Update on Using Foamed Asphalt Recycling Agent For CIR

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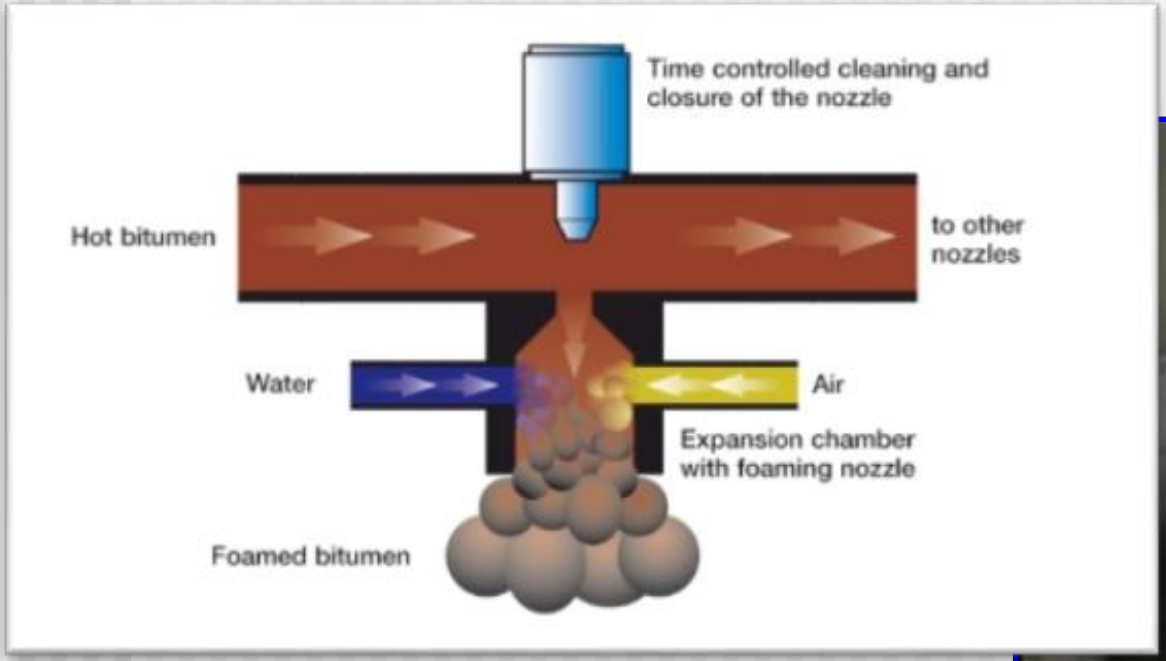
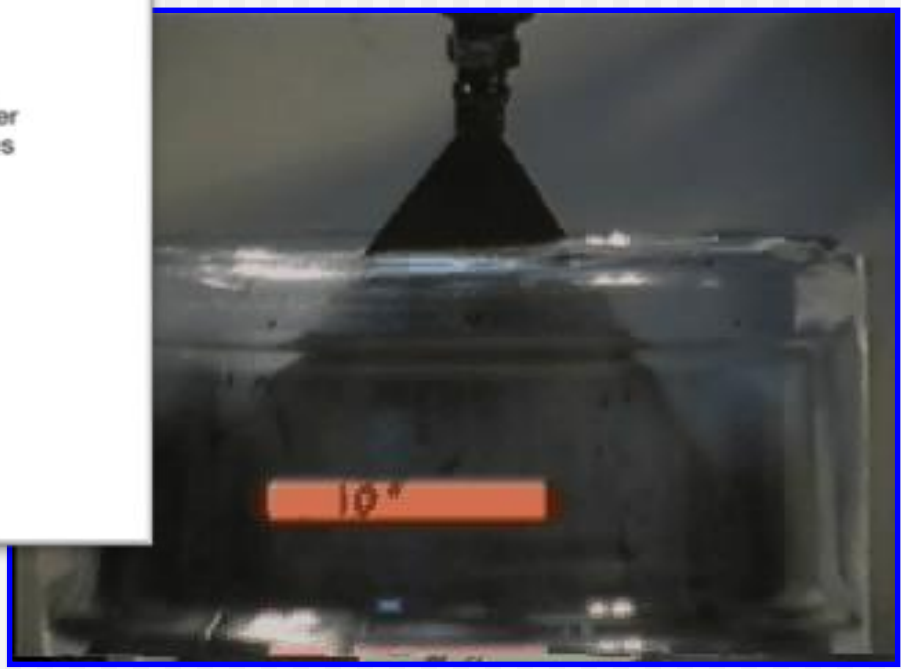
PCCAS Recycling Meeting
University of Nevada, Reno
October 25, 2016

What is Foamed Asphalt?

