


Resource Responsible Asphalt Mixtures (R²AMs)

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Acknowledgement


- FHWA Contract :
 - Deployment of Performance-Based Technologies for Mechanistic-Empirical (ME) Pavement Design and Resource Responsible Materials Design
- Team
 - Chris Wagner, FHWA
 - Advanced Asphalt Technologies, LLC
 - Applied Research Associates, Inc.



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Our Talk

- What are R²AMs?
- Do R²AMs have the same properties as hot mix asphalt?
- Can we design pavements to take advantage of the unique features of R²AMs?
- Overview of FHWA R²AMs Project
- Questions and Discussion



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What are R²AMs?



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What are R²AMs?



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What are R²AMs?

- Innovative practices that effectively save or reuse resources
- Examples
 - High recycle content mixtures
 - RAP
 - RAS
 - Ground tire rubber
 - Warm mix asphalt
 - Cold recycled mixtures
 - Combinations



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Our Talk

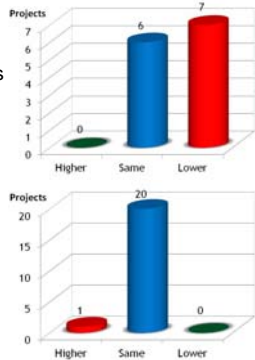
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Example 1: WMA vs HMA

- WMA probably less stiff
- Performance is very similar

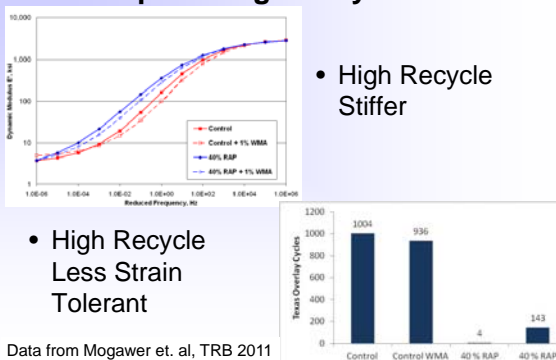
Data from NCAT, NCHRP 9-47A



Example 2: High Recycle

- High Recycle Stiffer
- High Recycle Less Strain Tolerant

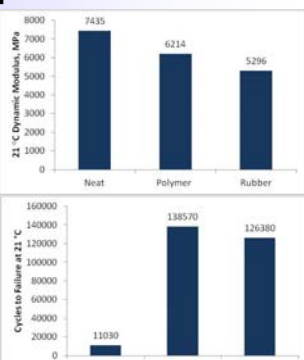
Data from Mogawer et. al, TRB 2011



Example 3: Asphalt Rubber


- Asphalt rubber less stiff
- Asphalt rubber improved resistance to fatigue

Data from Zeiada et. al, ra-foundation.org



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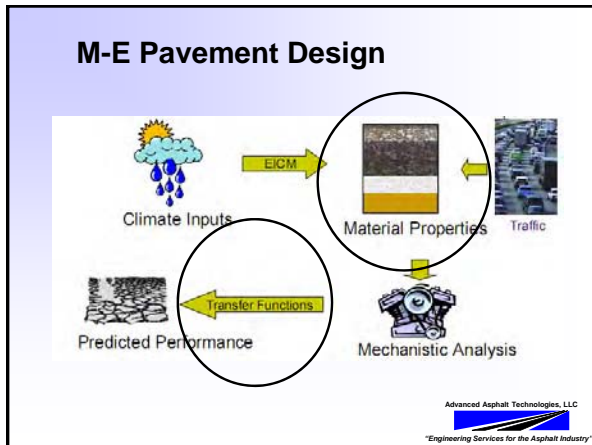


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Yes Through M-E Pavement Design...

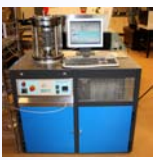
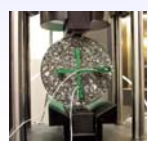




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...With Appropriate Material Properties, Transfer Functions ...

- Dynamic Modulus
- Permanent Deformation
- Fatigue
- Low Temperature Compliance & Strength

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...and Guidance

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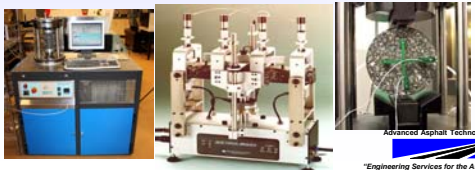

Products

- Practitioner's Guides
 - Performance Testing of R²AMs
 - Mechanistic-Empirical (ME) Design of Pavements With R²AMs
- R²AMs
 - High Recycle Mixtures
 - Asphalt Rubber Mixtures


PG for Performance Testing of R²AMs

- Chapters on measuring
 - Dynamic modulus master curves
 - Repeated load permanent deformation properties
 - Fatigue properties
 - Low temperature compliance and strength


Each Chapter

- Background
- Equipment requirements
- Specimen fabrication
- Test procedure
- Data analysis
- Example data and analysis
- Variability




PG for Mechanistic-Empirical (ME) Design of Pavements With R²AMs

- Chapters on
 - Overview of ME Design Principles
 - Laboratory Measured Engineering Properties of R²AMs
 - Field Calibrated Transfer Function for R²AMs
 - Obtaining ME Design Properties for R²AMs
 - Designing Flexible Pavements With R²AMs
 - How
 - Where
 - Examples




Use Data From Field Projects

Environmental Zone	High Recycle	Asphalt Rubber
Dry No Freeze	✓	✓
Dry Freeze	✓	✓
Wet No Freeze	✓	✓
Wet Freeze	✓	✓



Technical Advisory Committee

Person	Affiliation
Barry Paye	Wisconsin Department of Transportation
Greg Sholar	Florida Department of Transportation
Rod Birdsall	All State Materials Group
Grant Wollenhaupt	R2R, LLC
Jeff Stempihar	Arizona Department of Transportation
Chris Robinette	Granite Construction
Dale Rand	PaveTex Engineering and Testing
Mike Santi	Idaho Department of Transportation



Progress

- Potential Projects Identified for Several Cells
- Wet Freeze High Recycle Project Sampled and Testing has Started
 - Wisconsin STH73
 - Surface
 - Base
- Looking for Additional Projects



Questions/Discussion

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