FHWA Update

Delaware Winter Workshop

THOMAS HARMAN, MANAGER
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF TECHNICAL SERVICES –
FHWA RESOURCE CENTER


Backgrounds courtesy of
Larry A. Arneson *(FHWA-retired)*
http://www.highwaterlines.com/photography/

Moving Forward

Uncertainty	• Funding, HTF • Legislation
Change	• Rulemaking • Staffing
Leadership	• Technically • Programmatically

Our Visit Today

MAP-21

Legislative Process

The 3 R's

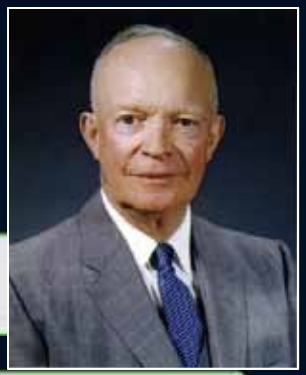
Moving to Performance…

MAP-21

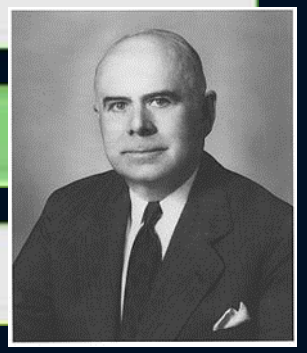
MOVING AHEAD FOR PROGRESS IN THE 21ST CENTURY

HTTP://WWW.DOT.GOV/MAP21

History of Highway Bills



- 1956 • Federal-Aid Highway Act
- • ...**Highway Only** Bills
- 1982 • **Surface Transportation** Assistance Act
- 1987 • Surface Transportation & Uniform Relocation Assistance Act
- 1991 • Intermodal Surface Transportation Efficiency Act **(ISTEA)**
- 1998 • Transportation Equity Act fro the 21st Century **(TEA-21)**
- 2005 • Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users **(SAFETEA-Lu)**
- 2012 • Moving Ahead for Progress in the 21st Century Act **(MAP-21)**



Thomas "Chief" MacDonald

2009 ARRA

2 Words

Authorization

- Legislative power of the US Congress to **authorize the activities** of agencies and programs with the executive power of the President

Appropriation

- Legislative power of the US Congress to **authorize the government to spend money** with the executive power of the President

Snap Shot

Authorization	• MAP-21 Expired 9/30/2014 • CR to 12/11/2014 • CR to 05/31/2014
Appropriation	• $40.3 Billion under FY15 Omnibus Bill (FY14 levels) • Thru September 30, 2015