Hot AC (350F +) with cold water (2-3%) in a controlled environment. Causes expansion of the asphalt and volume increase of 8 to 12x. Allows for dispersion and mixing.





Bituminous Recycling Agents

Asphalt Foam Recycling Agent

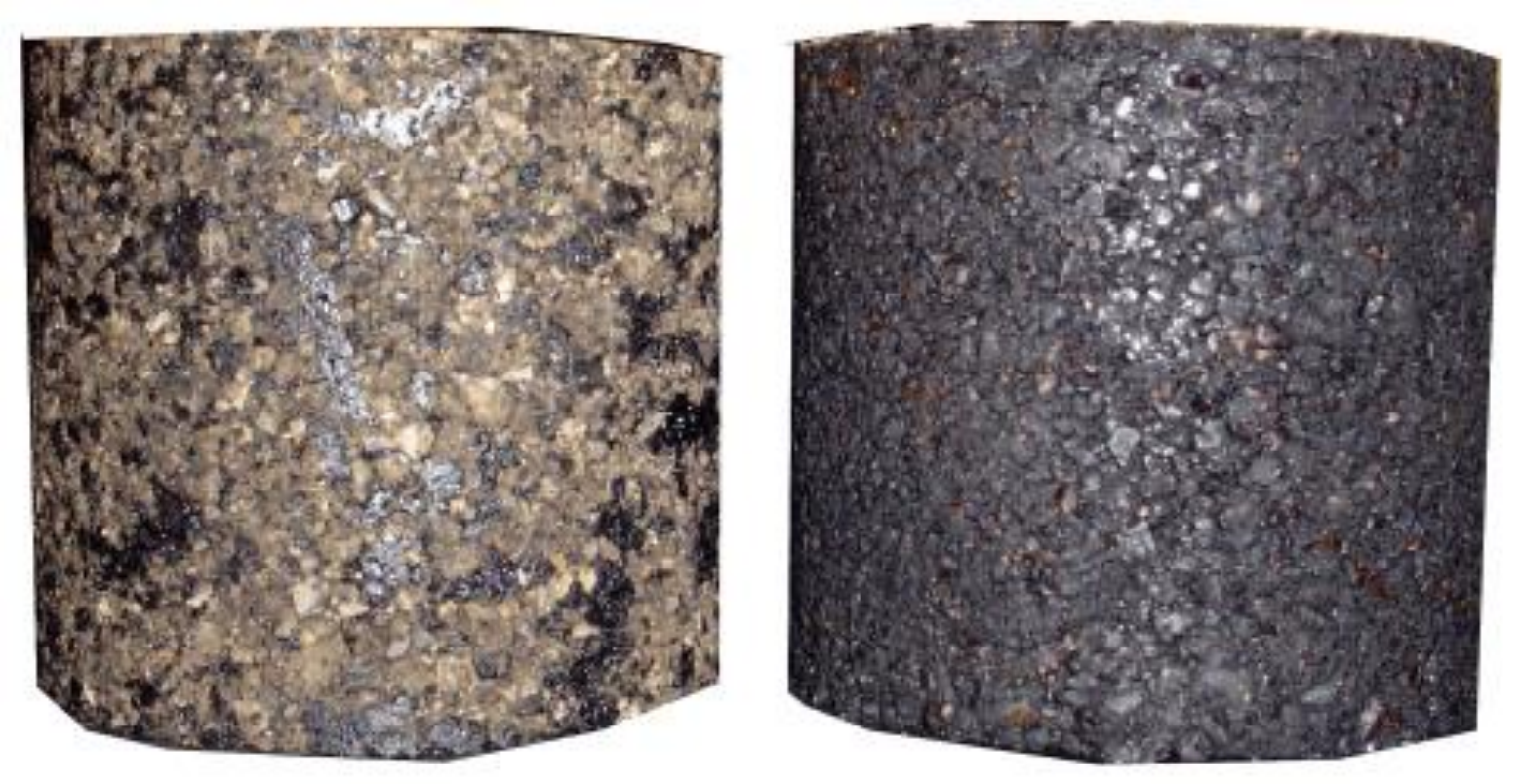
- Mastic technology
- Thought needs fines 8% to 20%
- Proven not necessary in CIR (<3% fines)

Emulsified Asphalt Recycling Agent

- Coating/Binding Technology

Concern is that with foamed asphalt, commonly too much cement is used to pass lab testing. Should maintain the 3 to 1 (2.5:1?) ratio of binder to cement. Davis is conducting research

