Ground Tire Rubber incorporated into Slurry Seals

Scott Metcalf Ergon
Environmentally Friendly. California produces more than 40 million waste tires annually, of which approximately 75 percent are diverted from landfill disposal. The state still faces the challenge of dealing with roughly 10 million surplus tires annually. The majority end up in our landfills but some end up in illegal stockpiles.
Environmental Problems Associated with Waste Tires

1. **Mosquitoes Disease**
2. **Fire Hazards**
Benefits

• Meets Recycling Credits
• Going Green is Good
• Used as a filler

Negatives

• No increase in mix performance benefits have ever been proven or documented in slurry seal and/or micro surfacing systems.
• When using Greater than 5%; GTR problems have occurred
  – Raveling in all processes, due to compression and expansion
  – Moisture resistance damage and loss of adhesion
Construction

- Recommend that you specify and use a Rubber Tire Roller (RTR) to roll the micro and slurry to reduce raveling.
- Using very fine 30 to 80 mesh ground tire rubber.
- How to verify the amount of rubber being used?
- Most systems greatly benefit from Polymers also being added.
- Let’s review the 3 most commonly used options and review one that is in the trials phase.

Ground Tire Rubber
Ground Tire Rubber in Slurry Seal and Micro-Surfacing Systems

• Incorporation Processes 1 of 4

1) 5% by weight of asphalt. The GTR is added at machine through fines feeder; since 1997.

2) 5% GTR Terminal Blended into the asphalt and than emulsified; since 2007.

3) Central Plant Mix 5% Blended into a Blended Mix; since 1997.

4) 5% blended into the aggregate stock pile; “trial phase”
Option #1

RPMS

AKA

Truck Added
Ground Tire Rubber (GTR)
Ground Tire Rubber (GTR) at 5% by Weight of Asphalt

<table>
<thead>
<tr>
<th></th>
<th>By Weight of Agg</th>
<th>12' lane @ 1 mi @ 18lbs</th>
<th>Materials used per lane mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>aggregate</td>
<td>100.0000</td>
<td>7040</td>
<td>58.16448 tons</td>
</tr>
<tr>
<td>emulsion</td>
<td>12.0000</td>
<td>18</td>
<td>7.6032 tons</td>
</tr>
<tr>
<td>Mineral Filler</td>
<td>1.0000</td>
<td>126720 lbs.</td>
<td>1267.2 lbs.</td>
</tr>
<tr>
<td>Emulsion Residue</td>
<td>63.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt in mix</td>
<td>7.5600</td>
<td></td>
<td>4.790016 tons</td>
</tr>
<tr>
<td>GTR (@5% by Weight Asphalt)</td>
<td>0.3780</td>
<td></td>
<td>479.0016 lbs.</td>
</tr>
<tr>
<td>Mix total</td>
<td>108.938</td>
<td></td>
<td>63.36 tons</td>
</tr>
</tbody>
</table>

Average car tire is 25 pounds and truck tire is 120 pounds
Average weight of GTR is 20 LBS per every 25 pounds of tire the rest is Steel Fiber, and Cords.

So on average RMPS uses 23.95 Car Tires Per Lane Mile.

Per the Department of Ecology State of Washington
Truck Added
Ground Tire Rubber (GTR)

• The GTR is being added through an extra fines feeder that is mounted on the machine.
City of Ontario Ca. using Tire Rubber Slurry “RPMS”
City of Palm Desert

City of Corona CA

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Option #2

Terminal Blended
Terminal Blended “Hybrid”

- Tire rubber is blended with hot asphalt cement at the refinery or at an asphalt terminal, transported to job site in tankers and is handled the same as any neat asphalt cement.
  - Tire rubber is fully dispersed into the asphalt medium
  - Must Meet ASTM D2042 Solubility Standards to Emulsify
    - Tire Rubber particle size is less than 1 micron
  - Meets all PG grading test
    - No special testing equipment or test specification
  - Asphalt cement is now modified with tire rubber
    - Tire Rubber Modified Asphalt is Homogeneous
    - Mixing and Compaction Temperatures remain constant
    - Excellent Stability
    - No Settlement or Phasing, Does Not Require Agitation
  - Polymers and other additives may also be included
Whole Tire Rubber
Gradation
30 mesh negative
No fiber
No metal
Tire Rubber Modified Asphalt is Blended at Terminal
The GTR is Digested into Asphalt at Processing Plant and than emulsified into a Slurry Seal or Micro Surfacing emulsions.
Tire Rubber Modified Asphalt is Milled at Emulsion Plant To Make Micro/Slurry Emulsions
Terminal Blended Ground Tire Rubber
TRMSS Emulsion Place as Slurry Seal
Option #3

Central Mix Tire Rubber Slurry Seal
Central Mix Tire Rubber Slurry Seal is a blend of asphalt emulsion, polymers, recycled tire rubber, properly graded aggregates Type I, Type II and or Type III, plus stabilizers aka thickeners.

Central Mix is then delivered in a truck with Augers and requires continuous mixing to keep Aggregate and Tire Rubber disbursed.
Option #4 “Trials”

Stock Pile Blending

AKA

GTR is Blended into Aggregate Stockpile with 2 Bin feeder
100 grams + 5% GTR = 105 grams Blend Material
Ground Tire Rubber Blended into Type II Slurry Aggregate

30 mesh ground tire rubber

Blended agg with 5% GTR

\[ 100 \text{ grams} + 5\% \text{ GTR} = 105 \text{ grams Blend Material} \]
So what is a head of us?? What are we working on???
CANTABRO LOSS

Scope
This test method determines the abrasion loss of compacted slurry, micro and hi-mod micro Samples. Measures the breakdown of various emulsion specimens utilizing the Los Angeles Abrasion machine.
Test Procedure

Mold specimens

Oven dry specimens in an oven until cured, not exceeding 24 hours. Temperature of oven shall be no greater than 140 F and not less than 122 F. Weigh specimen and record as A.

Place individual specimen in the Los Angeles testing machine. (do not include steel balls)

Rotate the machine at a speed of 30-33 rpm’s for 300 revolutions. After 300 revolutions, discard any loose material broken off of the specimen. Weigh the specimen record as B.
Use the following formula to measure Cantabro Loss:

\[
CL = \frac{A - B}{A} \times 100
\]

- CQS-1H: Mass Loss % = 5.21
- MICRO: Mass Loss % = 2.89
- HI-MOD MICRO: Mass Loss % = 0.04
Samples were normalized to the dry Cantabro loss readings. These utilize the difference between dry samples and wet samples. The percentage is based on the total loss (wet+dry). Below is this graphical representation.

As shown, as the levels of aluminum sulfate increase, the durability of the samples decrease. As these samples are conditioned and tested, these values dramatically decrease as aluminum sulfate contents increase.

We are still working on our findings and final report. We hope to have finished the report by July 2017, which will cover other additives i.e. Tire Rubber, Sulfate, Cement, and other Chemical additives to see if there is any positive or adverse effects.
% Retained Durability vs. % Sulfate

- **% Retained Durability 24 hour soak at 25°C**
  - $R^2 = 0.9865$

- **% Retained Durability for 90% Saturation, 23 hr at 60°C, 1 hour at 25°C soak**
  - $R^2 = 0.9944$

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Questions

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