Asphalt Rubber Market Development in Mexican State of Baja California

Theron Roschen, PE – Interwest Consulting

With assistance from:
The California Department of Resources Recycling and Recovery (CalRecycle)
Why choose asphalt rubber?

- Less maintenance
- Higher binder without rutting
- Resistance to reflective cracking
- Established life cycle cost-effectiveness
- Can be used in reduced thickness
- Proven alternative to costly reconstruction
- Quieter pavements
- Reduced Tire Piles
2,000 recycled tires per lane mile for a 2-inch (50mm) overlay

32 lbs (~14.5kg) Rubber per ton

1.9 tons/yard$^3$ (2.25 tonnes/m$^3$)
Performance in Indio, CA
Asphalt Rubber vs. Conventional for Arterial Streets

- About 300 data points
- About 7 Years

Conventional HMA Family Curve

New RAC Family Curve
What is Asphalt-Rubber?

“Asphalt-Rubber is a blend of asphalt cement, reclaimed tire rubber and certain additives, in which the rubber component is at least 15% by weight of the total blend and has reacted in the hot asphalt cement sufficiently to cause swelling of the rubber particles.”
Viscosity is what defines Asphalt-Rubber Binder

Asphalt-Rubber
1,500 to 2,500 Centipoises At 375°
Extremely Viscous

Rubberized Asphalt Terminal Blend
300 to 600 Centipoises At 325°
Finish Product and Bagging
Ground tire rubber in 2,000 pound (~1 tonne) “Supersacks”
Rubber is fed from the weigh hopper into a high shear mixer.
liquid asphalt and modifier at 375° (190° C) to 425° F (218° C)
- Made at the refinery
- Tire rubber completely digested
- Refined for 16 hours, under pressure and temperature
- Polymers are added
- Material comes ready to use upon arrival
- No special equipment
Aggregate Gradation Comparison

Open Graded
Use Field Blend

Gap Graded
Use Field Blend

Dense Graded
Use Terminal
HMA vs. RAC
Temp of ARHM-GG

SHOULD BE A MINIMUM OF 315° F (157° C) LEAVING PLANT
HEAT

• Mix Temp @ Plant: 315°- 325° F (157-163°C)
• 1st Breakdown: >280° F (138°C)
• All compaction: >250° F (120°C)
• Ambient/Surface Temp: >55°F (13°C)
Cost Factors

- When AR is in production the plant can not make conventional
- Long haul distances maintaining heat
- Traffic control for cooling time
Contractor’s Cost Issues

• Small Projects = LARGER UNIT COSTS!!
• Expensive move-in
• Agencies can save $$ with larger economy of scale
• Be flexible
Chip Seals With Asphalt Rubber
Application

- Temp: 375° F to 400° F  
  (190° C - 205° C)
- Rate: 0.60 to 0.65 gal/SY  
  (2.8-3.0 liters/m²)
• Chips protect the membrane from traffic and provide friction
• Membrane is the seal and water barrier
• The thicker the membrane, more durable the seal
• Asphalt-Rubber binder is applied at 0.55 to 0.65 gal/sy because of its viscosity
– (Hot Pre-Coated Aggregate)
Aggregate

- 3/8” and ¼” (9.5 and 6.3mm)
- Precoated w/ 0.5 to 1.0% PG binder
- Supplied to project at 225-325°F (107-163°C)
- 3/8” (9.5mm) @ 28-34 lbs/SY (15-18.5kg/m²)
- Clean & dry
- Apply IMMEDIATELY!
Rolling (Seating)

- Roll with three rubber tired rollers in tandem immediately following chip application
- Three passes (minimum)
- A static steel roller (8-10 ton) after the pneumatics seat interlock the chips and reduce sweeping
• A fog or slurry seal on top of a chip seal can reduce chip loss and smooth surface

• Sand cover can be included in the specs as a blotter
SAMI - Stress Absorbing Membrane Interlayer

Also known as a Two Layer System
Non Performance Based Treatments

Dry Process – 1 to 5% crumb by weight of total mix as aggregate filler
Non Performance Based Treatments

- **California DOT PG+5 Initiative** – All asphalt binders contain 5% recycled tires, regardless if the mix is placed in a surface course or underlying roadway structural section
- **Still requires either a terminal or field blended asphalt rubber**
Portable Mixing Unit & Reaction Tank

High Capacity: US $1.5M New
Low Capacity: US $800,000 New
Mixer/Distributor Truck

3,000 Gallon Mixer Distributor Truck 14 Foot Spray Bar With Truck Chassis: US $270,000 New Heat Resistant Chip Spreader: US $250,000 New
Terminal Blend Refinery Equipment

Most systems are proprietary.
Estimated at $3-4 M
# Rubberized Asphalt Investment Summary

## Performance Based

<table>
<thead>
<tr>
<th></th>
<th>Asphalt Rubber Concrete</th>
<th>Asphalt Rubber Chip Seal</th>
<th>Terminal Blend Rubberized Asphalt</th>
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<tbody>
<tr>
<td><strong>Equipment</strong></td>
<td><strong>Cost</strong></td>
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<tr>
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<td>Rubberized Distributor Truck</td>
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Questions?

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