

AI's REOB Task Force

Asphalt Binder ETG

Apr 9-10, 2015

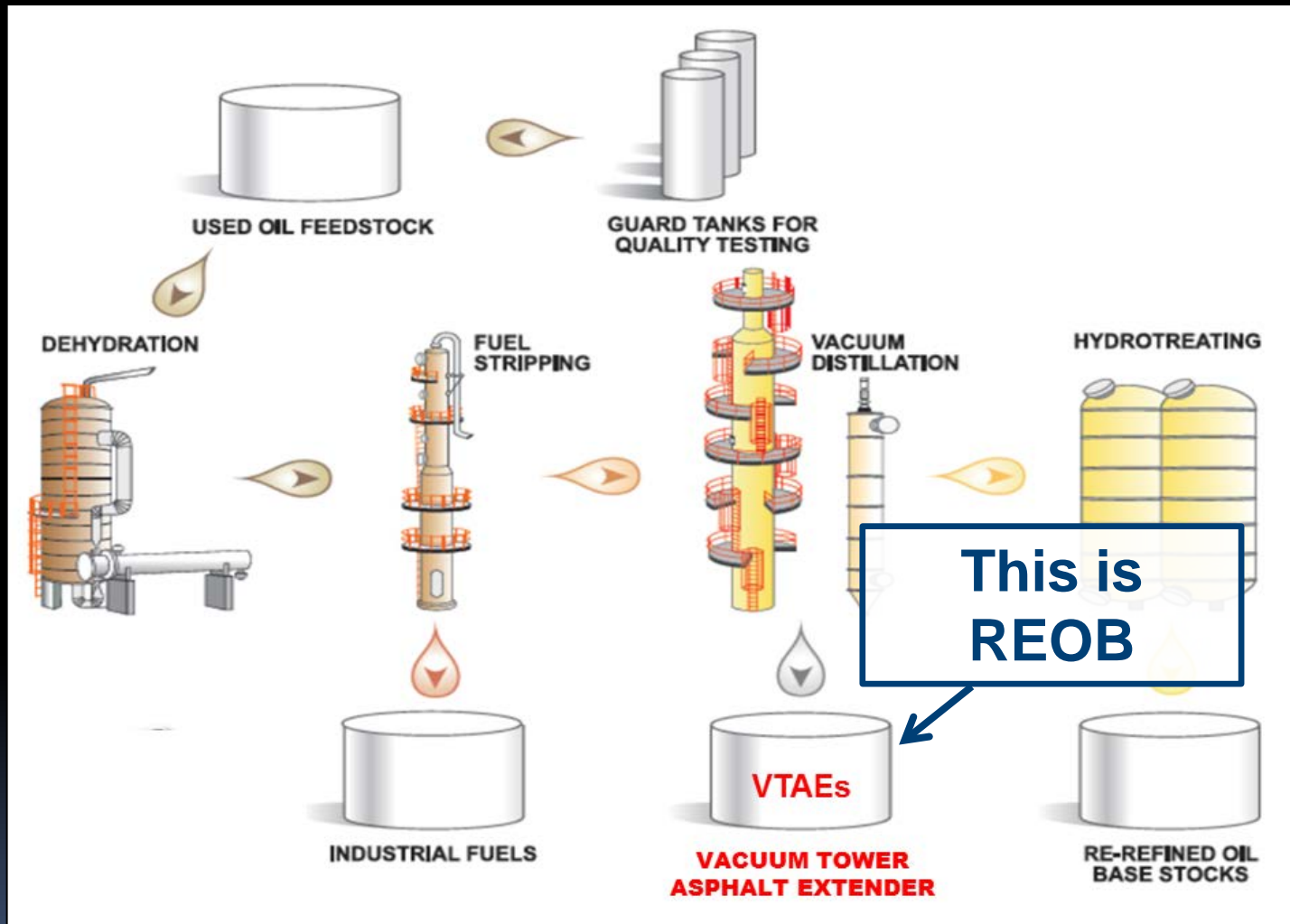
But first a public safety announcement...