Lab Coating



Foamed Asphalt

Emulsified Asphalt

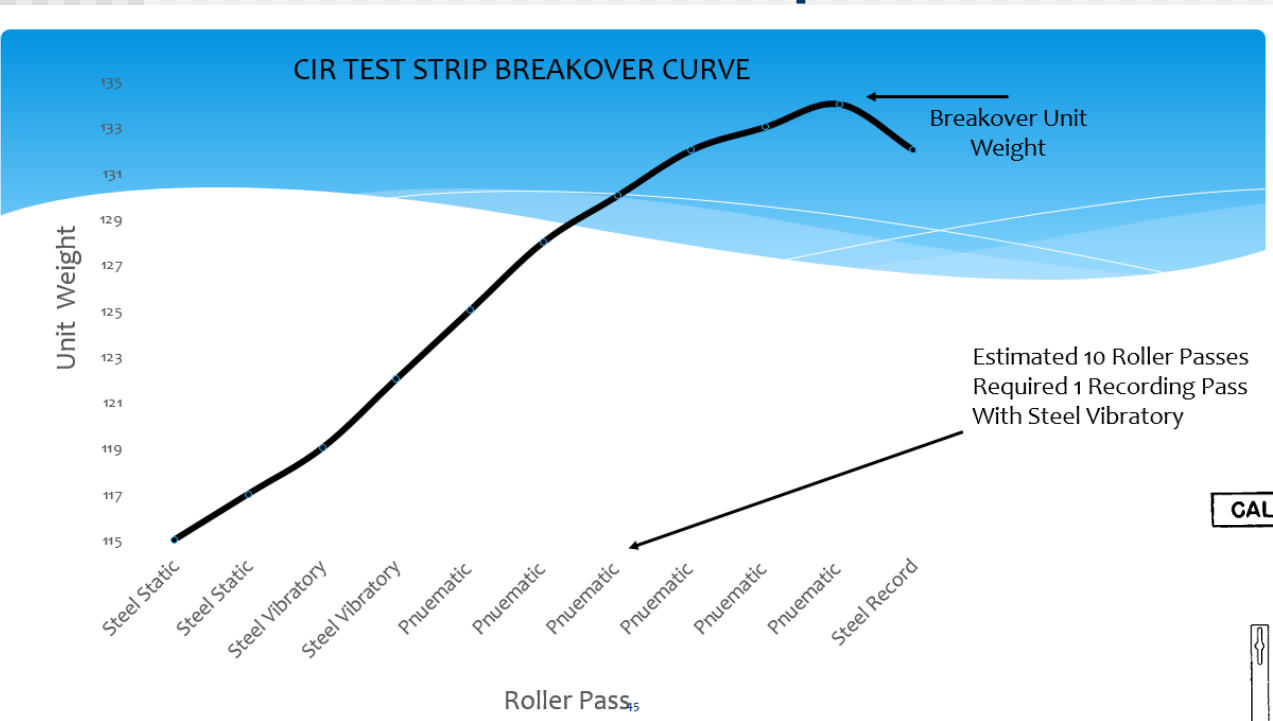
Same aggregate; same residual asphalt content

Field Coating

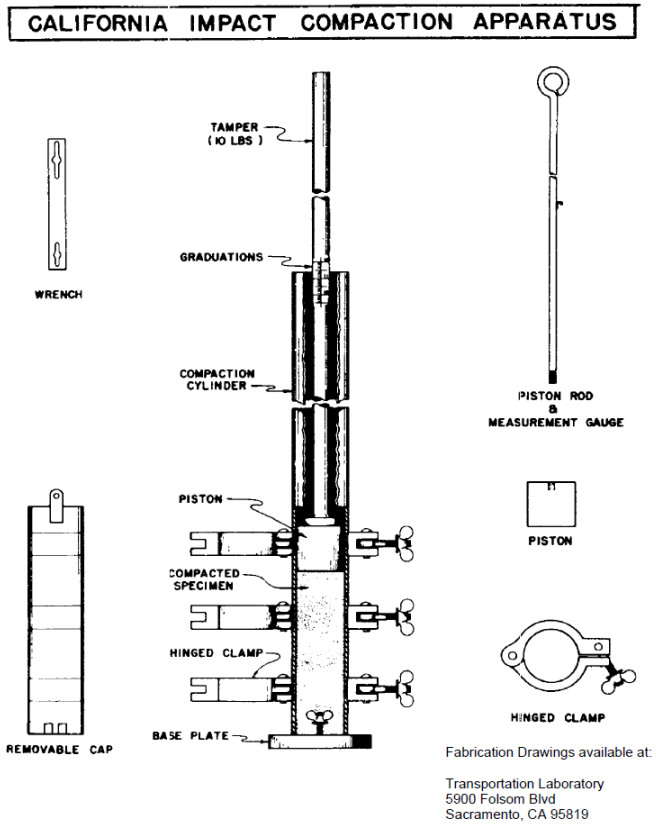
Foamed Asphalt
Tends to Be More Dry Looking and More “Salt and Pepper”

Emulsified Asphalt
Better Coating and More Uniform Color

Relative Compaction In California



Emulsified Asphalt



Foamed Asphalt

TEST FOR STRENGTH/STABILITY AND MOISTURE SENSITIVITY

Emulsified Asphalt
Marshal Stability
@ 104 Deg. F.

