AI’s REOB Task Force

Asphalt Binder ETG

Apr 9-10, 2015
But first a public safety announcement...
Background

- The Asphalt Institute supports the responsible modification of asphalt materials for improved performance and better life cycle costs, but does not endorse any specific or proprietary form of modification.
- AI currently has no official (written) guidance on REOB.
- AI does have information/guidance/studies regarding some modification types (PPA, SEA, PMA)
- REOB TF formed in Summer 2014 under TAC to recommend course of action
  - John Brownie - Chair, Mike Anderson, Sandy Brown, Mark Buncher, Greg Harder, Paul Sohi, Gaylon Baumgardner, Everett Crews, Kevin Hardin, Edgard Hitti, Mark Homer, Gerald Reinke, Bob Hockman, Laurand Lewandowski, Tony Kriech, Matt Corrigan (FHWA)
  - Continues to meet (f-t-f on Feb 3rd and Apr 16th)
  - Monitoring numerous studies (FHWA, WRI, Rutgers, U-Mass, MTE, LTRC, others)
HOW IS REOB MADE?

Slide provided by Safety-Kleen, one of the leading suppliers of REOB in the USA
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www.noranews.org, search on “VTAE”

- Official position paper, 9/5/14
  - “...arbitrary prohibition is not justified.”
  - References 2014 Heritage study
  - New name is Vacuum Tower Asphalt Extender (VTAE)

- Draft spec released 3/3. Accepted comments till 4/3.
  - VTAE is the product of processing used oil using atmospheric distillation followed by vacuum distillation to produce a vacuum residuum meeting the specifications outlined in Table 1.”
  - VTAE shall be homogenous, free from water, not foam when heated to 350º F.

- Table 1
  - Flash Point, COC: min 450ºF (for roofing: min 500ºF)
  - Mass Change, RTFOT: max 1.0%
  - Solubility in Trichloroethylene: min 98.0%
    - Solubility of less than 98.0% is acceptable provided the final asphalt blended product meets the solubility requirements in the specifications
  - Viscosity, 140°F: max 5000 cP
VISCOSITY CURVES FOR TWO DIFFERENT REOB SAMPLES

Slide provided by Everett Crews, MWV

Proposed NORA max, 5000 cP
## The “Controversial” Results

<table>
<thead>
<tr>
<th>Point</th>
<th>Counter-Point</th>
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<tbody>
<tr>
<td>Bitumen containing Engine Oil Residues (EOR) exhibit</td>
<td>Bitumen containing Re-refined Heavy Vacuum Distillate Oil (RHVDO) did not exhibit</td>
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<tr>
<td>- increased physical hardening</td>
<td>- accelerated aging (at RHVDO levels up to 20%)</td>
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<tr>
<td>- lower strain tolerance</td>
<td>- increased asphaltene content with extended PAV aging</td>
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<tr>
<td>- high metals content</td>
<td>- (in a subsequent study) no increased stripping potential at RHVDO levels of 6%</td>
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Connected dots: thermal degradation products (from the oil and oil surfactants in the EOR) are oxidatively labile and the metals could act as oxidation catalysts.
CONTROVERSIES CAN BE RESOLVED

"Conquer fear by becoming wise"
General REOB Info and Findings

• Used to soften PG grade (lowers both high and low end)
  o Added benefit is that UTI can sometimes be increased

• Increase of RAP/RAS has led to softer grades being specified, which as led to increased demand for REOB or other fluxes.

