In-place Recycling Curing Time & BARM

Midwestern Pavement Preservation Partnership

Kansas City, Missouri

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Technical Director

Asphalt Recycling & Reclaiming Association

Asphalt Recycling & Reclaiming Association

- www.ARRA.org
- Industry Segments
  - *Cold Planing (CP)*
  - *Hot In-place Recycling (HIR)*
  - *Cold Recycling (CR)*
    - *Cold In-place Recycling (CIR)*
    - *Cold Central Plant Recycling (CCPR)*
  - *Full Depth Reclamation (FDR)*

Recycling & Reclaiming Strategies

M&R	Strategy	Method	CP	HIR	CR	FDR
Construction	New					
	Reconstruction		X			X
Rehabilitation	Major		X		X*	X
	Structural Overlay		X	X*	X*	X*
	Minor		X	X	X	
Maintenance	Preventative	PP	X	X	X	
	Routine	PP	X			
	Corrective	PP	X	X	X	
	Catastrophic		X			

*With HMA Overlay

PP = Pavement Preservation

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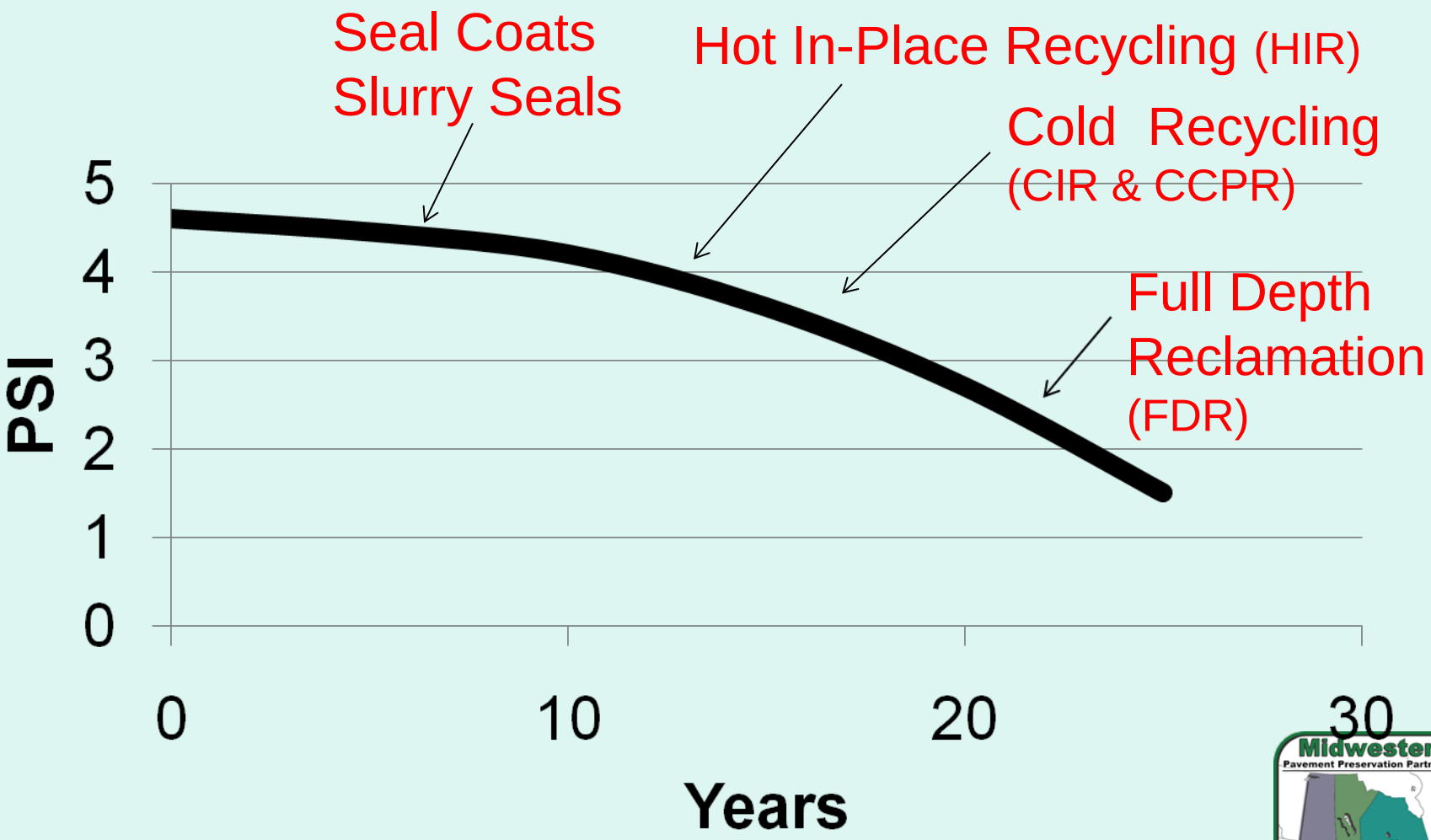
Pavement Management