Our Visit Today

MAP-21

Legislative Process

The 3 R's

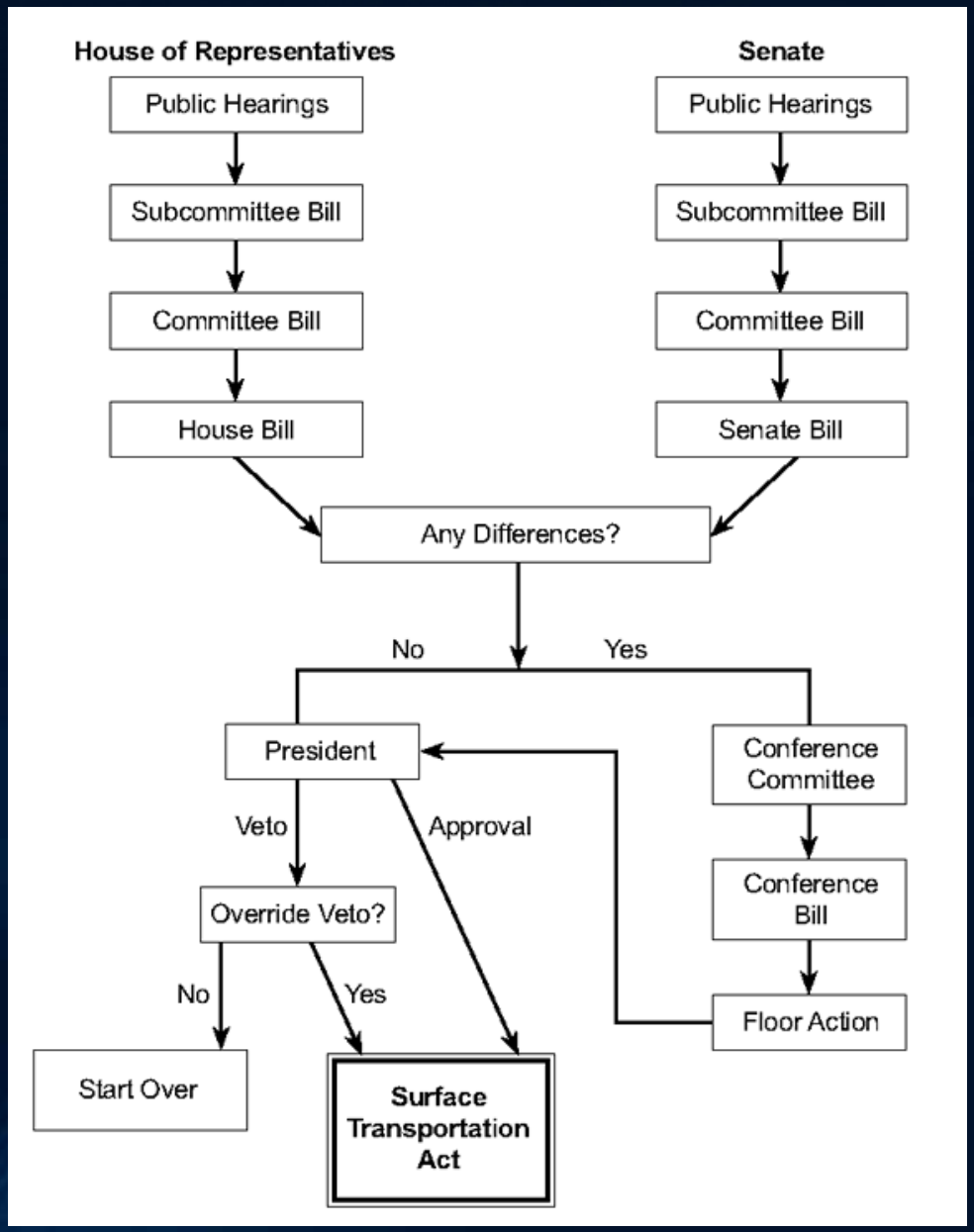
Moving to Performance…

Legislative Process

FHWA Office of Policy & Government Affairs
http://www.fhwa.dot.gov/policy/

Figure 1. Congressional Procedures *(simplified, typical process)*

US DOT FHWA
Office of Policy & Government Affairs



http://www.fhwa.dot.gov/policy/olsp/financingfederalaid/authact.cfm#fig1

I'm Just a Bill (Schoolhouse Rock!) http://www.youtube.com/watch?v=tyeJ5503Elo

Our Visit Today

MAP-21

Legislative Process

The 3 R's

Moving to Performance…

The 3 R's

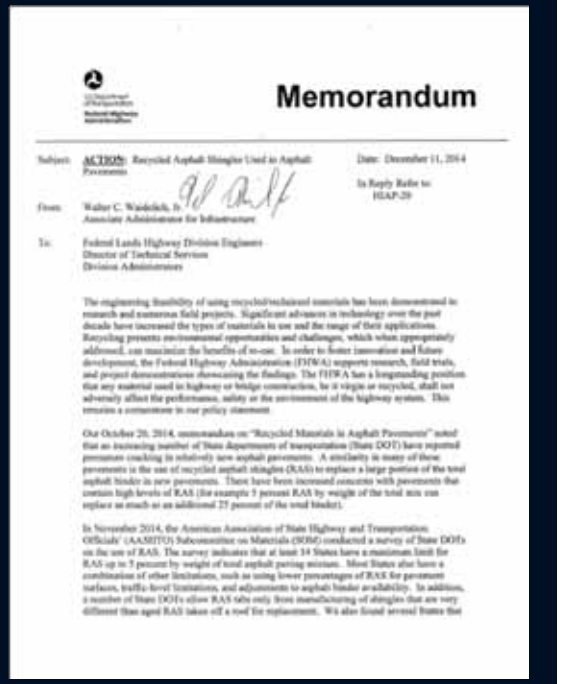
The Use of Reclaimed Asphalt Shingles (RAS) in Asphalt Pavements

FHWA Memo
Associate Administrator HIF
Date: December 11, 2014

To: Division Offices

"We are asking each division office to meet with their respective State DOT by January 30, 2015…"

"If performance related concerns are identified, divisions must ensure that AASHTO standard PP 78-14 is required for future Federal-aid projects…"



Memorandum

Subject: ACTION: Recycled Asphalt Shingles Used in Asphalt Pavements

Date: December 11, 2014

In Reply Refer to: HIAP-20

From: Walter C. Waidelich, Jr.
Associate Administrator for Infrastructure

To: Federal Lands Highway Division Engineers
Director of Technical Services
Division Administrators

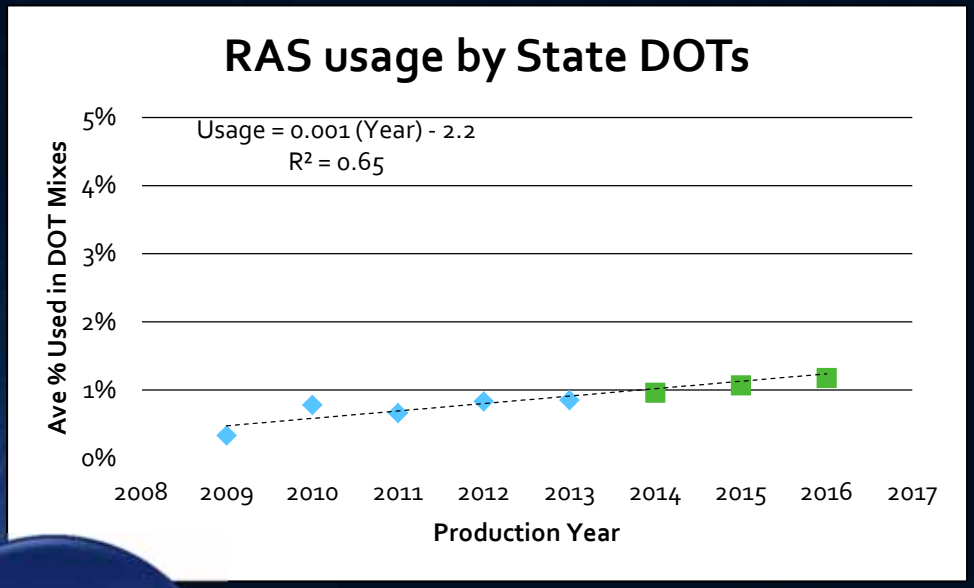
The engineering feasibility of using recycled/reclaimed materials has been demonstrated in research and numerous field projects. Significant advances in technology over the past decade have increased the types of materials in use and the range of their applications. Recycling presents environmental opportunities and challenges, which when appropriately addressed, can maximize the benefits of re-use. In order to foster innovation and future development, the Federal Highway Administration (FHWA) supports research, field trials, and project demonstrations showcasing the findings. The FHWA has a longstanding position that any material used in highway or bridge construction, be it virgin or recycled, shall not adversely affect the performance, safety or the environment of the highway system. This remains a cornerstone in our policy statement.

On October 20, 2014, memorandum on "Recycled Materials in Asphalt Pavements" noted that an increasing number of State departments of transportation (State DOT) have reported premature cracking in relatively new asphalt pavements. A similarity in many of these pavements is the use of recycled asphalt shingles (RAS) to replace a large portion of the total asphalt binder in new pavements. There have been increased concerns with pavements that contain high levels of RAS (for example 5 percent RAS by weight of the total mix can replace as much as an additional 25 percent of the total binder).