Foamed Asphalt
ITS @ 77 Deg. F.

Raveling Test Emulsified Asphalt

Proper CIR

Inadequate CIR

Foamed Asphalt Will Not Pass

Equipment Misconception

Wirtgen 2200
Asphalt Foam
Recycling Agent

Wrong! Both Equipment Can Do Either

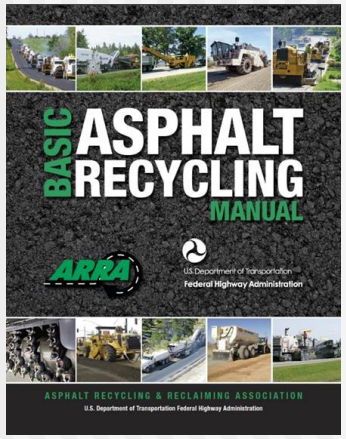
Multi Unit Trains
Emulsified Asphalt
Recycling Agent

Bituminous Recycling Agents

- In California
  - Since 2003 been 100% emulsified asphalt recycling agent with generally very positive results
  - CIR Subtask Group on Foam is working on an NSSP and mix design lab procedure
  - Expect to have a pilot project constructed in 2017 using a foamed asphalt recycling agent
  - Working group on mix design and quality assurance is to beginning to look for performance measures for CIR as a whole, regardless of bituminous recycling agent used

Bituminous Recycling Agents

- Other Agencies and Organizations
  - Currently across the United States emulsion is more prevalent
  - Most specifications specify the recycling agent type to be used
  - Ontario Department of Ministry allows the contractor to choose as long as "performance" measures are met
  - Virginia DOT uses primarily foamed asphalt
  - Asphalt Recycling and Reclaiming Association (ARRA) has guidelines for both and does not indicate any preference



- Pavement Recycling Systems, Inc.
  - Currently prefers emulsified asphalt for favorable weather conditions
  - Much safer (140 degs to 350 degs!)
  - Appears to behave better during the construction phase
  - Prefer foamed asphalt for night time or inclement weather conditions due to fewer curing constraints

But Conflicting Opinion From Someone Who Uses Both

"Really odd that your CIREAM (Asphalt Foam) holds up better to the rain than emulsion, and that we experience just the opposite. Perhaps gradation, type of AC & rate, ambient temperature, play a part?"