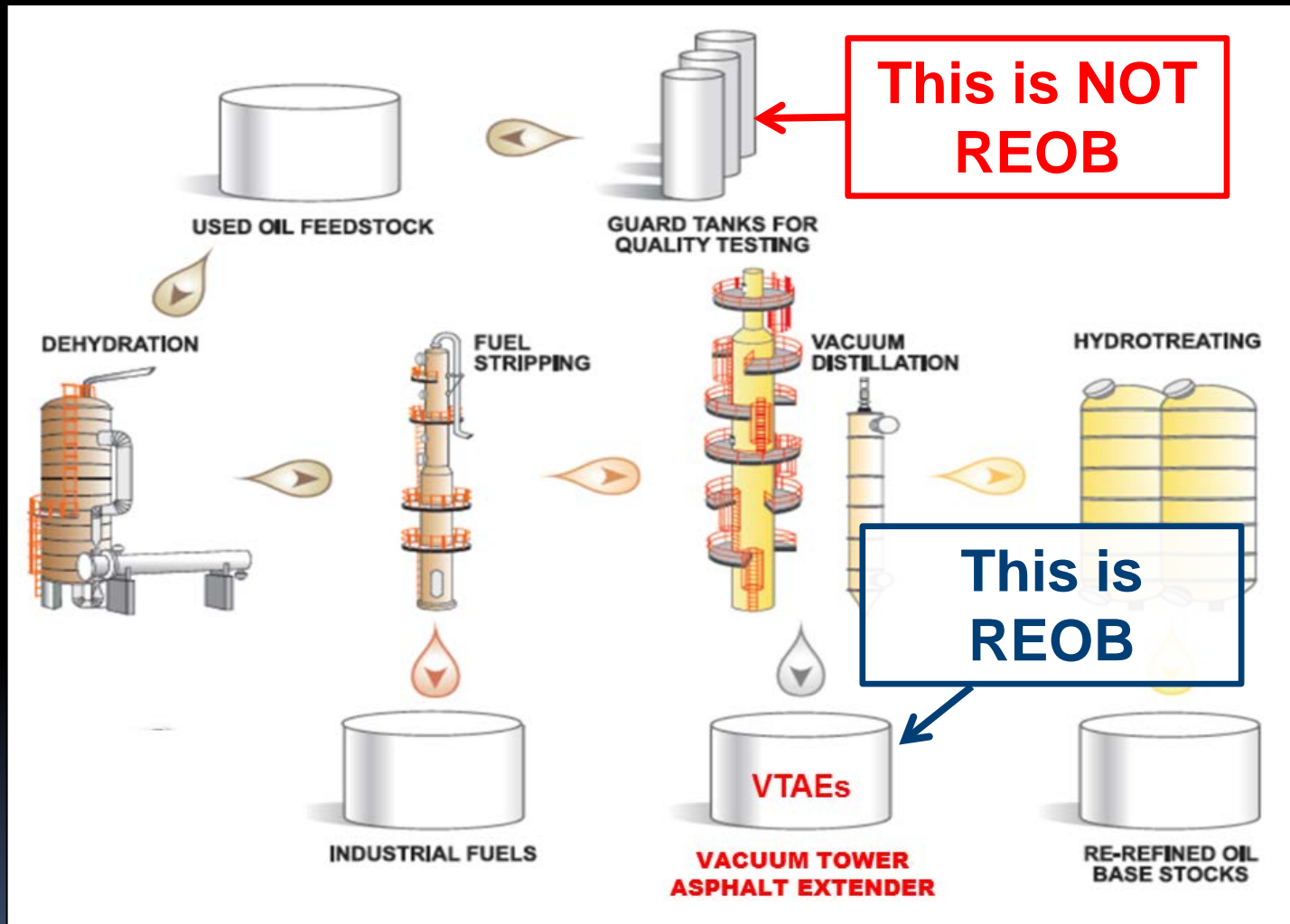
Background

- 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?