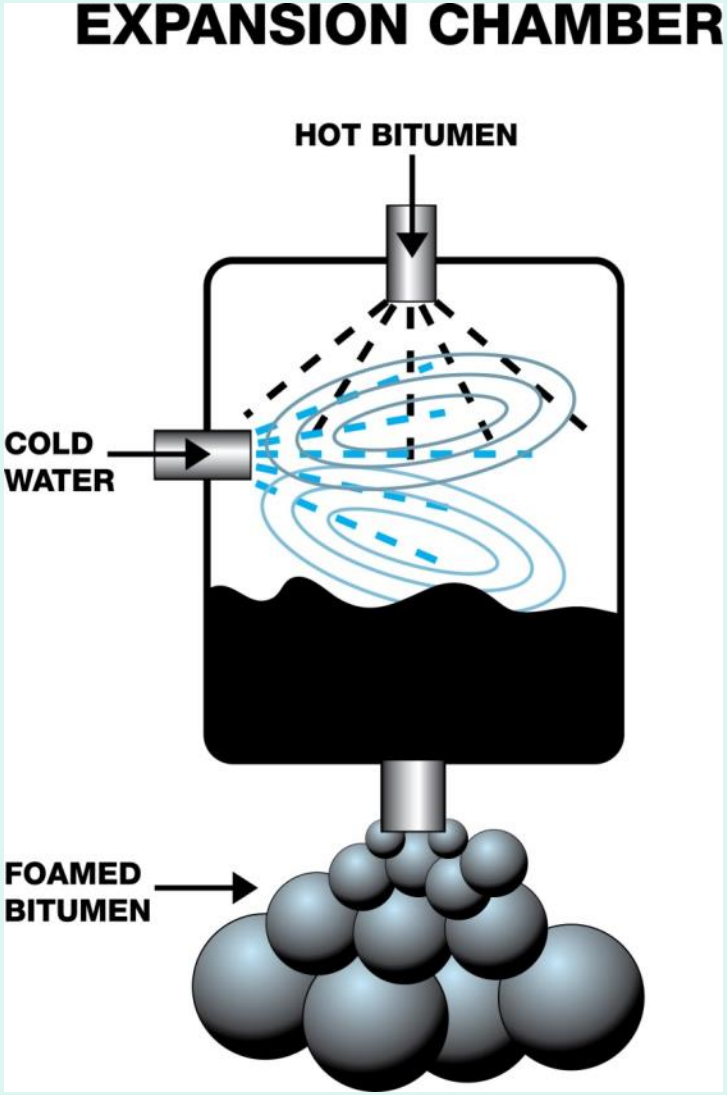


Curing – (removal of water from system)

- Cold In-place Recycling
  - Foam (expanded asphalt)
    - Water cool cutting teeth
    - Water to foam asphalt
    - Water for compaction
  - Emulsified asphalt
    - Water cool cutting teeth
    - Water in emulsified asphalt
    - Water to disperse emulsion

