WHEN THE RUBBER MEETS THE ROAD

PHD INES ANTUNES
DR DOUG CARLSON
Il Bitume Modificato con Polverino di Gomma di Pneumatico Riciclata

✓ Exclusive producer of Asphalt Rubber in Italy

Project, innovative solutions and complete technical support

www.bitem.it
RPA is a non-profit industry association
Technology transfer through many initiatives

www.rubberpavements.org
Asphalt Rubber

40 years of experience

- Reduced oxidation
- Higher resistance to fatigue
- Smaller thicknesses
- Lower construction times
- Higher safety (high friction)
- Lower noise
- Saves natural resources and costs
- Lower maintenance costs
2000 Recycled Tires per Km on a typical 5 cm overlay
“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.

ASTM D6114

- Process in public domain – not patented
- Initially Mac Dowell had a patent
- Exists for 40 years
“Asphalt Rubber”

- Wet Method (less than 15%)
- Wet Method (10%) - Terminal Blend
- Wet Method (5% + SBS) - Terminal Blend
- Wet Method (3.5%) - Terminal Blend
- Dry Method (1, 2, 3%) of aggregate weight - Short and Long Reaction times
- Proprietary Methods (no technical info!)

☑ Wet Method (with 18-22%)
Modified Binder 20 +/- 2 % CRM
Specification ASTM D6114

Cracking and Patches (m²/1000m²)

- 0% Rubber
- 5% Rubber
- 10% Rubber
- 15% Rubber
- 17% Rubber
- 10% Rubber, Dry Mix

Months after Construction

0  20  40  60  80  100  120
Italian Asphalt Rubber

- Uses 20 +/- 2 % crumb rubber
- Crumb rubber gradation passes #10
- Rubber and asphalt mixed together hot to form a modified binder
- Binder pumped into plant and mixed with aggregate
- Hot mix paved as normal
Italian Asphalt Rubber

Summer 2006

2000 Ton of GAP gradded
500 Ton of OPEN gradded

Several jobs in TOSCANA
Advantages

Fatigue Cracking

Low Temperature

Longitudinal Cracking

Rutting

To solve problems
Asphalt Rubber

“Can undergo about five times the strain before rupture than asphalt”

1977 ADOT Research Report
By Green and Tolonen

Film Thickness

- 5% Bitume
- 7.5% Asphalt Rubber
- 9.0% Asphalt Rubber
- Up to **50% thickness reduction** when compared with conventional mixes
- Approved by FHWA, CSIR and UCB
Maintenance Cost $/lane - Kilometer

- **Overlays / Inlays**
- **AR-ACFC**

Years: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Maintenance Costs: 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500
<table>
<thead>
<tr>
<th>Location</th>
<th>Before</th>
<th>After</th>
<th>Decrease</th>
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<tbody>
<tr>
<td>Shoulder (15m)</td>
<td>79.8</td>
<td>72.6</td>
<td>7.2</td>
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<tr>
<td>Soundwall (30m)</td>
<td>76.6</td>
<td>67.1</td>
<td>9.5</td>
</tr>
<tr>
<td>Residential (120m)</td>
<td>51.7</td>
<td>45.6</td>
<td>6.1</td>
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</table>
Improves security
Improves security
**Improves security**

### Accident Data: FM 1431 - Travis County - Near Jonestown

(PFC mixture was placed in February 2004)

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
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<tbody>
<tr>
<td>Total # of accidents</td>
<td>25</td>
<td>48</td>
<td>36</td>
<td>17</td>
<td>6</td>
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<tr>
<td>Dry weather accidents</td>
<td>10</td>
<td>22</td>
<td>13</td>
<td>15</td>
<td>5</td>
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<tr>
<td>Wet weather accidents</td>
<td>15</td>
<td>26</td>
<td>23</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Fatalities</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Total injuries</td>
<td>25</td>
<td>16</td>
<td>21</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Incapacitating injuries*</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Non-incapacitating injuries</td>
<td>19</td>
<td>12</td>
<td>18</td>
<td>6</td>
<td>1</td>
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<tr>
<td>Annual rainfall (inches)</td>
<td>42.9</td>
<td>36.0</td>
<td>21.4</td>
<td>52.0</td>
<td>22.3</td>
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<tr>
<td>Total rain days (&gt;0.1 in.)</td>
<td>57</td>
<td>56</td>
<td>37</td>
<td>70</td>
<td>45</td>
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<table>
<thead>
<tr>
<th>Avg 01'-03'</th>
<th>Avg 04'-05'</th>
<th>% Change in 04' &amp; 05'</th>
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<tbody>
<tr>
<td>36.3</td>
<td>11.5</td>
<td>-68.3</td>
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<tr>
<td>15.0</td>
<td>10.0</td>
<td>-33.3</td>
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<tr>
<td>21.3</td>
<td>1.5</td>
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<td>20.7</td>
<td>4.0</td>
<td>-80.6</td>
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<td>4.3</td>
<td>0.5</td>
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<tr>
<td>16.3</td>
<td>3.5</td>
<td>-78.6</td>
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<td>33.4</td>
<td>37.2</td>
<td>11.1</td>
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<tr>
<td>50.0</td>
<td>57.5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

* Some of these injuries later became fatalities

Source: Cedar Park Police Department & Austin Mabry Weather Station
More than 30,000,000 tires were recycled since 1988, AZ.
New Research

Urban Heat Island
www.urbanheat.org
Conclusions

- Asphalt-Rubber Friction Courses can enhance safety and reduce accidents
- Asphalt-Rubber Friction Courses can be applied in very thin layers on aged concrete surfaces and can be used to reduce tire noise
- Asphalt-Rubber provides a longer lasting fatigue and crack resistant surface

Thank you!
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