each year
The ARST is a blend of 20% crumb rubber (20 mesh) and asphalt (58-28 or 64-22). CRM is hot spray-applied (approx. 375-400 degrees) at the rate of 0.60 gallons per square yard. Then covered with heated and pre-coated 3/8" or 1/2" stone, followed by rolling and sweeping.
Adding Crumb Rubber.....

![Bar Graph showing Softening Point with values AC-5: 112, AC-5R: 143, AC-20: 129, AC-20R: 151 degrees F.]
Why Asphalt Rubber / SAMI?

- 1. High residual application of asphalt for long term performance.
- 2. Impermeable!
- 3. Flexible ~ good for moderately cracked pavements.
- 4. Relative easy/fast to apply.
- 5. Reliable performance.
- 6. Ideal for Cold/Wet Climates.
- 7. Can be used as Macro Surface or SAMI layer.
- 8. Quick HMA Overlay
Advantages of an Asphalt Rubber Surface Treatment / SAMI!

- Natural anti-oxidants of rubber
- Increased expansion & contraction of asphalt even at low temperatures to resist thermal & fatigue cracking
- Higher softening point of asphalt (no bleeding) (150 – 165)
- Greater amount of asphalt applied
- No loose aggregate
- Minimizes Reflective Cracking
- Longer Life Cycle ~ reduced aging/oxidation
- Reduced life cycle costs
- Can be Recycled
...limit costly rehabilitation or structural overlays.

Asphalt Rubber can extend the life of structurally sound pavements...

...prevent future deterioration...
Environmentally Sound
CRMA vs. Tire Disposal
Approx. 10lbs of Recyclable Rubber in 1 passenger size tire.

1 gallon of 20% CR is made up of; by weight is 8 lbs.

8 lbs X .20 = 1.6 lbs of CR per gallon

Application rate of .60 gals / sy = .960 lbs of CR / SY

1 mile of pavement by 24’ wide = 14,080 SY

14,080 SY X 0.960 lbs of CR / SY = 13,517 lbs of CR

13,517 lbs per mile / 10 lbs per passenger tire = 1,352 passengers tires recycled per mile.
WHY Pavement Preservation?

- 6. Saves Budgets $$$.
PPM is a Low-Cost Solution with Dedicated Funding

- PPM projects have demonstrated that for every dollar spent now, $6 - $11.5 will be saved in the future.

- **Michigan**
  - Implementation of PPM has led to, up to 11.5:1 savings over road reconstruction.
  - $700+ Million had been saved since 1992

- **California**
  - Implementation of PPM has led to a 6:1 savings over road reconstruction.
  - Currently spends $70-$80 million per year on PPM
ASPHALT RUBBER VS. HOT MIX

- 2 MILES ROAD X 22’ = 25,813 SY

- ARST @ $ 3.50 / SY = $ 90,345.50

- 1 ½” Overlay @ $ 62.00 / Ton = $134,850.00

- Cost Savings ~~~ 20% ~ $ 44,504.50
COSTS NOT SEEN BEHIND THE SCENE!!!

- NO NEED FOR SHOULDER WORK
- NO REAL LOSS TO CURB REVEAL
- NO DRIVEWAY APRONS NEEDED
- SKID RESISTANCE
- SALT AND WINTER CALCIUM/MAG RESIDUAL
- HELPS RETARD REFLECTIVE CRACKING
- IMPERMIABLE PRODUCT!!! WATER BARRIER.....
## Asphalt Rubber Surface Treatment vs. CRS-2 Emulsion Chip Seals

<table>
<thead>
<tr>
<th></th>
<th>CRS-2</th>
<th>CRMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Asphalt Applied</td>
<td>.25 gal / sy (residual) AC-20</td>
<td>.60 gal / sy AC-20</td>
</tr>
<tr>
<td>2. Stone Applied</td>
<td>20-25 lbs / sy virgin or treated with pugmill</td>
<td>35 lbs / sy heated &amp; treated at hot mix plant</td>
</tr>
<tr>
<td>3. Avg. Life Cycle</td>
<td>3 – 7 years</td>
<td>10 – 12 years</td>
</tr>
<tr>
<td>4. ADT</td>
<td>2,000 vehicles</td>
<td>30,000 vehicles</td>
</tr>
<tr>
<td>5. Post Sweeping</td>
<td>1 week</td>
<td>Same Day</td>
</tr>
<tr>
<td>6. Rubber Content</td>
<td>20% Crumb Rubber</td>
<td></td>
</tr>
</tbody>
</table>
Economics for Low and High Volumes Roads

Highways ~ High
ADT 25,000

Streets ~ Low
ADT 8,000

Approx. 17,500 ADT

Approx. 4,000 ADT

No Loose Stone!!!
Finished Surface

Longitudinal Joint Overlap
ASPHALT RUBBER SURFACE TREATMENT

Will seal any minor cracking!