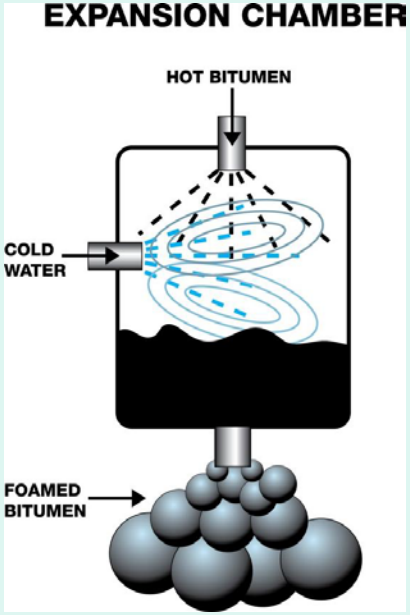
Foamed Asphalt

- Small amount of water added to hot asphalt
- Result is small droplets of hot asphalt
- Gains strength quickly as asphalt droplets cool binding the RAP together



Verifying Foaming Characteristics

- Check expansion ratio and half-life in the field
- Asphalt above 320 F but never above 375 F



- Expansion ratio is the volume of foamed asphalt to residual unfoamed asphalt
  - Minimum 8
- Half-life is the time required for the foam to loose half of its maximum volume
  - Minimum 6 seconds

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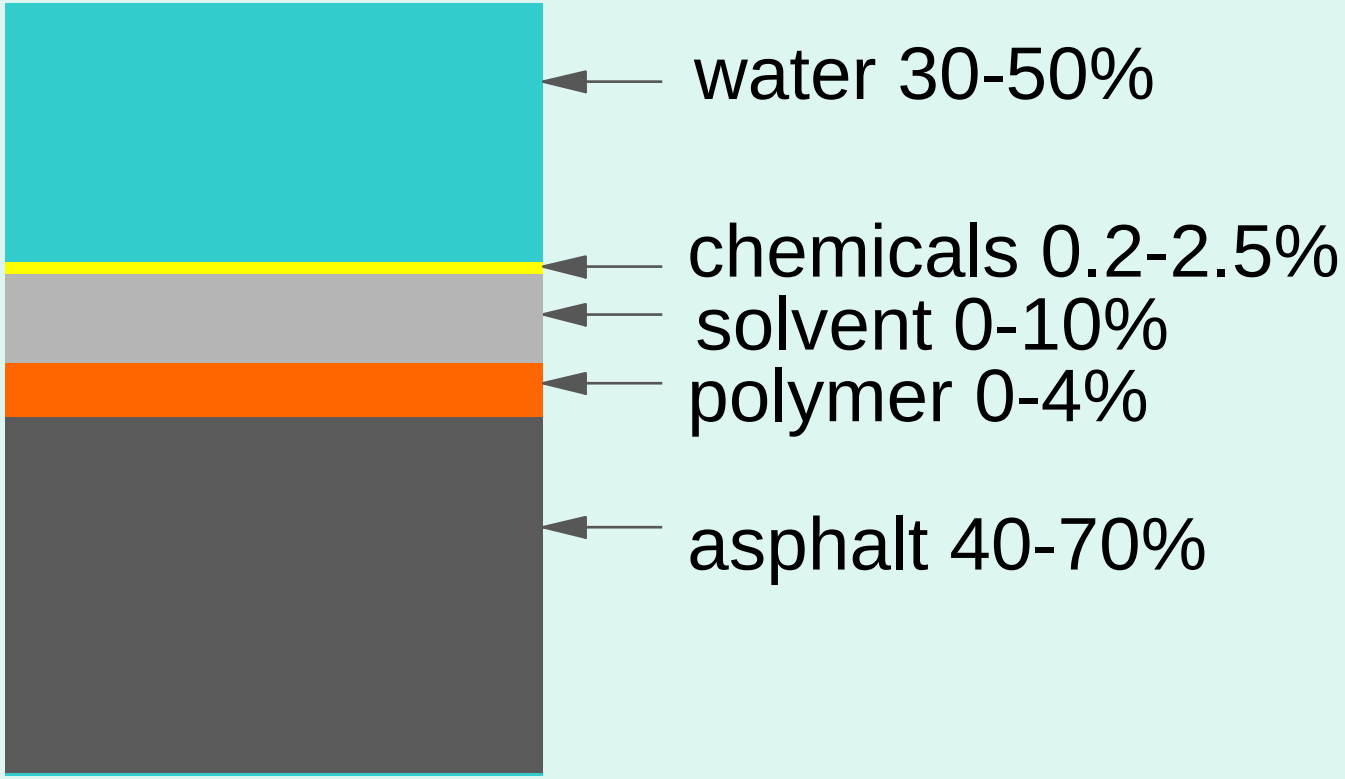
COMPONENTS OF AN ASPHALT EMULSION



