REOB
History and Use
January 14, 2015
• When cars reach their mileage requirements for oil changes the oil is collected for reuse
The Process

• Oil collectors are required under used oil regulations strictly enforced by EPA to check the oil for contaminants that should not be in the crankcase oil
  – PCB’s from old transformers
  – Water
  – Glycols from coolants
  – Chlorinated compounds such as solvents

• The EPA has determined that oil collected in this way is non-hazardous
• The used oil is collected in trucks and taken to the refinery to be re-refined into lubricant base oil for autos and trucks
What is REOB?

• Recycled Engine Oil Bottoms
  – The non-distillable fraction from the vacuum tower of re-refined crankcase oil
• ASTM D 92 Flash Point > 232 °C
• ASTM D 2872 RTFOT < 1.0 %
• ASTM D 2042 Solubility > 98 %
• ASTM D 4402 Brookfield Viscosity at 60 °C < 50 P.
Approximately 160,000 tons of REOB are produced in North America which is ≈ 0.5% of total asphalt used and less than 0.4% of the paving asphalt.

- Generally it is used between 4 and 10% by weight of binder.
Some misunderstandings

• This is not a new product
  – Used since the mid 1980s in paving asphalt
  – Used to enhance low temperature and aging properties
• REOB is not waste crankcase oil
  – Rather it is a refined low volatility high flash vacuum resid (non distillable) produced very similar to asphalt from a refining standpoint
• If used crankcase oil was added to asphalt it would not meet flash point, weight loss under PG grading
• It also would produce significant blue smoke in a hot mix plant stack
• REOB is not a waste
  – EPA Regulations control this product are well established at all levels of collection and refining
Some Misunderstandings

• Why did producers not tell the DOT it was being used?
  – Formulation was not required to be reported to DOT’s
  – Because the business is competitive REOB had advantages in the blending to PG specification grade
    • REOB requires only 6-10% to convert a PG 64-22 to a PG 58-28.
    • A soft asphalt refinery flux may require 35-75% to do the same thing
What is REOB?

- REOB is composed of the higher boiling components of re-refined engine oil
  - Paraffinic lube (neutral base oil) additive package for oxidation
  - Viscosity improvers (polymer)
  - Anti wear additives such as zinc dithiophosphates MoS.

- These additives are added to protect the engine from damage, oxidation and achieve cold and hot weather performance properties
What is REOB?

- REOB is the highest boiling paraffinic lubricants
  - ~ 15% of the used oil
  - Contains about 4% polymer
- Engine oil additives (zinc and molybdenum) represent about 5% of the REOB.
  - These metal compounds are soluble.
What is REOB?

• Heritage Research has analyzed the REOB in comparison to PG 64-22 using chemical separation testing (Streiter Analysis).

• Streiter separates asphalt into three components.
  – Asphaltenes
  – Resins
  – Oils
<table>
<thead>
<tr>
<th>Oil Fraction</th>
<th>Asphaltenes%</th>
<th>Resins%</th>
<th>Oils%</th>
<th>Viscosity cP @ 50 °C</th>
<th>Pour Point, °C</th>
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</thead>
<tbody>
<tr>
<td>REOB</td>
<td>10.0</td>
<td>31.4</td>
<td>58.6</td>
<td>81</td>
<td>-20</td>
</tr>
<tr>
<td>PG 58-28 (9% REOB)</td>
<td>24.4</td>
<td>38.4</td>
<td>37.2</td>
<td>95</td>
<td>0</td>
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<tr>
<td>PG 58-28 (neat)</td>
<td>27.7</td>
<td>33.6</td>
<td>38.7</td>
<td>122</td>
<td>+9</td>
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<tr>
<td>PG 64-22 (neat)</td>
<td>28.6</td>
<td>33.1</td>
<td>38.3</td>
<td>197</td>
<td>+12</td>
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</tbody>
</table>
Streiter Oil Fraction

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REOB
82 cP
Pour Point -20 C
9% REOB
PG 58-28
92 cP
Pour Point 0 C
PG 64-22 Neat
197 cP
Pour Point +12 C
• REOB is known to reduce Stiffness (S) for the same m-value
• REOB contains about 58% of a lower viscosity dewaxed lubricating oil
• When added to asphalts such as neat PG 64-22 it lowers the stiffness of the heavy vacuum gas oil in the PG 64-22
• There is some wax in conventional asphalts so blends have higher pour points due to reduced wax content
Summary

• REOB is obtained by distillation of used motor oil similar to crude oil distillation which produces asphalt
• Collection and refining is controlled by EPA regulations to prevent contaminants
• REOB represents ~ 15% of used motor oil
• Used since the 1980s
• REOB is composed of dewaxed paraffinic lube and engine additives
• Streiter analysis explains S/m behavior
Thank You!

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