100% Residual compared to other procedures using Emulsion.
Asphalt Rubber on Concrete Pavement

Before

Delamination not an issue over PCC.

After
43#'s compared to 110#s for HMA
CRM/S Components!

  - Special design blending equipment
- 2. Sized, Heated, Pre-Coated Aggregate.
- 3. Modified Distributor with mixing capabilities.
- 4. Adjustable width Chip Spreader.
- 5. Rollers.
HIGH VOLUME ROADS ~ 35 – 75 MINUTES, TRAFFIC IS BACK ON!

ONLY UP TO 10% WASTE FOR STONE ~ NO LOOSE STONE ONCE SWEPT!

Post-Sweep
Suffield, CT 20% RACS

August 1996 (Before)

August 1996 (After)
Picture taken September 26, 2006 of same road, 11 years later.
Delaware ~ Horse n’ Buggy Traffic
Tompkins County Route 13
Finished Surface Texture
Herkimer County Route 28

08/14/2006
Chenango County Route 8
Jefferson County Route 11

08/06/2006
Properties of CRMA ~ SAMI Layers

- High Asphalt Content >12% ~ ASTM 6114
- Enhance Structural Strength ~ Equivalent to 1” HMA
- Impermeable
- Resistance to Fatigue, Reflective and Thermal Cracking
- Can Cover Immediately with HMA or Open to Traffic and Pave Later
SAMI in a three layer system

- Pre-existing Pavement
- SAMI
- Leveling Course
- HMA Overlay
Crack disappearing in 10 year old Seal Coat

Crumb Rubber SAMI
after 8 years service

WITHOUT RUBBER SAMI    WITH RUBBER SAMI

ALL STATES ASPHALT, Inc.
Crumb Rubber SAMIs (Stress Absorbing Membrane Interlayer)
Crumb Rubber SAMIs
Crumb Rubber SAMI with applied HMA
Rubber SAMI ~ Stress Absorbing Membrane Interlayer

- SAMI done in July 2000 in Chicopee, MA. Picture taken 2/16/06

SAMI’s Help Prevent Reflective Cracking
Chicopee, MA October 2006
6 years old
<table>
<thead>
<tr>
<th>Site</th>
<th>Alligator A Cracking (%)</th>
<th>Alligator B Cracking (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Lt-5</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
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<tr>
<td>15</td>
<td>15</td>
<td>15</td>
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</tbody>
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Table 1. Pavement Condition Report for CIWMB test site.
<table>
<thead>
<tr>
<th>Site</th>
<th>Starting Post Mile</th>
<th>Strategy</th>
<th>Tack Coat</th>
<th>Thickness (in)</th>
<th>Aggregate (maximum)</th>
<th>Quantity (tons)</th>
<th>Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.25</td>
<td>RAC-O</td>
<td></td>
<td>1/2</td>
<td>3/8</td>
<td>198</td>
<td>$18,525</td>
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<td>2</td>
<td>28.75</td>
<td>RAC-O</td>
<td></td>
<td>3/4</td>
<td>3/8</td>
<td>297</td>
<td>$24,875</td>
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<td>3</td>
<td>29.25</td>
<td>RAC-O</td>
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<td>1</td>
<td>1/2</td>
<td>380</td>
<td>$30,175</td>
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<td>4</td>
<td>29.75</td>
<td>RAC-G</td>
<td></td>
<td>1</td>
<td>1/2</td>
<td>437</td>
<td>$35,250</td>
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<tr>
<td>5</td>
<td>30.25</td>
<td>RAC-D</td>
<td></td>
<td>1</td>
<td>1/2</td>
<td>465</td>
<td>$36,600</td>
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<tr>
<td>6</td>
<td>30.75</td>
<td>PBA6-O</td>
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<td>1</td>
<td>1/2</td>
<td>475</td>
<td>$29,550</td>
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<tr>
<td>7</td>
<td>31.20</td>
<td>PBA6-D</td>
<td></td>
<td>1</td>
<td>1/2</td>
<td>348</td>
<td>$25,800</td>
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</table>