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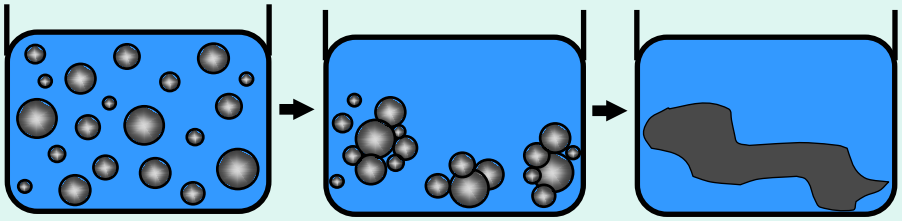
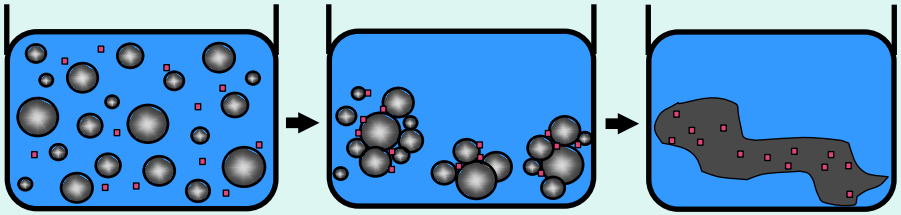
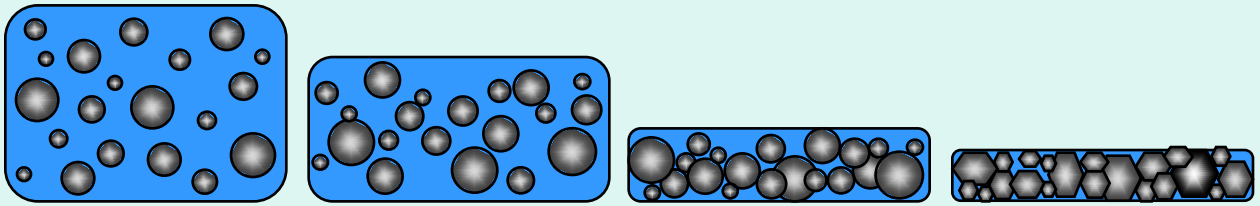
SETTING MECHANISMS EMULSIONS



- Destruction of charge by neutralization of acid (cationic)