Nicholas Cifelli, BASc, MBA
Technical Services Manager
Miller Paving Limited

Long Term Performance

NCAT Test Track, 2012

10 million ESALs

Applied in 2 years

First cycle completed 2014

Used a Foamed Asphalt Recycling Agent as Per Virginia's Preference

Has Recently Constructed More Test Sections with Both Binders

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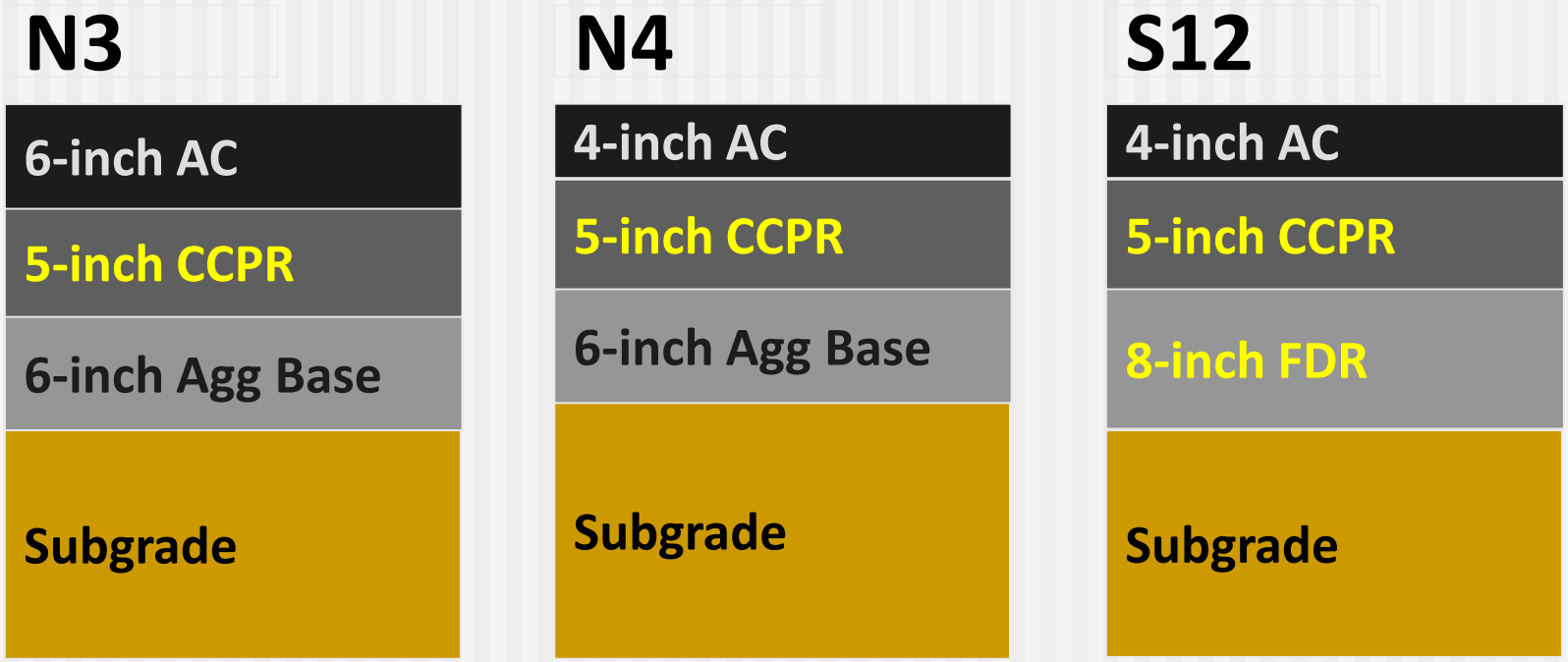
Virginia Center for Transportation Innovation and Research / VDOT

NCAT Test Track, 2012



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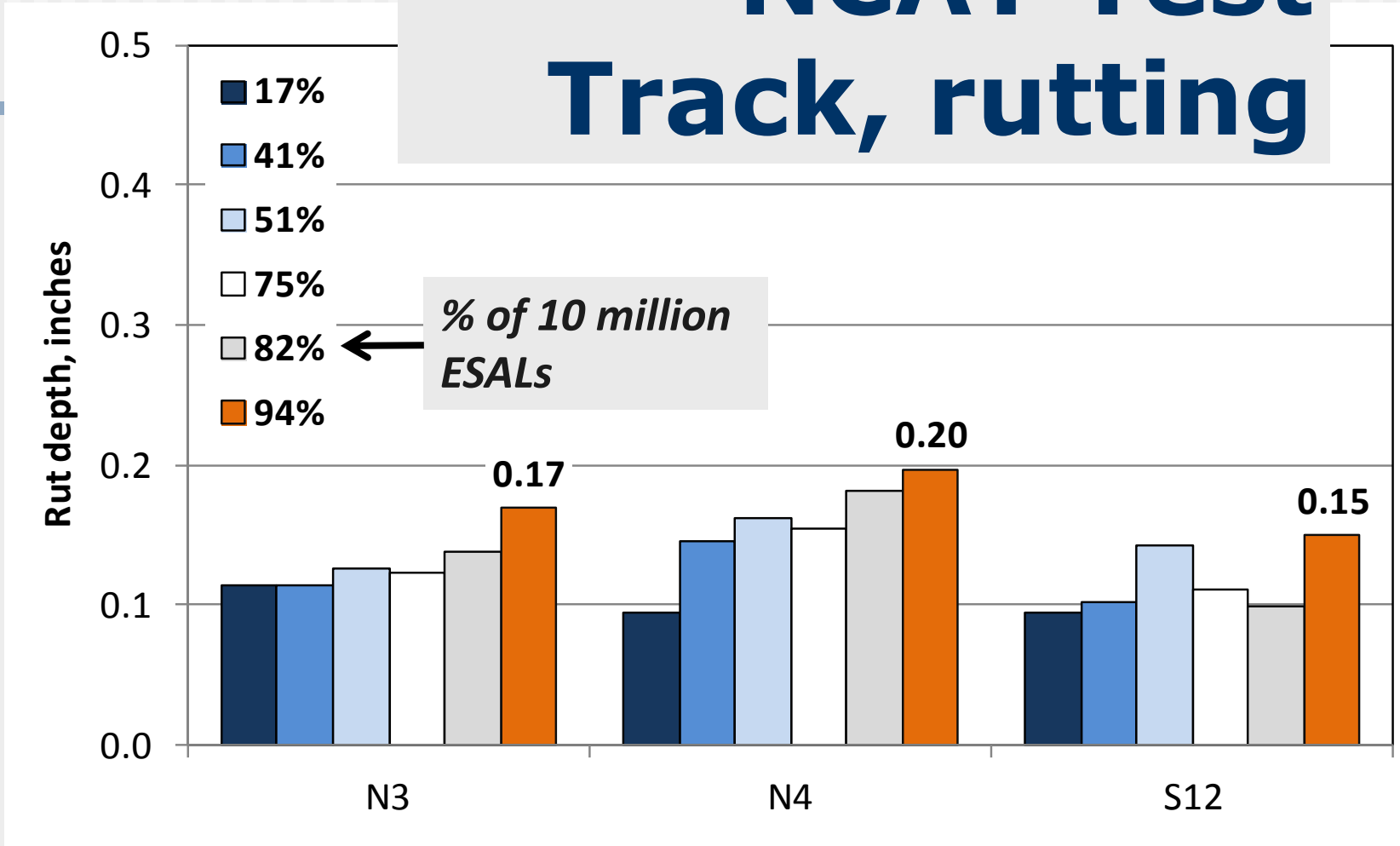
NCAT Test Track, rutting