**Bridge and bridge approaches PM 31.65**

<table>
<thead>
<tr>
<th>Site</th>
<th>Starting Post Mile</th>
<th>Strategy</th>
<th>SEAL COAT</th>
<th>Thickness (in)</th>
<th>Aggregate (maximum)</th>
<th>Quantity (tons)</th>
<th>Cost*</th>
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<tbody>
<tr>
<td>8</td>
<td>33.00</td>
<td>Hot- Applied Seal Coat</td>
<td>PBA-6 Binder</td>
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<td>153</td>
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<td>9</td>
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<td>Hot- Applied Seal Coat</td>
<td>AR Binder</td>
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<td>156</td>
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<tr>
<td>10</td>
<td>34.00</td>
<td>RAC-O Over SAMI</td>
<td>1/2</td>
<td>3/8</td>
<td>198 + 156 (SAMI)</td>
<td>$38,125</td>
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<tr>
<td>11</td>
<td>34.50</td>
<td>RAC-O Over SAMI</td>
<td>3/4</td>
<td>3/8</td>
<td>297 + 156 (SAMI)</td>
<td>$44,450</td>
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<td>12</td>
<td>35.00</td>
<td>RAC-O Over SAMI</td>
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<td>380 + 156 (SAMI)</td>
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<td>13</td>
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<td>RAC-G Over SAMI</td>
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<td>1/2</td>
<td>437 + 156 (SAMI)</td>
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<td>14</td>
<td>36.00</td>
<td>RAC-D Over SAMI</td>
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<td>1/2</td>
<td>465 + 156 (SAMI)</td>
<td>$55,200</td>
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<tr>
<td>15</td>
<td>36.50</td>
<td>Hot- Applied Seal Coat</td>
<td>AR Binder</td>
<td>Coarse 1/2” x N0. 4 Pre-heated Pre-coated</td>
<td>156</td>
<td>$22,050</td>
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</tbody>
</table>

*Cost is for materials and placement of each test section.

Figure 2. CIWMB test site layout.
<table>
<thead>
<tr>
<th>Section</th>
<th>Strategy</th>
<th>Depth (in)</th>
<th>Begin PM</th>
<th>End PM</th>
<th>Lane</th>
<th>1993 %</th>
<th>1999 %</th>
<th>2004 %</th>
<th>Total Cost ($)</th>
<th>Estimated Life* (years)</th>
<th>Annual Costs ($/lane mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RAC-O</td>
<td>1/2</td>
<td>28.25</td>
<td>28.75</td>
<td>L1</td>
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<td>75</td>
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<td>0</td>
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<td>29,550</td>
<td>21.3</td>
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<tr>
<td>7</td>
<td>PBA6-D</td>
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<td>31.2</td>
<td>31.65</td>
<td>L1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>25,800</td>
<td>21.3</td>
<td>2216</td>
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<tr>
<td>11</td>
<td>RAC-O/SAMI</td>
<td>3/4</td>
<td>34.5</td>
<td>35</td>
<td>L1</td>
<td>0</td>
<td>0</td>
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<td>44,450</td>
<td>18.2</td>
<td>3776</td>
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<tr>
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<td>35</td>
<td>35.5</td>
<td>L1</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>49,775</td>
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<td>22,050</td>
<td>15.6</td>
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*Estimated life is based upon the parabolic prediction curves.

Table 2. Alligator B cracking for 1993, 1999 and 2004 pavement condition surveys.
Two ALF’s with 12 Pavement Lanes Constructed in the Summer and Fall of 2002
<table>
<thead>
<tr>
<th>CRMA 70-22</th>
<th>70-22</th>
<th>AB</th>
<th>SBS</th>
<th>TB</th>
<th>CR</th>
<th>Elvo</th>
<th>70-22 + Fibers</th>
<th>70-22</th>
<th>SBS 64-40</th>
<th>AB</th>
<th>SBS</th>
<th>Elvo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>
Percentage of Area Cracked vs. ALF Wheel Load Passes

- L2S3 (Control)
- L3S3 (Air Blown)
- L5S3 (CR-TB)
- L6S3 (Terpolymer)
- L4S3 (SBS LG)
- L1S2 (CR-AZ)
Summary!!! What have we learned...

- Asphalt Rubber being widely used to enhance asphalt performance.
- SAMI layers ~ stopping the water barrier and reducing reflective cracking.
- Longer lasting pavements resulting in Lifetime Savings $$!!!
- FP2 & NCPP are there to help!
We thank you for your time!

PRODUCTS n’ SERVICES

- ASPHALT RUBBER SURFACE TREATMENT
- FIBERMAT CHIP SEAL
- FABRIC ~ FIBERGLASS/POLYESTER NON-WOVEN (TRUPAVE)
- COLD MIX ASPHALT IN PLACE
- RECLAMATION / BOMAG
- LIQUID CALCIUM CHLORIDE/MAGNESIUM CHLORIDE ~ OTHER LIQUIDS
- NOVA CHIP (PAVER PLACED SURFACE TREATMENT)
- CONVENTIONAL CHIP SEALS / SAND SEALS
- CALCIUM CHLORIDE EQUIPMENT

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