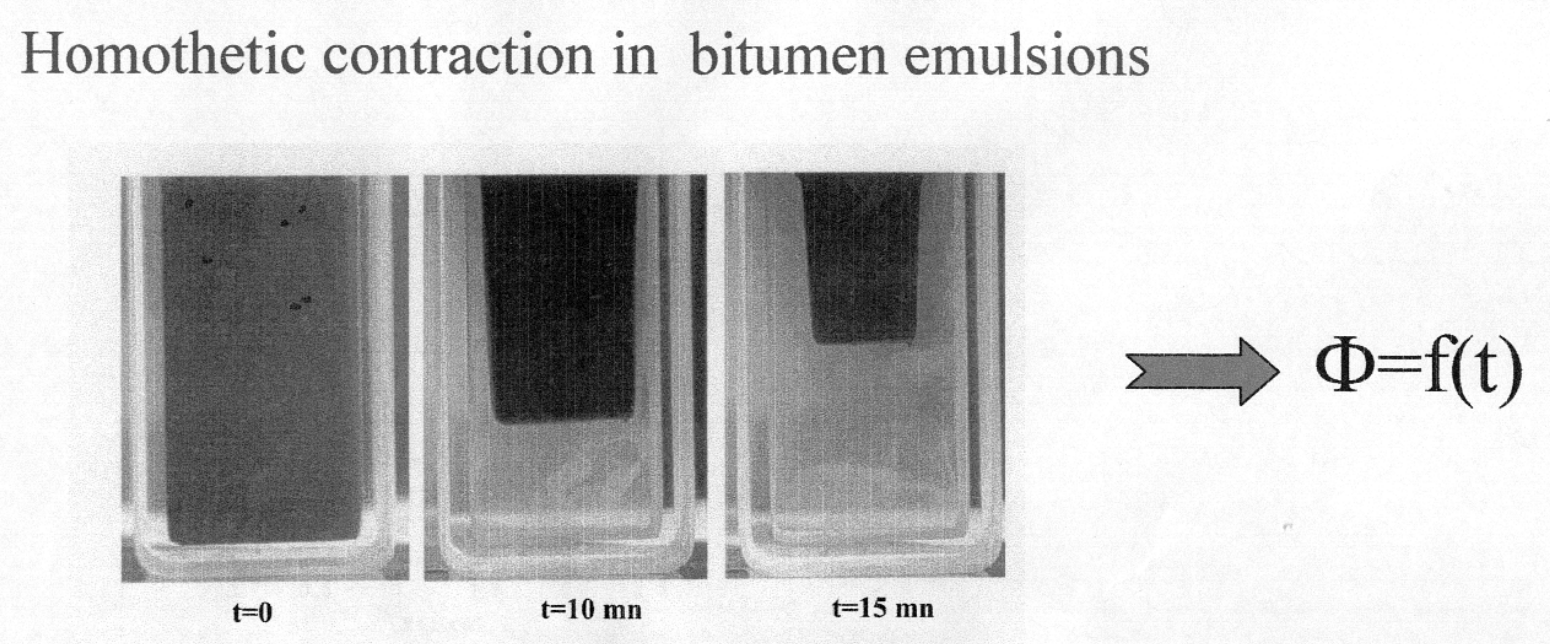


- Destruction of charge by oppositely charged aggregate



- Evaporation of water

BREAKDOWN OF THE EMULSION



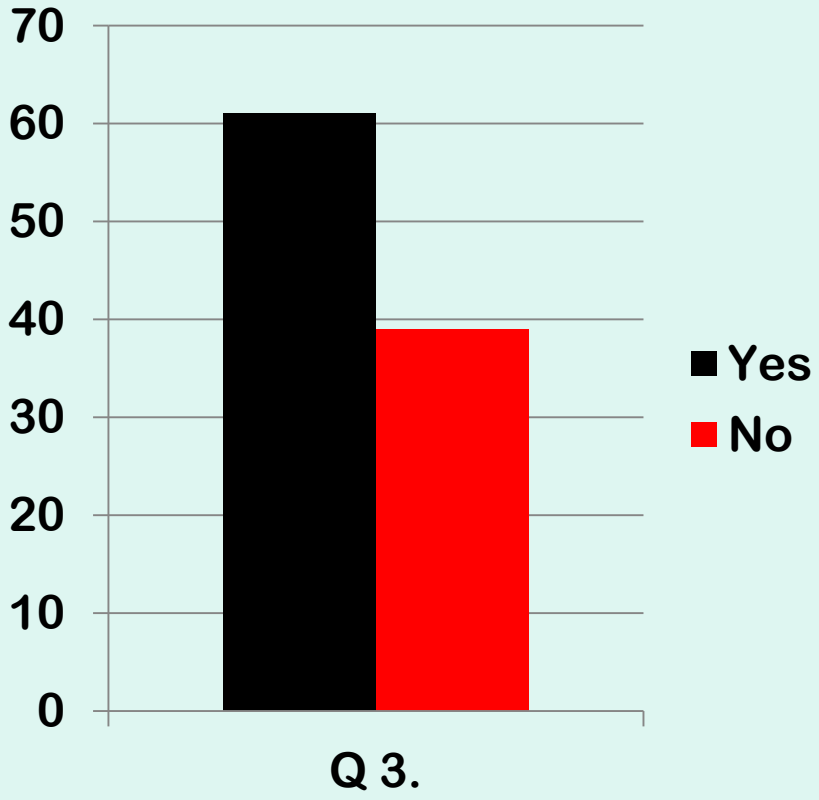
Once the droplet charge is destroyed the droplets are strongly attracted to one another The asphalt will coagulate even with water still present.

