

AI's REOB Task Force

Asphalt Binder ETG

Sept 15-16, 2015

- 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 Summer 2014 under TAC to develop an Informational Series (IS) document on REOB modification
 - 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)

AI EOB TF Activities and Timeline

- Last F-T-F meeting was Aug 20th in Lake Tahoe
- Last WebEx meeting was Sept 10th
- Next F-T-F meeting in Lexington KY on Sept 29-30
 - Review 1st draft of document in its entirety
- 2-hr seminar hosted by REOB TF in Dec at AI Annual Mtg to address gaps in knowledge
- Goal of publishing document in May 2016

- Maintain AI's public repository of REOB info.
 - Publications, presentations at public mtgs , manufacturers info

AI's REOB webpage

- NCHRP 09-60 [Anticipated] The Impacts on Pavement Performance from Changes in Asphalt Production

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 – 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 April Binder ETG, 01 Mohammad LTRC RAS and or RAP
- 2015 April Binder ETG, 02 Ahearn AASHTO REOB Task Force update
- 2015 April Binder ETG, 02 Ahearn Atypical raveling
- 2015 April Binder ETG, 03 Buncher AI REOB Task Force Update
- 2015 April Binder ETG, 04 Reinke MTE REOB & Other Paraffinic Oils
- 2015 April Binder ETG, 05 Mogawer UMass Dartmouth VTAE
- 2015 April Binder ETG, 06 Gibson FHWA REOB
- 2015 April Binder ETG, 07 Bennert Rutgers REOB study
- 2015 April Binder ETG, 08 JP Planche WRI REOB
- 2015 Video of presentation by Safety Kleen on VTAEs at OHMPA's 2015 Road Tour
- 2015 Aug AASHTO SOM REOB Task Force