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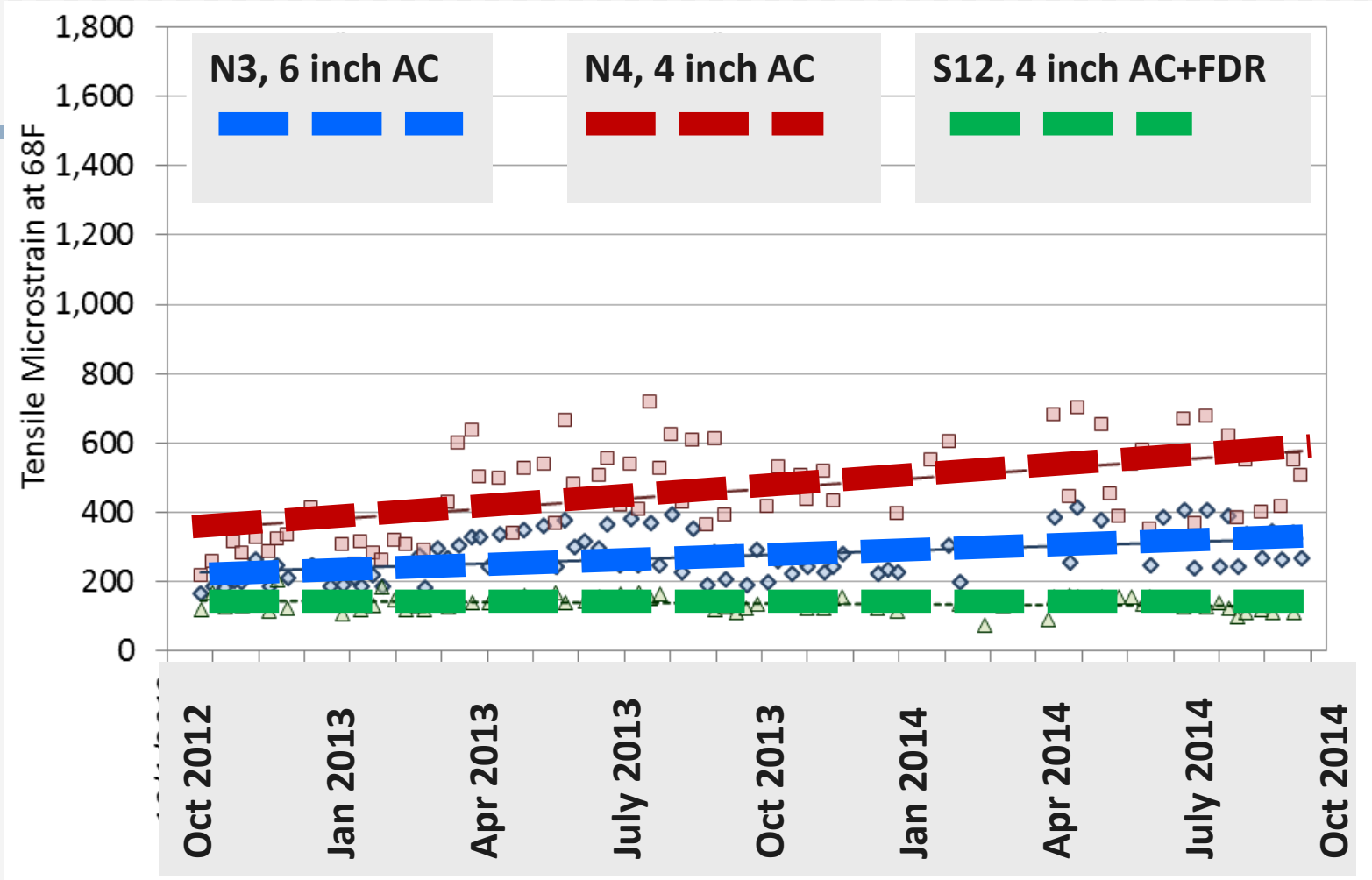
Tensile Strain Beneath CCPR Layer at 68F