In November 2014, the American Association of State Highway and Transportation Officials' (AASHTO) Subcommittee on Materials (SOM) conducted a survey of State DOT's on the use of RAS. The survey indicates that at least 34 States have a maximum limit for RAS up to 5 percent by weight of total asphalt paving mixture. Most States also have a combination of other limitations, such as using lower percentages of RAS for pavement surfaces, traffic level limitations, and adjustments to asphalt binder availability. In addition, a number of State DOTs allow RAS tabs only from manufacturing of shingles that are very different than aged RAS taken off a roof for replacement. We also found several States that

RAS…

- Draft TechBrief
- Division Survey | Industry Survey



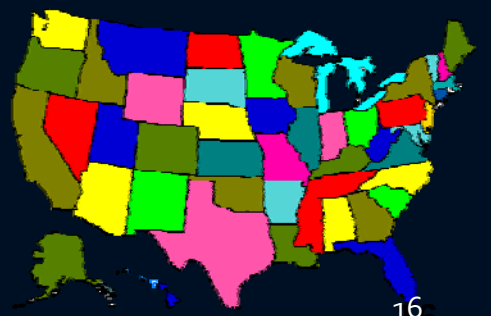
2013 NAPA Survey,

Delaware Asphalt Contractors reported using RAS

RAS Snapshot…

- 33 State DOTs have a defined max % RAS *(by total weight of mix)*
  - Average maximum: 4.7%, ranging from 2% to 6%
  - 3 DOTs allow a maximum of 6% (DelDOT)
  - 23 DOTs allow a maximum of 5%
  - 4 DOTs allow a maximum of 3%

- 15 DOTs further limit the addition of RAP and/or RAS with the total ABR.
  - Average: 25%, ranging from 10% to 50%



RAS Snapshot

- Some key observations regarding the use of ABR:
  - 9 DOTs use it to define the criteria for "grade dumping"
  - 7 DOTs use it to differentiate RAS limits in surface and lower lifts
  - 6 DOTs use it to differentiate RAS limits for traffic levels

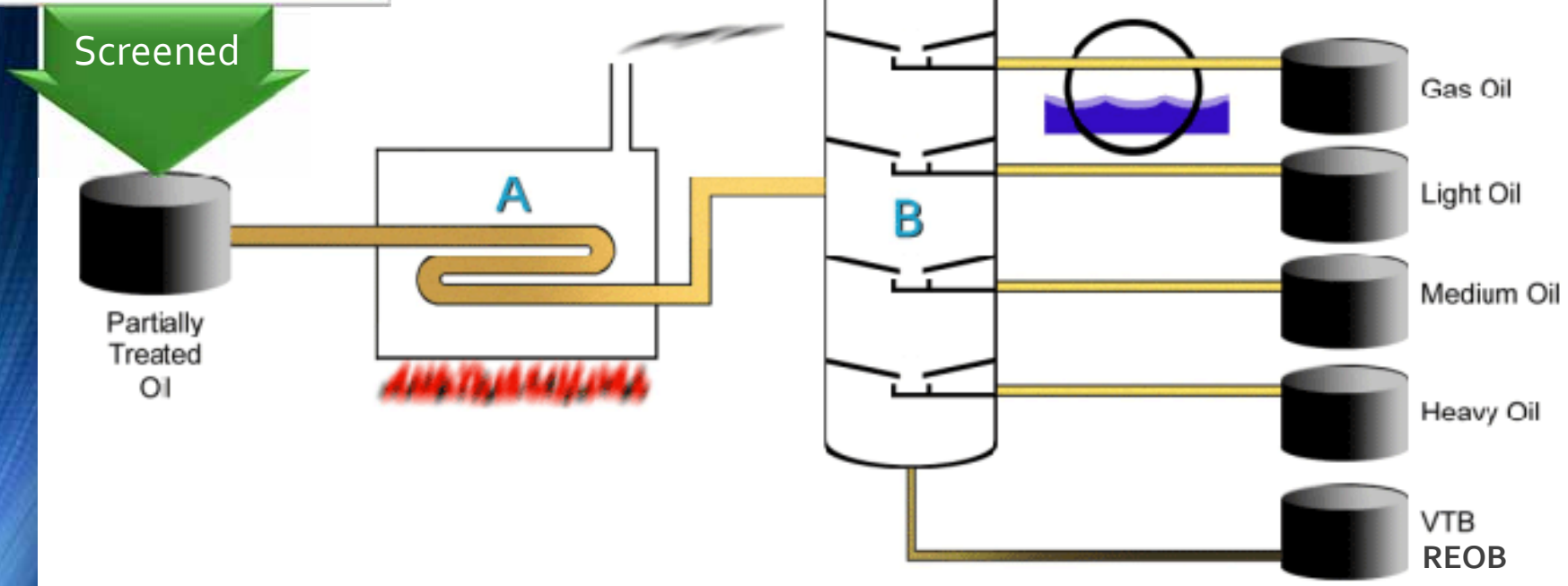
	Maximum Total %	Added Maximum ABR (%)	Added Minimum Total Virgin Binder (%)
Number of States	33	15	1

The 3 R's… REOB

REOB?