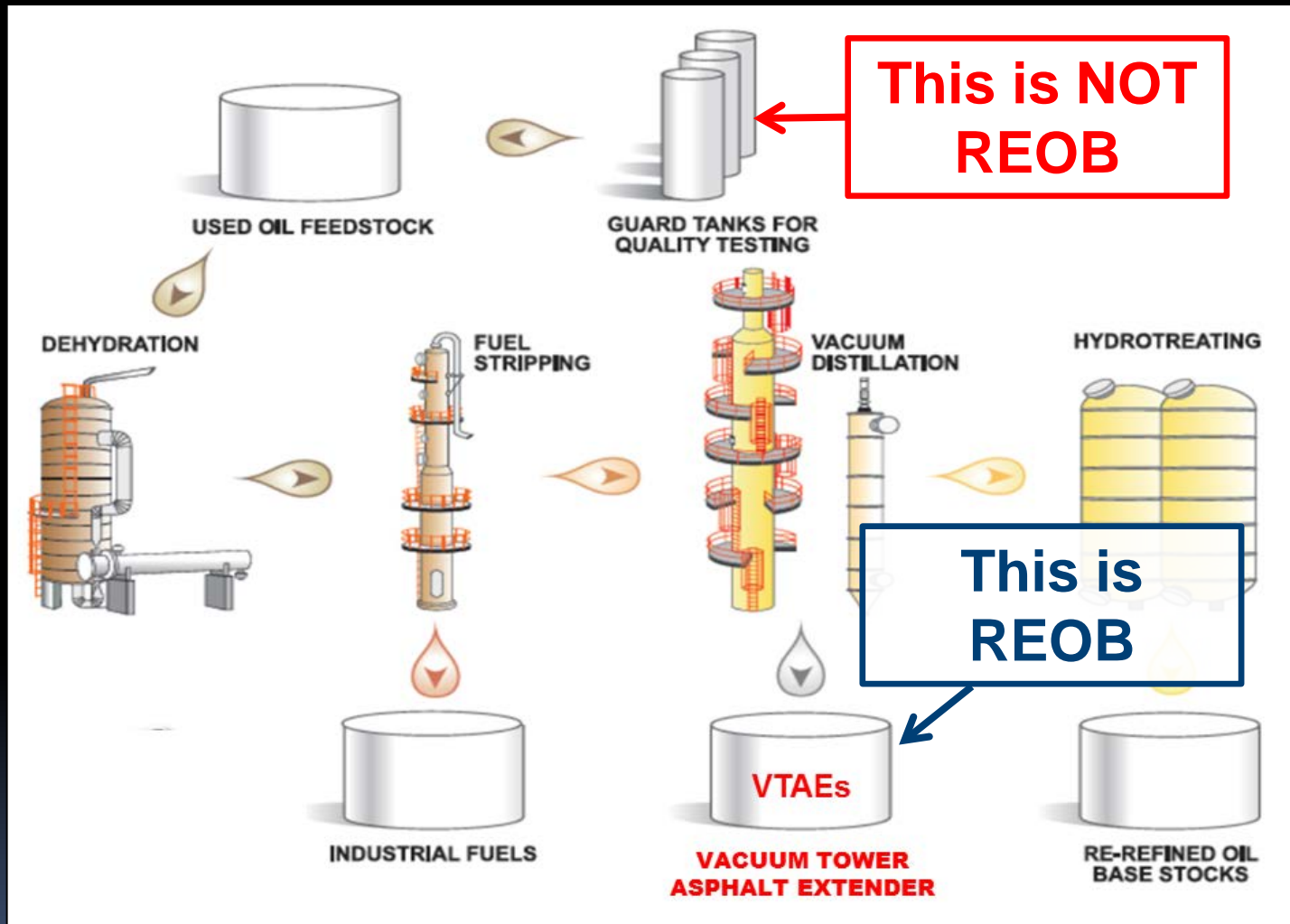
REOB Manufacturers Info

- 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

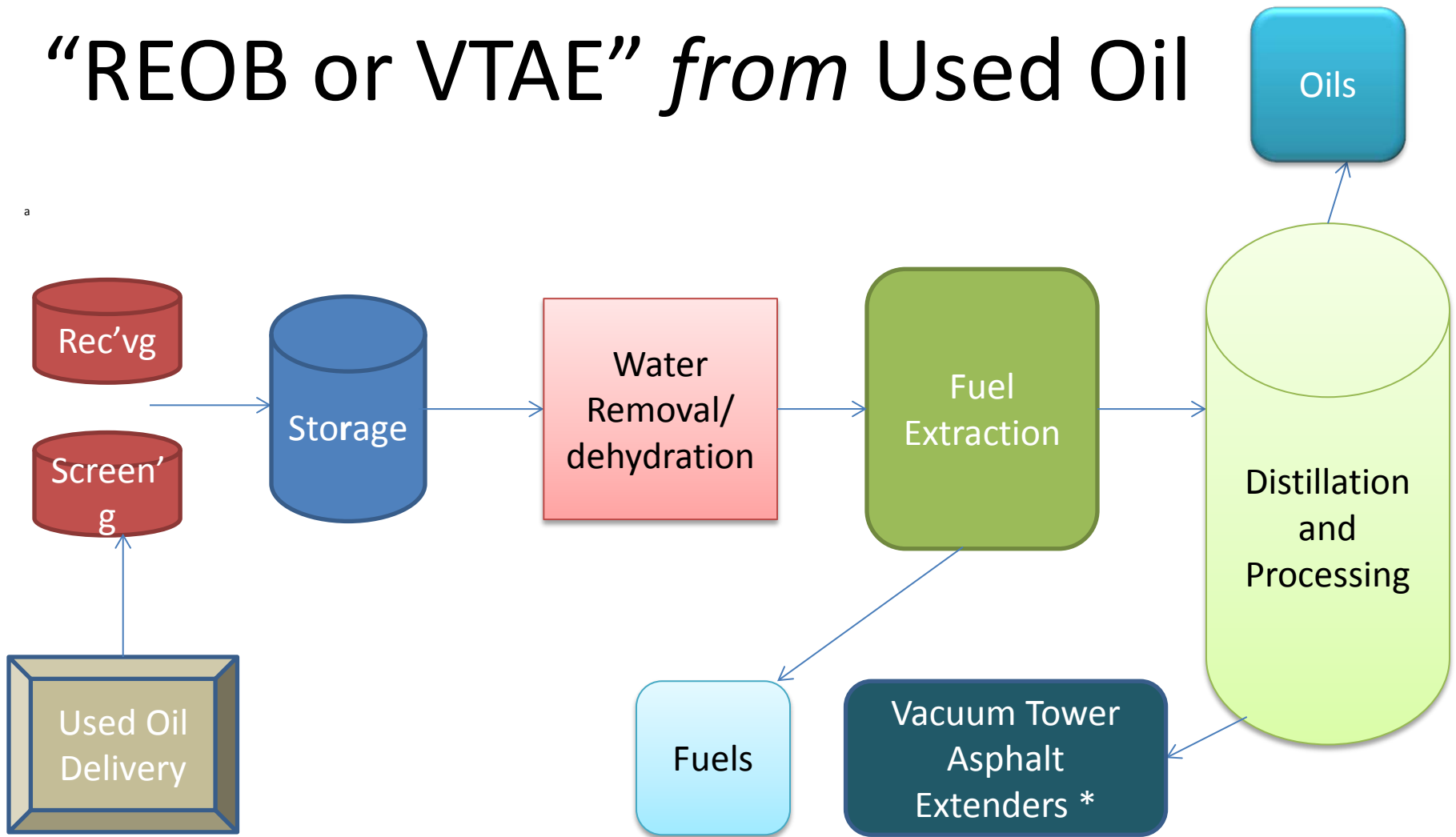
Outline of Draft REOB Document

- General Overview & Intent of Informational Document
- REOB Production and Manufacturing, Material Characteristics and Composition
- Literature Review of REOB in Asphalt and Performance
- HSE Aspects
- Considerations for an Improved Binder Spec
- Frequently Asked Questions by Agencies and Answers

HOW IS REOB/VTAE MADE?



“REOB or VTAE” *from* Used Oil



This slide from AASHTO SOM Recycled Engine Oil TF Report to SOM, Aug 2015

Speaker notes: “...made a conscious decision to present this as REOB, so that it is clear that we are dealing with a very wide range of materials and properties.” “...REOB is a refined product – with many options on its manufacture and characteristics.”

- 17 Research papers reviewed
 - First 16 on performance, 17th on detection
 - All published and/or peer reviewed
 - One in 1993, others from 2009-2015
 - Listed on AI's REOB webpage
 - By academia, consultants, REOB manufacturers, agencies