FACTORS AFFECTING BREAKING AND CURING

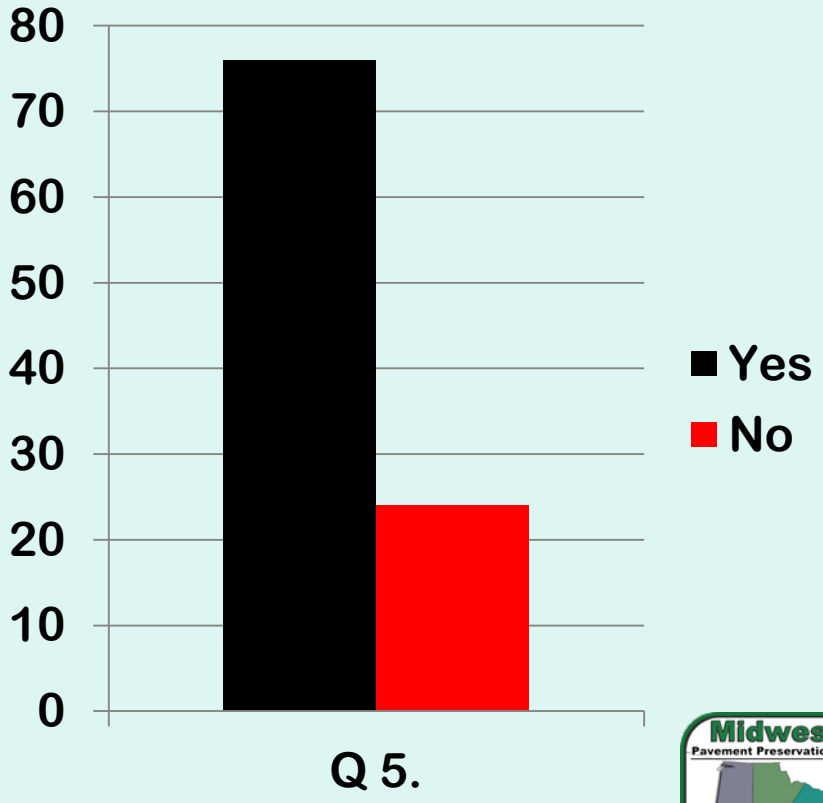
- Aggregate Reactivity
  - surface area, surface charge, surface chemistry
  - filler chemistry e.g. cement, lime
- Emulsion Reactivity
  - emulsifier chemistry, concentration
  - other additives
  - asphalt viscosity
- Temperature, Humidity, Wind Speed
  - remove water from the system
- Mechanical Treatment e.g. compaction
  - squeeze the droplets together and squeeze out water

TERRA Survey Results

Q 3. Is time/criteria when place overlay an issue or concern?



Q 5. Are you satisfied with your criteria?



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How do we measure curing?

- ARRA CR101
  - Cure a minimum of 3 days.
  - The moisture content < 3.0 percent.
  - If the moisture content does not fall below 3.0% after 10 days and if the roadway has been free of rain for a minimum of 2 days, the Contractor shall be permitted to place the final surfacing or perform the secondary compaction, as required.

How do we measure curing?

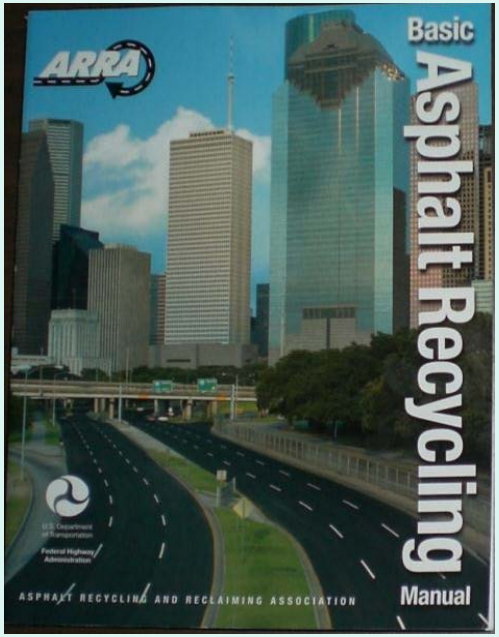
- Moisture content not always best method - Not necessarily total moisture but removal of moisture trapped in asphalt films
- Many cases moisture content seems work well
  - Relatively dry pavements
  - No rain