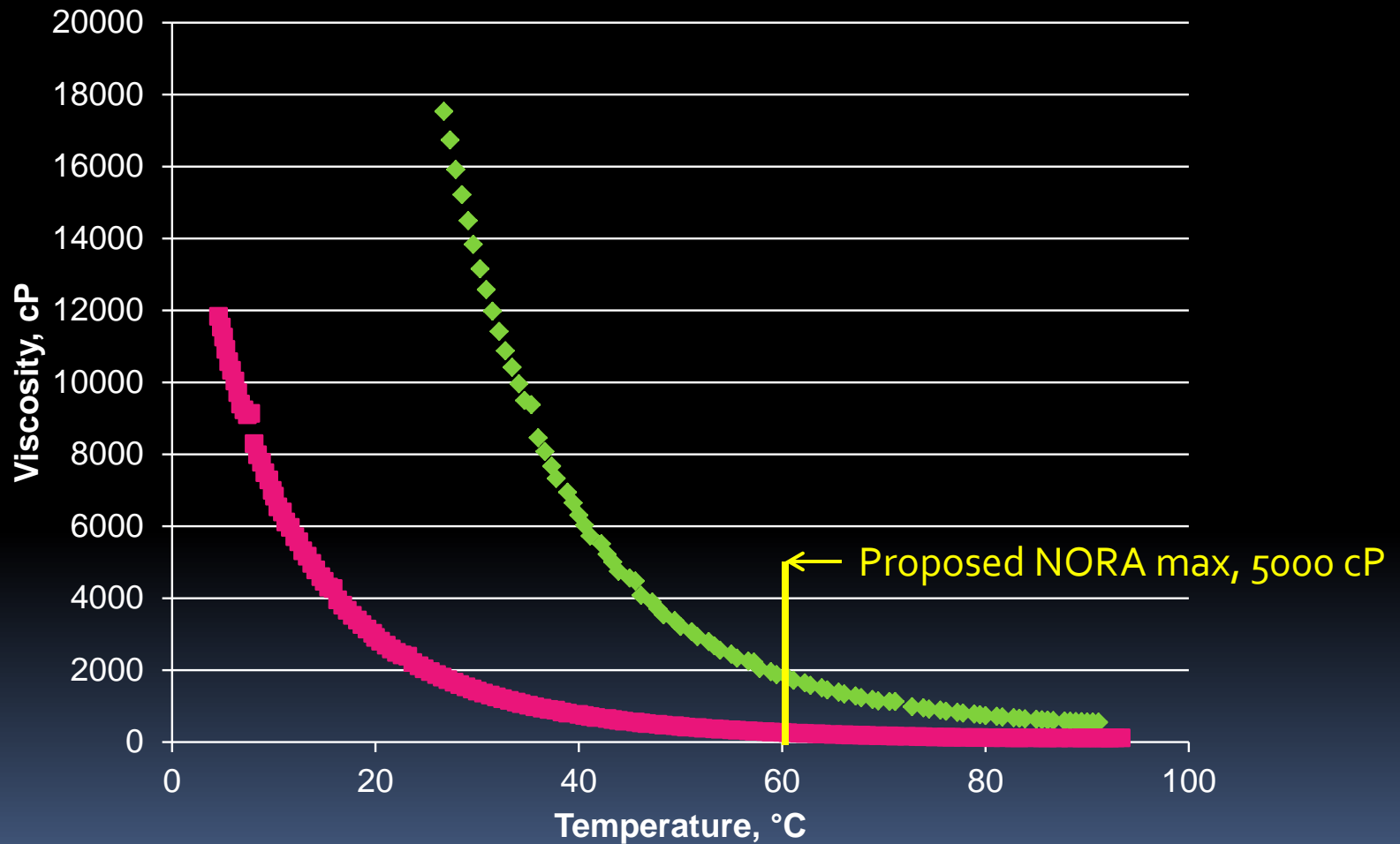
HOW IS REOB MADE?



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 350° F.
 - Table 1
 - Flash Point, COC: min 450°F (for roofing: min 500°F)
 - 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

THE “CONTROVERSIAL” RESULTS

POINT

Bitumen containing Engine Oil Residues (EOR) exhibit

- increased physical hardening
- lower strain tolerance
- high metals content

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

COUNTER-POINT

Bitumen containing Re-refined Heavy Vacuum Distillate Oil (RHVDO) did not exhibit