 - Some info in multiple publications
 - EOB dosages varied: 5-20%.
 - Often very little material characterization of REOB
- 7 papers suggest the use of REOB is detrimental to pavement performance
- 7 papers suggest the use of REOB is not detrimental and may enhance pavement performance
- 2 papers looked at waste engine oil (not re-refined)
 - 1 was favorable when used with 100% RAP
 - 1 was generally not favorable

1. Waste Oil Distillation Bottoms As Bitumen Extenders, **1993 RTR**

P.R. Herrington, V.K. Dravitzki, C.W.B. Wood, and J.E. Patrick

2. Five Year Performance Review of a Northern Ontario Pavement Trial: Validation of Ontario's Double-Edge-Notched Tension Test (DENT) and Extended Bending Beam Rheometer (BBR) Test Methods, **2009 CTAA**

S.A.M Hesp, S.N. Genin, D. Scafe, H.F. Shurvell and S. Subramani

3. Asphalt Cement Loss Tangent as Surrogate Performance Indicator for Control of Thermal Cracking, **2009 TRB**

Abdolrasoul Soleimani, Shanan Walsh, and Simon A. M. Hesp

4. X-ray Fluorescence Detection of Waste Engine Oil Residue In Asphalt and Its Effect on Cracking In Service, **2010 IJPE**