- Really Energetic Outgoing Boy…
- Re-refined vacuum tower bottoms (VTB)
- asphalt flux,
- asphalt cutter,
- re-refined asphalt cement,
- waste engine oil residue (WEO),
- re-refined asphalt cutter (RRAC), & most commonly called…
- ***Re-refined engine oil bottoms (REOB).***

Vacuum Tower Bottoms (VTB)



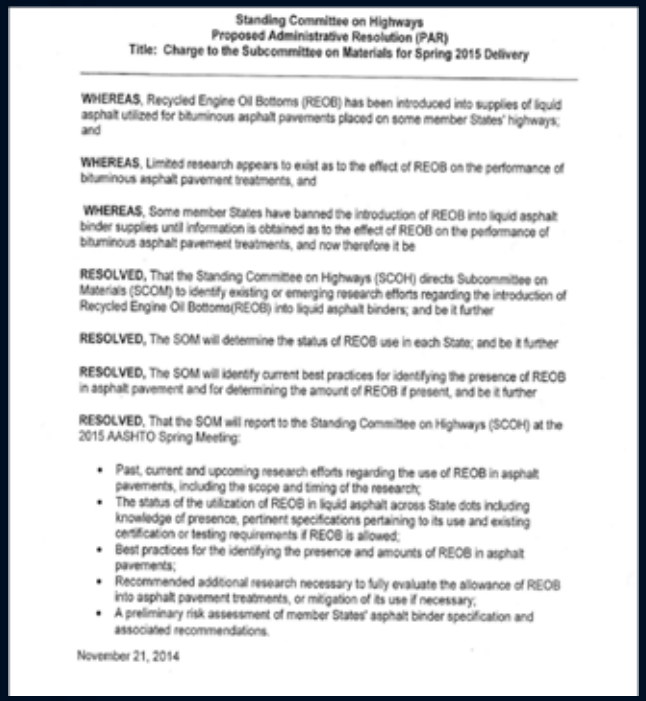
REOB Residue Use

- A leading REOB residue manufacturer states the product has been used as an asphalt cutter for more than 30 years
  - [Bouldin, 2014]

- Localized use of REOB residue in the U.S. has occurred for more than 20 years
  - [Asphalt Institute IS-230, 2011]

Recent Activities, AASHTO

- Submitted August 2012: $600,000
- Research needs statement for paraffinic base oil and REOB to the AASHTO SOM
- NCHRP Problem No. 2014-D-06
- Ranked as low priority (not funded) ☹
- http://www.trb.org/nchrp/pages/nchrp_unselected_problem_2014-d-06_834.aspx



Standing Committee on Highways
Proposed Administrative Resolution (PAR)
Title: Charge to the Subcommittee on Materials for Spring 2015 Delivery

WHEREAS, Recycled Engine Oil Bottoms (REOB) has been introduced into supplies of liquid asphalt utilized for bituminous asphalt pavements placed on some member States' highways; and

WHEREAS, Limited research appears to exist as to the effect of REOB on the performance of bituminous asphalt pavement treatments, and

WHEREAS, Some member States have banned the introduction of REOB into liquid asphalt binder supplies until information is obtained as to the effect of REOB on the performance of bituminous asphalt pavement treatments, and now therefore it be

RESOLVED, That the Standing Committee on Highways (SCOH) directs Subcommittee on Materials (SCOM) to identify existing or emerging research efforts regarding the introduction of Recycled Engine Oil Bottoms(REOB) into liquid asphalt binders; and be it further

RESOLVED, The SOM will determine the status of REOB use in each State; and be it further

RESOLVED, The SOM will identify current best practices for identifying the presence of REOB in asphalt pavement and for determining the amount of REOB if present, and be it further

RESOLVED, That the SOM will report to the Standing Committee on Highways (SCOH) at the 2015 AASHTO Spring Meeting:

- Past, current and upcoming research efforts regarding the use of REOB in asphalt pavements, including the scope and timing of the research;
- The status of the utilization of REOB in liquid asphalt across State dots including knowledge of presence, pertinent specifications pertaining to its use and existing certification or testing requirements if REOB is allowed;
- Best practices for the identifying the presence and amounts of REOB in asphalt pavements;
- Recommended additional research necessary to fully evaluate the allowance of REOB into asphalt pavement treatments, or mitigation of its use if necessary;
- A preliminary risk assessment of member States' asphalt binder specification and associated recommendations.

November 21, 2014

AASHTO
THE VOICE OF TRANSPORTATION
SUBCOMMITTEE ON MATERIALS

2015 TRB Session

- EPA classifies REOB as reuse not waste
  - where ~85% is re-refined for engine use
- Typically 6-10% REOB will take a PG64-22 to a PG58-28
- REOB contains traces elements typically not found in asphalt binder *(foreshadowing)*
  - Phosphorous, Calcium, Copper, Zinc, Molybdenum
- REOB also contains ~4% styrene butadiene
- And REOB has anti foaming agents
  - ? Emulsions, WMA ?