• “Typical” dosages appear to be in the 4-8% range
  o Although some have reported much higher

• Various REOB products may behave differently in asphalt
  o Viscosities can be very different
  o Different dosages needed for same grade drop

• Interaction with base asphalt

• XRF can detect REOB, but cannot reliably quantify it
  o Sample needs to be from tank versus extracted from roadway core
    • Lots of confounders (tire rubber, oil drippings, extraction process)

• A concern by some is that REOB (and other paraffinic additives) may cause binder to become more m-controlled under aging
REOB Task Force – Some Products

• **Planned:** Document on REOB Modification
  – Hopeful completion by Fall 2015
  – Likely modeled after AI’s PPA Informational Series (IS-220)
  – Balanced, state-of-the-knowledge, based on science
  – Help agencies make informed decisions
  – Draft outline
    • Overview: How is REOB used. Why this document
    • What REOB is (and isn’t)
      – Re-refining industry, production, CAS#, properties (NORA spec)
    • Synthesize literature on performance impacts
    • Include pertinent HS&E info gathered from NORA
    • Answers to FAQs from agencies
    • Guidelines/Recommendations (where

• **Current:** Repository of REOB information on AI’s website
Engineering

Asphalt Institute engineers have a long tradition of promoting the use and quality of asphalt to user agencies through support and technology transfer. In this Engineering section you will find a wide variety of technical information about the asphalt industry categorized into five very broad topical areas listed to the left. These are further divided into more specific categories. Content includes documents, reports, articles, FAQs, links, etc. Also note our Glossary of Terms below and our State Binder Spec Database above.

Glossary of Terms

Longitudinal Joint Information

Re-refined Engine Oil Bottom Residue (REOB) Information

MSCR Information

TEA-21 – Transportation Equity Act for the 21st Century Funding Tables
All presentations are downloadable, along with most papers. In a few cases, just the citation is provided for a journal paper.
2015 TRB Session on REOB

Hope to add 6+ hrs of REOB presentations from Apr 2015 Binder ETG mtg.

REOB Manufacturers Info

2014-03 – EcoAddz MSDS
Safety-Kleen Refining of Asphalts
Safety-Kleen VDB Eco ADDZ Michigan DOT
Many Names in the Literature for Re-refined UEO Products as Asphalt Modifier

• Re-refined Vacuum Tower Bottoms (RVTB)
  o Heritage Research Group, 2014

• Waste Engine Oil Residue (WEOR), Waste Engine Oil (WEO) Residue, Engine Oil Residue (EOR)
  o Simon Hesp (Queens Univ.)

• Waste Oil Distillation Bottoms (WODB)
  o Herrington (1993)

• Re-Refined Heavy Vacuum Distillation Oil (RHVDO), Re-refined Heavy Vacuum Distillate Bottoms (RHVDB)
  o D’Angelo

• Asphalt Flux, Asphalt Extender, Asphalt Blowdown, Vacuum Tower Asphalt Binder (VTAB), Other names above, now firm on VTAE
  o National Oil Recyclers Association (NORA)
Some Research on **Straight WEO or UMO (Not Re-refined)** as an Asphalt “Rejuvenator”

- Referred to as
  - Waste Engine Oil (WEO)
    - DeDene et al (2011, 2014)
  - Used Motor Oil (UMO)
    - Oliveira et al (2013)
- Additional WEO Studies Referenced in the Literature
- These studies say that straight WEO or UMO can be used as a “rejuvenator”.

- It appears that a challenge of synthesizing the published literature on REOB will be the lack of information on the additive product in some cases.
Loose Terminology Leads to Industry Confusion

- The many names for REOB
- Non re-refined products (waste oil) getting lumped into re-refined products
- “rejuvenator” vs “recycling agent” vs “softening agent” vs “flux” vs “extender”
- “Modifiers” vs “additives”?

Terms get used interchangeably
Summary

• No official AI position at this time on REOB
  o Pending informational document

• Guidance from IS-220, “Polyphosphoric Acid Modification of Asphalt” (2005) still valid
  o “The Asphalt Institute supports the responsible modification of asphalt materials for improved performance and better life cycle costs, but does not endorse any specific or proprietary form of modification. Furthermore, the Asphalt Institute encourages the continuing development of performance-related specifications to replace recipe-type binder specifications wherever feasible.”
Questions?

Global, International, Regular, Associate and Canadian members

Affiliate and Commercial members