Simon A. M. Hesp and Herbert F. Shurvell

5. Oxidative Aging Of Asphalt Cements From an Ontario Pavement Trial, **2011 IJPE**

Logan Wright, Amit Kanabar, Eric Moul, Syed Rubab, and Simon Hesp

6. Effects of Engine Oil Residues on Asphalt Cement Quality, **2011 CTAA**

Syed Rubab, Kezia Burke, Logan Wright, and Simon Hesp, Pamela Marks and Chris Raymond – Ontario Ministry of Transportation

7. Waste Engine Oil Residue in Asphalt Cement, **2012 MAIREPAVE**

S.A.M. Hesp and H.F. Shurvell

8. Asphalt Binder Modification with Re-Refined Heavy Vacuum Distillation Oil (RHVDO), **2012 CTAA**

John D'Angelo, Ken Grzybowski, and Steve Lewis

9. Evaluation of the Performance Properties of Asphalt Mixes Produced with Re-refined Heavy Vacuum Distillate Bottoms, **2013 CTAA**

John A. D'Angelo, Ken Grzybowski, Steve Lewis, and Rodney Walker

10. Pushing the Asphalt Recycling Technology to the Limit, **2013 IJPRT**

Joel R. M. Oliveira, Hugo M.R.D. Silva, Carlos M.G. Jesus, Liliana P.F. Abreu, and Sara R.M. Fernandes

11. Investigation of the Effect of Oil Modification on Critical Characteristics of Asphalt Binders, **2013 Dissertation Univ of WI-Madison**

Amir Golalipour

12. Effect of Waste Engine Oil Residue on Quality and Durability of SHRP Materials Reference Library Binders, **2014 TRB**

Kelli-Anne N. Johnson and Simon A. M. Hesp

13. The Performance of Aged Asphalt Materials Rejuvenated with Waste Engine Oil, **2014 IJPRT**

Christopher D. DeDene and Zhanping You

14. Evaluation of Oil Modification Effect on Asphalt Binder Thermal Cracking and Aging Properties, **2014 CTAA**

Amir Golalipour, Hussain Bahia

15. The Impact of Asphalt Blended with Re-refined Vacuum Tower Bottoms (RTVB) and Its Effect on HMA Mixture Performance, **2014 CTAA**

Jason C. Wielinski, Anthony J. Kreich, Gerald A. Huber, Andreas Horton, Linda V. Osborn, Heritage Research Group

16. Analysis of Vacuum Tower Asphalt Extender and Effect on Bitumen and Asphalt Properties, **2015 RMPD**

Jason C. Wielinski, Anthony J. Kreich, Gerald A. Huber, Andreas Horton, Linda V. Osborn, Heritage Research Group

17. Analysis of Asphalt Binders for Recycled Engine Oil Bottoms by X-ray Fluorescence Spectroscopy, **2015 TRB**

Terry S Arnold, A Shastry, FHWA Editors

Sample Findings from First Published Paper in 1993

1. Waste Oil Distillation Bottoms As Bitumen Extenders

P.R. Herrington, V.K. Dravitzki, C.W.B. Wood, and J.E. Patrick

- Calls it “Waste Oil Distillation Bottoms”
- Blends had 9% and 20% WODB, compared to control of equal pen
- All WODB blends showed similar or positive effects relative to control, except for lower ductility
- Displayed similar field performance (up to 14 months)
- No constructability issues
- Mentioned considerable variation in WODB physical properties over 13 months of monitoring production