An Engineer's understanding of Chemistry

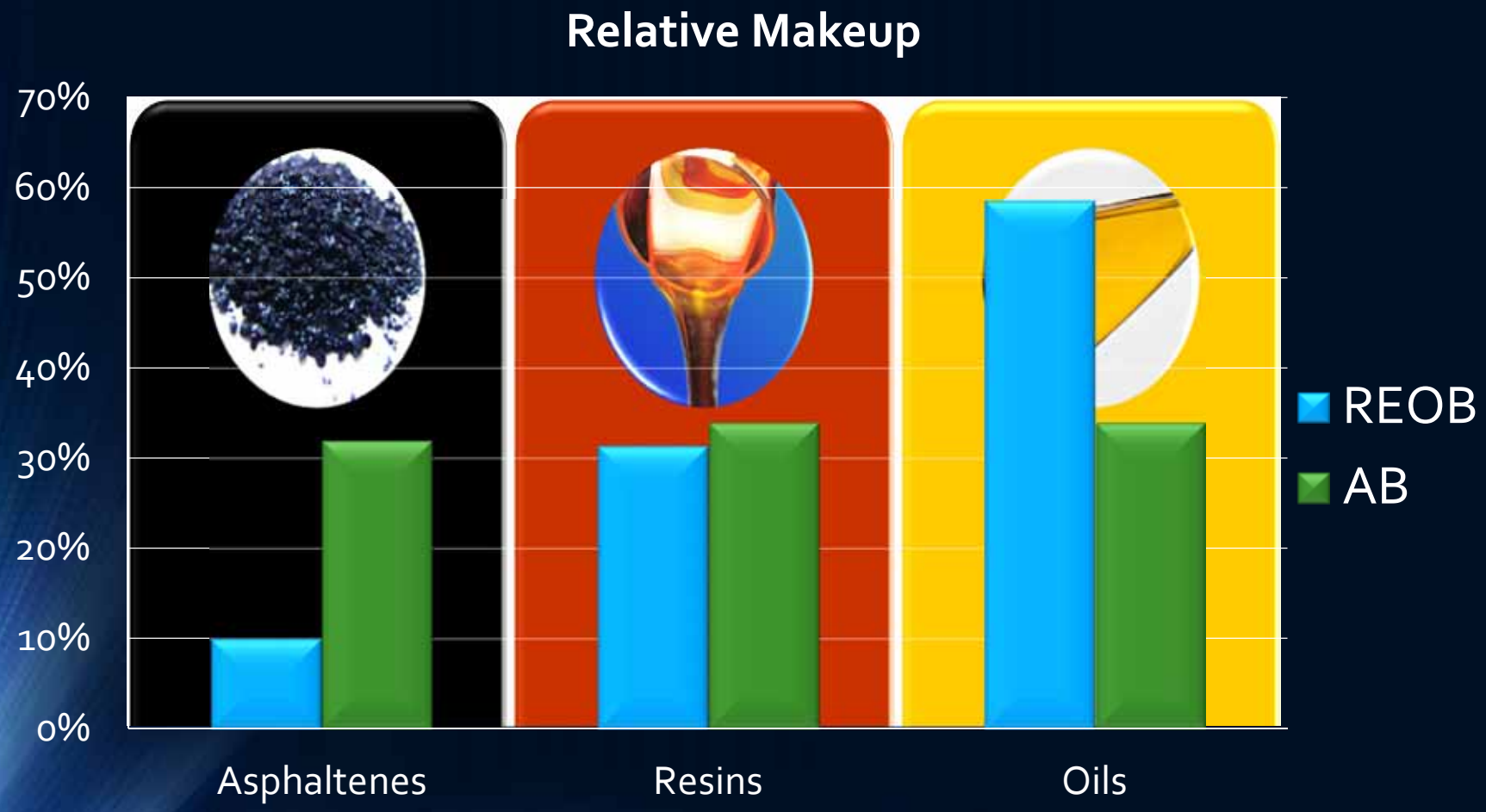
Asphaltenes

Resins

Oils

Asphalt Binder Fractions

REOB vs Good Asphalt Binder (AB)



An Engineer's understanding of Chemistry

Asphaltenes

Resins

Oils

"Unbalanced Chemistry"

Inhomogeneity of the binder may impact the faction absorbed by the mineral aggregate?

M320 Superpave PG Grading

- T313 Bending Beam Rheometer
  - Creep stiffness, S max 300MPa
  - Slope, m-value min 0.300
    - Test temp = PG LT + 10˚C @ 60 seconds

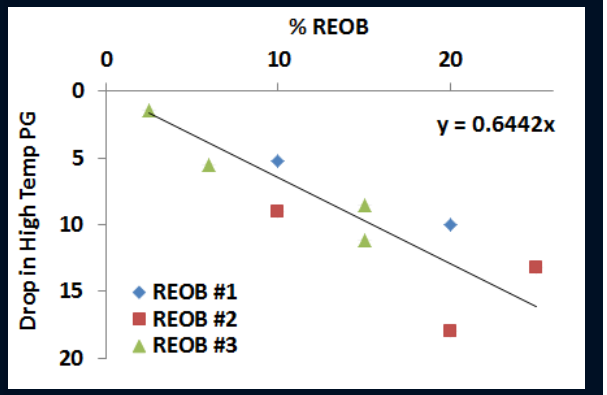
- $\Delta Tc = S_{(60\ sec)} - m_{(60\ sec)}$ (related to Durability, e.g. >3˚)
- An asphalt binder's low temperature grade can be "controlled" by either *S* or *m*.

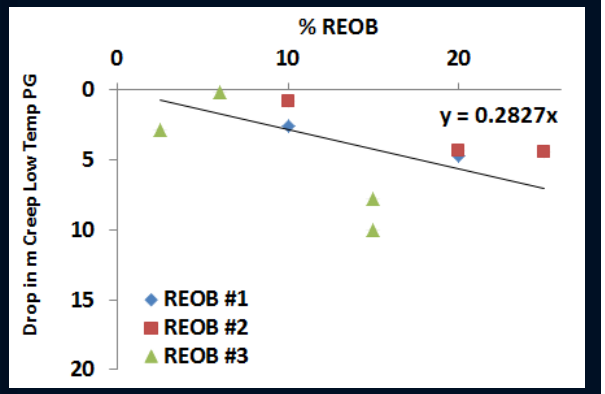
- In general, *m*-controlled binders may have low temperature cracking performance issues.
- high ΔTc binders may have "*age changing molecular fractions*"

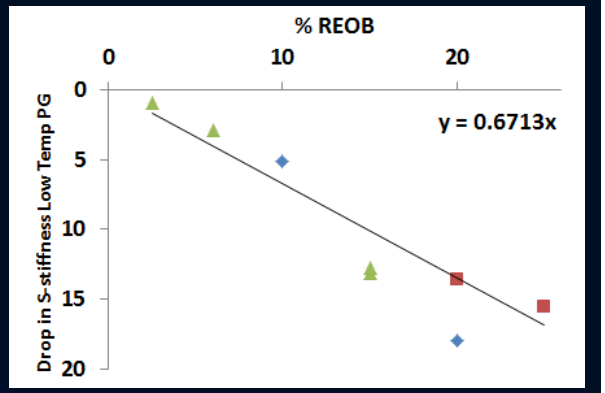
2015 TRB Session: PG HT-LT

- FHWA R&D preliminary finding (*)
  - Nelson Gibson / Terry Arnold
- High Temperature (HT) Effect
  - 9% REOB ↓ HT ~ 6˚C
- BBR *S* and *m* values (LT) Effect
  - 9% REOB ↓ *S* ~6˚C
  - 21% REOB ↓ *m* ~6˚C
  - 10% REOB ↑ ΔTc ~4˚C