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NCAT, Lessons Learned

- Recycling can be part of a **high-volume** roadway
  - No cracking at 10 million ESALs
  - Ride quality steady
  - Rutting < 0.25 inches
  - Trends in strain data
- Perpetual section?
  - Will the presence of the FDR section make the CCPR act "perpetually"?
- Layer coefficients
  - CCPR range = 0.36-0.39 (FWD)

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Structural Design Considerations
Structural Number

ARRA BARM II	0.30 – 0.35
Virginia Center for Transportation Innovation and Research/VDOT Interstate 81 Project	0.35 – 0.39
Adaption and Verification of AASHTO Pavement Design Guide - Ontario Department of Ministry	0.28 – 0.38

NCHRP 9-51 - Material Properties for CIR and FDR for Pavement Design

No Distinguishing Between Binder Types

NCHRP 9-51

- ***Material Properties of Cold In-Place Recycled and Full-Depth Reclamation Asphalt Concrete for Pavement Design***

- **Focus areas**
  - **Laboratory testing for structural properties of field cured materials**
  - **Material property inputs for MEPDG/DarWin-ME**
  - **Distress models for MEPDG/DarWin-ME**

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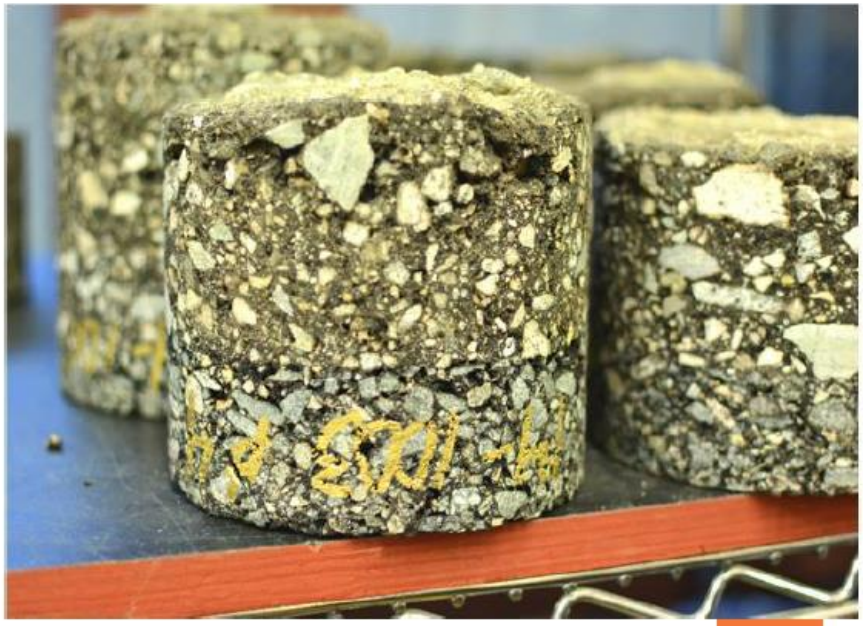
NCHRP 9-51

Brian Diefenderfer

- *Material Properties of CIR and FDR for Pavement Design*
- Partners
  - University of MD, VDOT, Colas Solutions, Wirtgen
- Project locations (22)
  - **California, Colorado, Delaware, Edmonton, Georgia, Illinois, Kansas, New York, Ontario, Utah, Washington, West Virginia**