- Use is detrimental – papers 2,3,4,5,6,7,12
 - All by Hesp et al
 - Current Superpave testing/specification doesn't properly predict field performance
 - Need for additional aging/testing protocols
 - Poor field performance of binders containing zinc
 - 15% REOB estimated in binder
 - Proposed extended aging/new test methods (Dent, ExBBR) would have predicted poor performance
- Waste engine oil use is detrimental – paper 13
 - Binder testing of virgin/RAP/WEO showed reduced aging characteristics
 - Mix testing showed an increase in rutting and a reduction in TSR strengths

- Use is not detrimental – papers 1,8,9,11,14,15,16
 - Binder testing showed improved properties with most blends containing 10% or less REOB (some binder testing in paper 8 was done at 20%) when compared to conventional binders
 - Additional aging was included
 - Mixture testing completed at 10% or less REOB - indicated equal or improved laboratory mixture properties when compared to control mixtures
 - Limited field data
- Waste engine oil use is not detrimental – paper 10
 - WEO used in 100% RAP mixtures as a rejuvenator
 - Equivalent laboratory mixture performance compared to conventional mixture

Many Names in the Literature for REOB/VTAE

- 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), Others, Now VTAE
 - National Oil Recyclers Association (NORA)

Currently, “REOB” term prevalently used by highway agencies and “VTAE” prevalently used by manufacturers

National Oil Recyclers Association (NORA) has developed two draft ASTM specs on VTAE (Roofing & Paving)

- Draft Specs on NORA's website
- Brought to ASTM meeting in June
- Spec development and ballot process expected to take ~18 mos.
- “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

- New document had been developed & approved by the NEAUPG **requiring all non-bituminous components added to a binder to be identified.** Reporting shall be as follows:
 - Any non-bituminous components added prior to the point where samples are taken for certification purposes must appear on the Certificate of Analysis (COA).
 - Any non-bituminous components added after the certification sample point but prior to transport must appear on the Bill of Lading.
 - Any non-bituminous components added at the HMA plant must appear on the HMA producer's documentation.
 - The reporting of all non-bituminous components shall only disclose their presence and shall **not disclose their dosage** as this is considered proprietary.
 - Any "special handling" requirements shall remain on the Bill of Lading.
 - The attached list shall **not be considered as all-inclusive** but provides some examples of the different types of non-bituminous components.
 - The list shall also **not be considered as any type of an approved list** of additives – please consult with each individual agency to insure their acceptance for the additives use.
- It's unclear if and how all NEAUPG States will require this disclosure; however, many have indicated they would.

ETG

- New REOB related task force formed under the FHWA Binder ETG at April mtg.
 - Led by Geoff Rowe
- The TF was asked to work on the following:
 - Synthesize & summarize information presented at the April 2015 ETG
 - Include discussion on use of delta Tc or the GR parameter to evaluate blended binders containing REOB, RAS, RAP, RAs, etc.
 - Include discussion on extended lab aging (i.e. PAVx2)
 - Draft “white paper” has been completed by Geoff Rowe, presented to Binder ETG on Sept 15

AASHTO

- REOB Task Force Presentation to SOM in August
- Subcommittee on Research accepted RNS in response to the REOB issue
 - NCHRP 09-60: *The Impacts on Pavement Performance from Changes in Asphalt Production*
 - Expert panel formed
 - Expected funding is \$1,000,000

AASHTO Report: Status of use of REOB

- Roughly half the States are receiving REOB modified binders
 - AASHTO Survey showed 20 of 43 States
 - FHWA detection testing showed 18 of 37 States
- State specifications and expectations:
 - Specific approval 2%
 - Conditional Approval 5%
 - Prohibit 22%
 - Silent – use general PG standards 71%
- Most states consider REOB a modifier of asphalt binder.
- Industry has not uniformly reported REOB as a modifier.

Summary: AI and REOB

- AI Working on REOB Informational Document
 - Publication goal of May 2016
 - Modeled after AI's PPA Informational Series (IS-220)
 - Balanced, state-of-the-knowledge, based on science
 - Help agencies make informed decisions
- Until then, AI has no official position on REOB
- 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