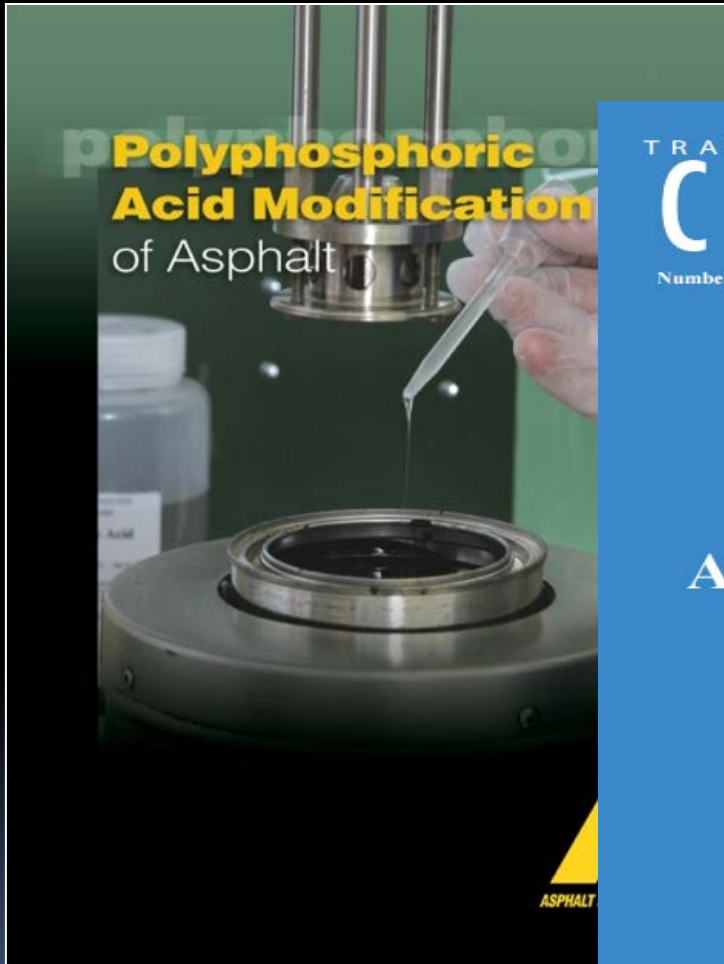
- accelerated aging (at RHVDO levels up to 20%)
- increased asphaltene content with extended PAV aging
- (in a subsequent study) no increased stripping potential at RHVDO levels of 6%

Hesp, S. et.al., “X-Ray Fluorescence Detection...,” *Intl J. Pave. Engineering*, 2010, 11, 541.
D’Angelo, J. et.al., “Asphalt Binder Modification...,” *Can.Tech. Asphalt Assoc.*, 2012, 57, 257.

Slide provided by Everett Crews, MWV

CONTROVERSIES CAN BE RESOLVED

“Conquer fear by becoming wise”



TRANSPORTATION RESEARCH
CIRCULAR
Number E-C160 January 2012

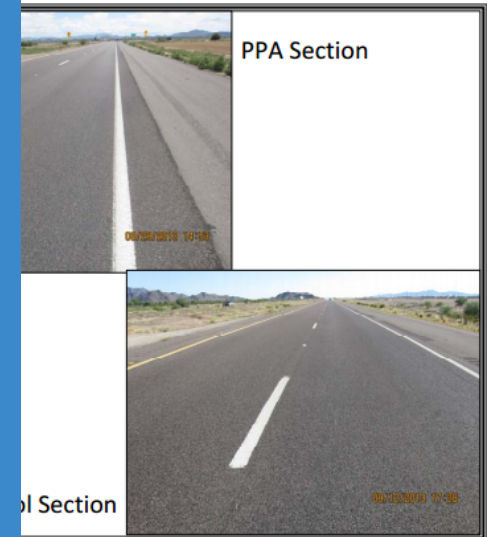
**Polyphosphoric
Acid Modification of
Asphalt Binders**
A Workshop

April 7–8, 2009
Minneapolis, Minnesota

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Performance of Asphalt Mixtures Containing Polyphosphoric Acid

Report No. 0001946-1



September 2014

es, Inc.

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Slide provided by Everett Crews, MWV

General REOB Info and Findings

- Used to soften PG grade (lowers both high and low end)
 - 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
 - Although some have reported much higher
- Various REOB products may behave differently in asphalt
 - Viscosities can be very different
 - Different dosages needed for same grade drop
- Interaction with base asphalt
- XRF can detect REOB, but cannot reliably quantify it
 - 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

[Design](#)

[Maintenance & Rehab](#)

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[Health](#)

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](#)



[Research Lab](#)

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Re-refined Engine Oil Bottom Residue

The Asphalt Institute's Technical Advisory Committee has formed a task force on re-refined engine oil bottoms (REOB) residue. The objectives of this REOB residue task force are to:

Learn more about REOB materials, processing, effects/benefits when blended in asphalt and best practices.
Recommend a course of action for Asphalt Institute that could include sponsoring a symposium, conducting research and/or developing information and guidance on REOB residue modification that may be similar to IS-220 for PPA modification.
Toward those objectives, the task force has developed this repository of REOB information and wanted to share it with industry.

