Evaluation of MacRebur recycled plastic for bitumen extension and modification in asphalt

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It’s the end of the road for waste plastic.

Virgin Media Business Voom Start-Up award winner of 2016.
What it is?

• 100% waste plastic
  – Industrial and domestic sources
  – Otherwise destined for landfill

• Selected, processed and blended

• Pellets, flakes or shreddings

• Three finished projects
  – MR 10. Stiff and flexible, but not rut susceptible.
The Products

MR6

MR8

MR10
How does it work?

• Melts during asphalt production
  – Mixed dry into the asphalt plant
  – Pre-blended into bitumen and wet mixed

• Similar to existing polymers
  – MR 6 like EVA (eg. P101)
  – MR 10 like SBS (eg. Kraton D)

• Chemical reactions and rheology not known

• Forms a stable and homogenous product
What are the benefits?

• Sustainable re-use of waste plastic
• Economical solutions
• Stiffness (thinner pavement)
• Deformation resistance (less shoving/rutting)
• Fracture resistance (less fatigue cracking)
• Safe to use
  – No leachate
  – No extra fumes (above bitumen)
What are the benefits?

Moisture damage resistance (modified Lottman test)

Moisture Damage Ratio (%)

Straight 40/60  6% MR6  6% MR8  6% MR10
What are the benefits?

**Structural stiffness (indirect tensile at 20°C)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Stiffness Modulus (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight 40/60</td>
<td>1,500</td>
</tr>
<tr>
<td>6% MR6</td>
<td>5,500</td>
</tr>
<tr>
<td>6% MR8</td>
<td>4,000</td>
</tr>
<tr>
<td>6% MR10</td>
<td>6,500</td>
</tr>
</tbody>
</table>
What are the benefits?

Deformation resistance (wheel tracking at 60°C)

Rut Depth (mm)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Rut Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight 40/60</td>
<td>3.2</td>
</tr>
<tr>
<td>6% MR6</td>
<td>1.2</td>
</tr>
<tr>
<td>6% MR8</td>
<td>2.5</td>
</tr>
<tr>
<td>6% MR10</td>
<td>2.0</td>
</tr>
</tbody>
</table>
What are the benefits?

Fracture resistance (Fatigue life at 20°C)
What are the benefits?

Performance grading (USA)
Where to use it?

• MR 6
  – Alternate to PMB
  – High stress (round-a-bouts, lights and T-sections)

• MR 8
  – Economics and sustainability
  – Local roads

• MR 10
  – Alternate to PMB
  – Base or binder course
Further research

• Wet versus dry mixing
• Chemical and rheological mechanisms
• Higher dosages of MR 8
• Combination with other products
  – MR 6 and MR 8
  – MR 8 and SBS
• Benefit of other additives
  – Sulphur
  – Blending oil
QUESTIONS?