(*) – 1 source of REOB, base binder PG64-22, and PG100-0







REOB Summary

- REOB r
- REO app
- R
- V
- We
- **FACT:** Us

bad)

ount of REOB residue

ce

continue to increase

The 3 R's… Rule

January 9th 2015

Submit comments to:

www.regulations.gov

Pavement and Bridge PM NPRM Docket Number:

FHWA-2013-0053

https://federalregister.gov/a/2014-30085

For clarifying questions or more information, please contact:

Francine Shaw Whitson
FSWhitson@dot.gov
PerformanceMeasuresRulemaking@dot.gov

Pavement Condition Thresholds

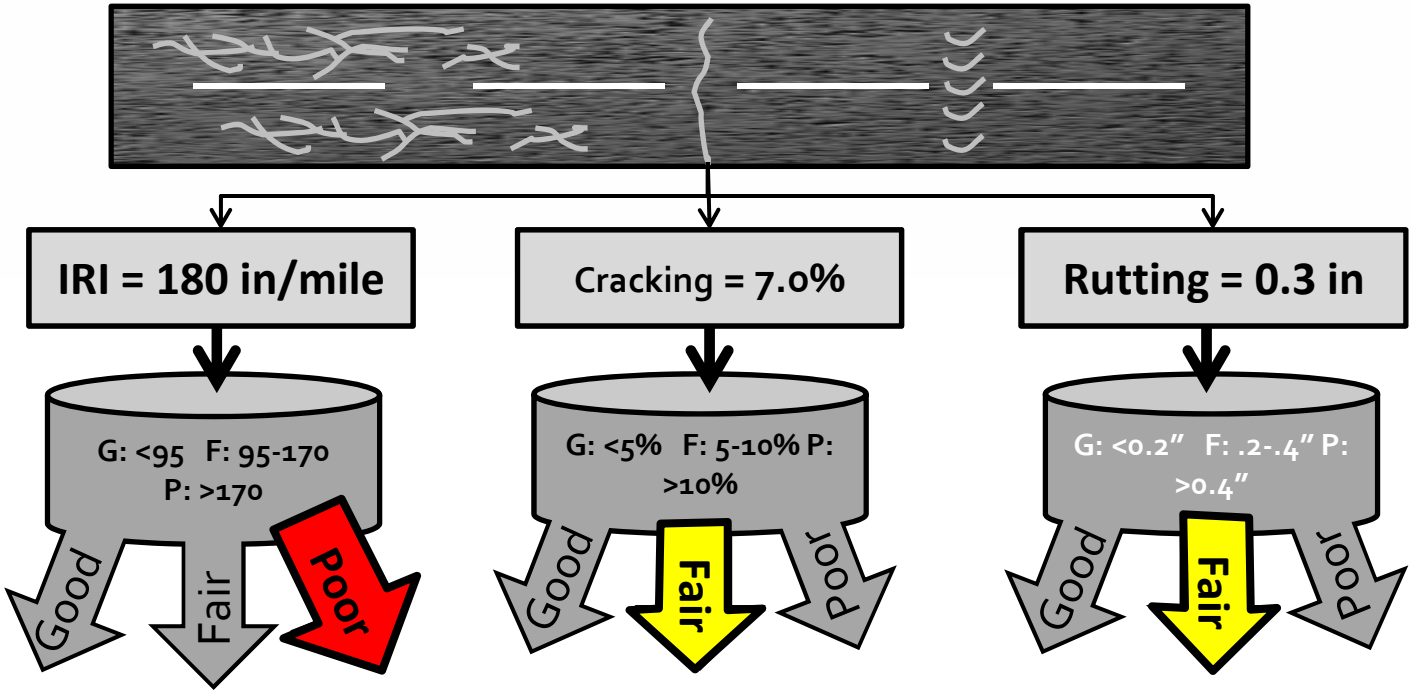
	Good	Fair	Poor
IRI *(inches/mile)*	<95	95-170 95-220*	>170 >220*
Cracking *(%)*	<5	5-10	>10
Rutting *(inches)*	<0.20	0.20-0.40	>0.40
Faulting *(inches)*	<0.05	0.05-0.15	>0.15

*Urbanized Population >1M

Calculation of Pavement Measures (§C490.313)

Overall Section Condition Rating	3 metric ratings (IRI, cracking & rutting/faulting)		Measures
Good	All three metrics rated "Good"	→	percentage of lane-miles in "Good" condition
Poor	≥ 2 metrics rated "Poor"	→	percentage of lane-miles in "Poor" condition

Example for an asphalt surfaced Interstate section located in a rural area



1 Poor rating and 2 Fair ratings

Overall Section Rating = Fair

Minimum Condition and Penalties for Pavements (490.315 and 490.317)

Minimum Condition Level: **Percentage of lane-miles of Interstate System in Poor condition would not exceed 5.0%**

FHWA is committed to reassessing the minimum condition level after completion of the first full performance period

Penalty: **If minimum not met for two consecutive years, State must obligate NHPP & transfer STP funds**

FHWA Staff Do's and Don'ts <u>During</u> the Comment Period

- **DO:**
  - Refer comments to the official docket
  - Provide fact sheet information
  - Refer questions to technical contacts
  - Refer requests for presentations to technical contacts
  - Share schedules of rollout events
- **DON'T:**
  - Organize meetings to discuss the NPRMs
  - Engage in any policy/advocacy discussion
  - Promote or advance the proposed regulation