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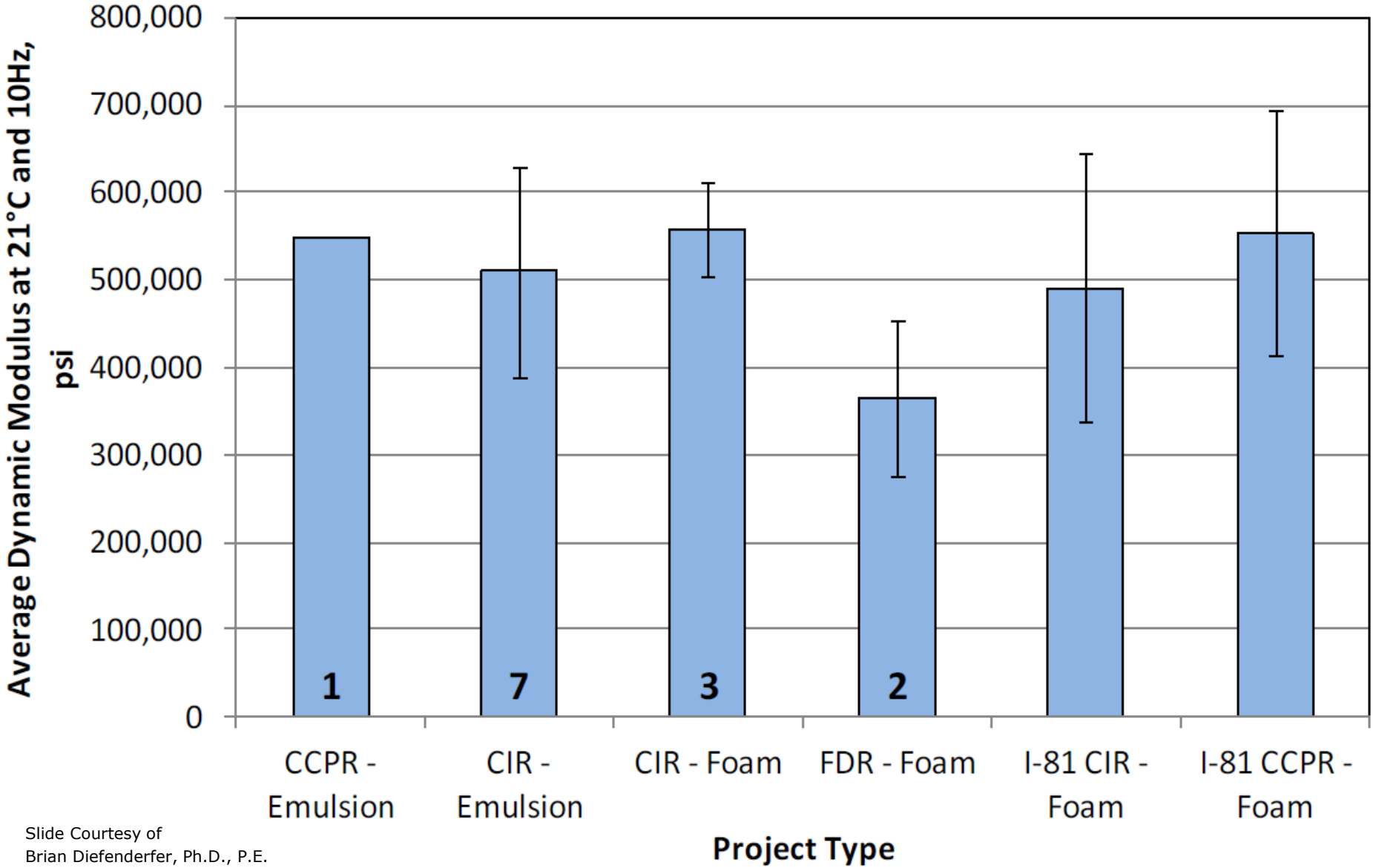
Example Results



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Conclusions

None Yet!

Let’s Focus on in Service Performance Measures and Not Equipment or Binder Specifications

NCHRP 09-62 [RFP]

Rapid Tests and Specifications for Construction of Asphalt-Treated Cold Recycled Pavements

Posted Date: 10/10/2016

Project Data	
Funds:	$1,000,000
Contract Time:	36 months
(includes 1 month for NCHRP review of the Phase I interim report and 3 months for NCHRP review and for contractor revision of the final deliverables)	
Authorization to Begin Work:	5/1/2017 -- estimated
Staff Responsibility:	Edward T. Harrigan Phone: 2023343232 Email: eharriga@nas.edu
RFP Close Date:	12/6/2016
Fiscal Year:	2017

Research … to develop appropriate time-critical tests, generally performed during construction, that allow an agency to quickly determine the quality of the as-constructed cold recycled pavement and evaluate its readiness for traffic and surfacing.

… a guide specification for process control and product acceptance of cold recycling operations is needed to promote consistency among agencies and allow contractors to more easily operate within multiple jurisdictions.

Thank You!

Questions?

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(951) 934-4753

See you in Auburn, AL