Members:

As an Asphalt Institute member you may [submit Technical Question to AI Engineering Staff](#)
You may also view all of the [Asphalt Institute Regional Engineer Quarterly Reports](#)

Re-refined Engine Oil Bottom Residue Information:

Published Papers and Reports

1993 – RTR paper on WODB as extender, by Herrington et al
2009 – CTAA paper, Validation of DENT and ExBBR, Hesp et al
2009 – TRB paper, AC Loss Tangent as Performance Indicator for Thermal Cracking – Soleimani, Hesp et al
2010 – IJPE paper – X Ray Fluorescence of WEOR in asphalt and its effect on cracking – Hesp Shurvell
2011 – CTAA paper, Effects of EOR on AC – Rubab, Hesp et al
2012 – MAIREPAV paper – Waste Engine Oil Residue in Asphalt Cement – Hesp Shurvell
2012 – CTAA paper – Asphalt Binder Modified with RVHDO, by D'Angelo et al
2013 – CTAA paper – Performance Properties of Mixes Modified with RHVDB, by D'Angelo et al
2013 IJPRT paper on UMO as rejuvenator additive, by Oliveira et al
2013 – Dissertation at Univ of WI-Madison – Investigation of Effect of Oil Modification on Critical Characteristics of Binders, by Golalipour
2014 – TRB paper on Effects of WEO, 14-0529, Hesp
2014 – CTAA paper on AC Acceptance Methodologies in Ontario, by Brown
2014 – Heritage RG Report to ILDOT on Chemical Analysis of AC with RVTB and Effect on Mix Performance
2014 - IJPRT paper on WEO as additive, by DeDene et al
2014 – CTAA paper – Eval of Oil Modification on Binder Thermal Cracking and Aging, by Golalipour and Bahia
2014 – CTAA paper, Impact of Blended RVTB on HMA Mix Performance, by Wielinski, Kriech, et al
Proposed AASHTO Problem Number 2016-D-04, The Impacts on Pavement Performance from Changes in Asphalt Production

Research Lab

Engineering

Education

All presentations are downloadable, along with most papers. In a few cases, just the citation is provided for a journal paper.

Presentations at Public Industry Meetings

2012 – Hesp ppt, WEO residue detection in asphalt

2013 – DAngelo ppt, Asphalt Modification with Re-refined Heavy Vacuum Distillate

2014, Oct – Grzybowski ppt at RMAUPG, VTAE Oils in Asphalt

2014 – September – Buncher PowerPoint_AI Update to ETG on REOB TF

2014 – Sept – Reinke ppt to FHWA ETG Meeting, Impact of REOB and Other Additives on Aged Binder and Mix Properties

**2015 TRB
Session
on REOB**

2015 – January – REOB Workshop at TRB – Moderator

2015 – January – REOB Workshop at TRB – Heritage Research Group

2015 – January – REOB Workshop at TRB – TFHRC-FHWA

2015 – January – REOB Workshop at TRB – Western Research Institute

2015 – February – Reinke ppt for AI, Summary of Testing and Distress Survey for Olmsted 112 Test Sections in MN

2015 – February – Bennert ppt for AI, Rutgers REOB Research

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

2014 – Position Paper of NORA, An Association of Responsible Recyclers, Concerning Vacuum Tower Asphalt Extender

Many Names in the Literature for Re-refined UEO Products as Asphalt Modifier

- Re-refined Vacuum Tower Bottoms (RVTB)
 - Heritage Research Group, 2014
- Waste Engine Oil Residue (WEOR), Waste Engine Oil (WEO) Residue, Engine Oil Residue (EOR)
 - Simon Hesp (Queens Univ.)
- Waste Oil Distillation Bottoms (WODB)
 - Herrington (1993)
- Re-Refined Heavy Vacuum Distillation Oil (RHVDO), Re-refined Heavy Vacuum Distillate Bottoms (RHVDB)
 - D'Angelo
- Asphalt Flux, Asphalt Extender, Asphalt Blowdown, Vacuum Tower Asphalt Binder (VTAB), Other names above, now firm on VTAE
 - 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.

- 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

- No official AI position at this time on REOB
 - Pending informational document
- Guidance from IS-220, “Polyphosphoric Acid Modification of Asphalt” (2005) still valid
 - “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