Our Visit Today

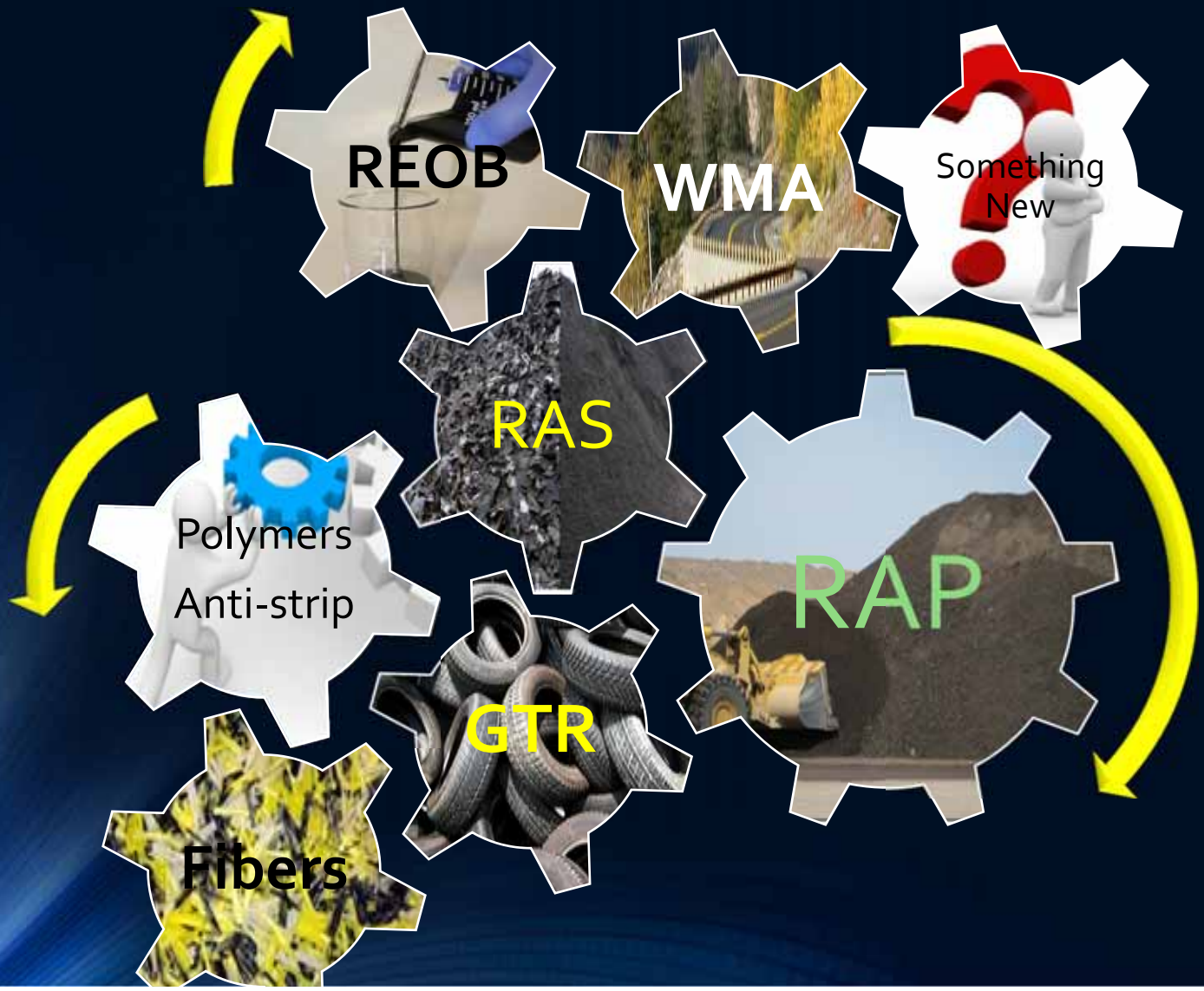
MAP-21

Legislative Process

The 3 R's

Moving to Performance…

Today's Challenge



Plan A

Limit Innovation

Restrict the use of recycled, reclaimed, and re-refined products

Set conservative limits or bans on products, e.g.

- RAS ≤ 3%, NOT allowed in surface mixes
- REOB banned as asphalt binder additive
- GTR open-graded mixes only & ≤ 15%

Plan B: Implement Mixture Performance Testing

Foster Innovation

Optimize the use of recycled, reclaimed, and re-refined products

Challenge Industry to meet performance demands

Plan B: Today's Needs

Rutting *(Permanent Deformation)*

- Mostly addressed by Consensus Standards
- Also, hard reclaimed material helps ☺

Fatigue Cracking

- Classic – bottom up
- Top down

Low Temperature Cracking

Moisture Damage

Plan B: Today's Tools

Asphalt Mixture Performance Test PP60, TP79, PP61

- Modulus (tie to MEPDG)
- Rutting Resistance (Fn)

Hamburg Loaded Wheel, T324

- Rutting Resistance
- Moisture Sensitivity

Asphalt Pavement Analyzer, TP63

- Rutting Resistance
- Moisture Sensitivity

Modified Lottman Test, T283

- Moisture Sensitivity

Texas Overlay Tester

- Fatigue / Reflective Cracking

Plan B: Today's Tools

- Key: R30 Long Term Aging, 5 days @ 85˚C
- WI using 24 hr @ 135 ˚C
- FHWA MAT Lab Study

Beam Fatigue

- Fatigue Cracking

Semi-Circular Bend, SC(B)

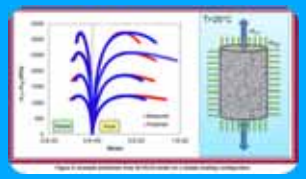
- Fatigue Cracking

Disk Shape Compaction Tension, DC(t)

- Low-temperature cracking

Thermal Stress Repeated Strain Test, TSRST

- Low-temperature cracking



Continuum Damage Theory – ***Next Generation***

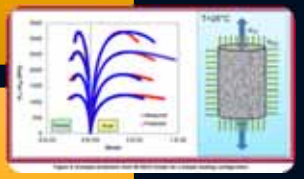
- Rutting & Fatigue

Today's Leaders

	Mix Design	Acceptance Pay Factor	Acceptance "Go – No Go"	Applicability
Superpave	Volumetric	Volumetric	Nothing	Routine Pavements
Performance Related (TX)	Volumetric Hamburg Overlay Tester	In-place density Volumetric	Hamburg Overlay Tester	Distresses
Performance Related (NJ)	Volumetric APA, SC(B), Overlay Tester	In-place density Volumetric	APA Beam Fatigue Overlay Tester	Unique mix types High RAP
Performance Based (CA)	Volumetric Beam Fatigue Repeat Shear Hamburg	In-place density Volumetric	Nothing	High traffic Long life
Performance Based (WI)	Volumetric SC(B), DC(t) Overlay Tester	In-place density Volumetric		Unique mix types High RAP/RAS

Plan B: What's your Plan?









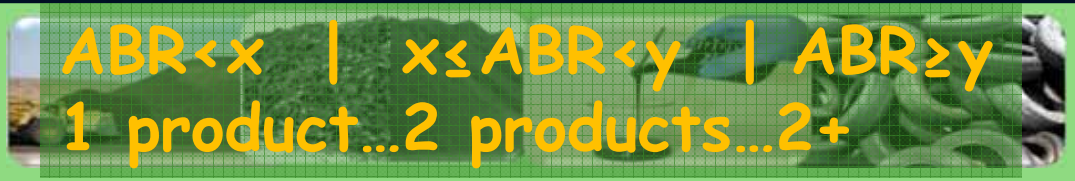





Plan T: What's your Plan?



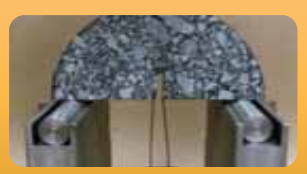





+

or











- Volumetric & Performance Criteria tied to layer location

Reflection

Authorization

Appropriation

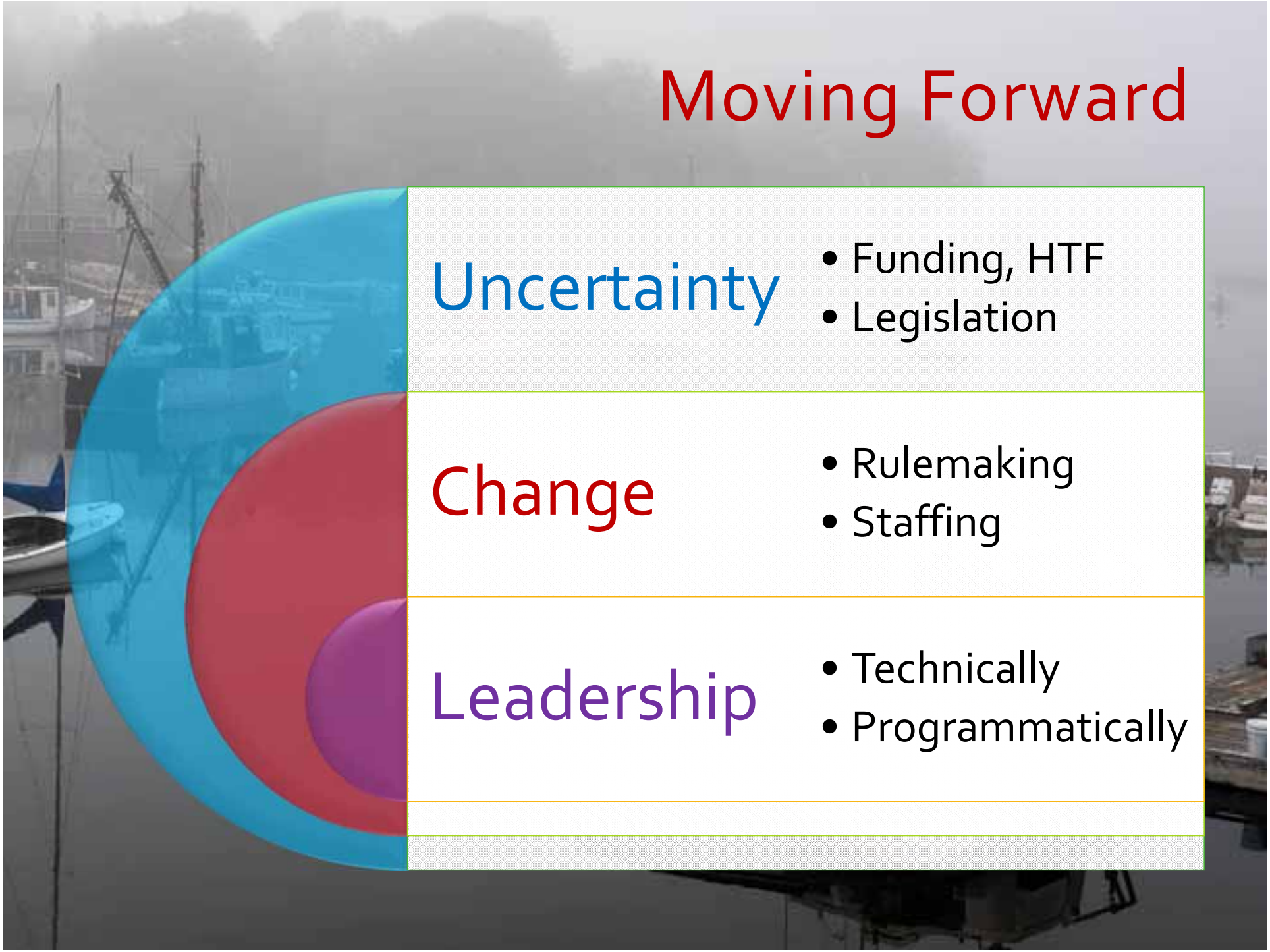
RAS

REOB

Rule(s)

Now is the time for us to advance mixture performance testing

Moving Forward



Uncertainty

- Funding, HTF
- Legislation

Change

- Rulemaking
- Staffing

Leadership

- Technically
- Programmatically