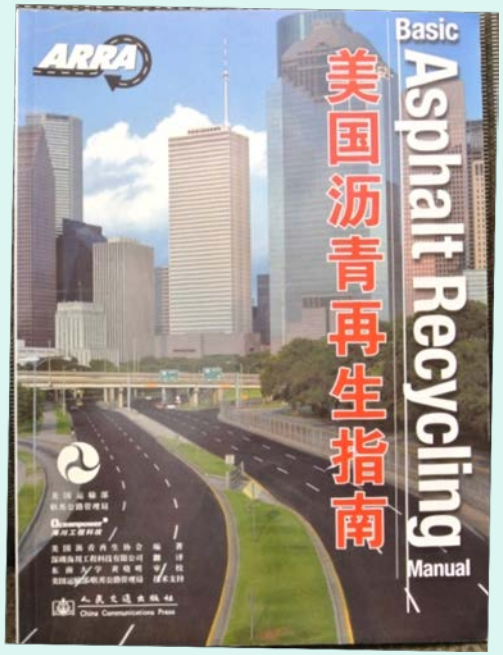
What to do?

- Don’t recycle in cold, damp weather
- Be careful with high moisture content pavements
- Perform raveling test
- Consider use of an additive
  - cement or lime
- Perform secondary compaction

Available Resources
Basic Asphalt Recycling Manual

First edition was published in 2001. Recognized around the world as "the book" on in-place recycling.





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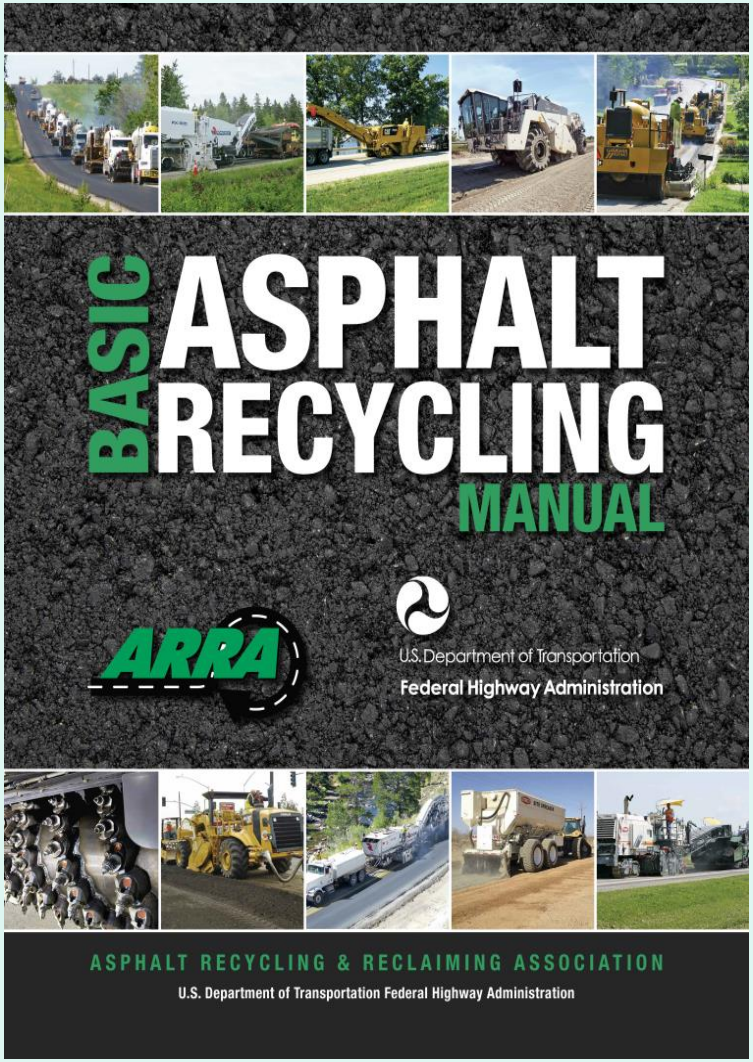
BARM II

The second edition of the *Basic Asphalt Recycling Manual* (BARM II) is finally available



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BARM II

- Completely rewritten
- Divided 6 Parts
  - Introduction
  - Cold Planing
  - Hot In-place Recycling
  - Cold Recycling
  - Full Depth Reclamation
  - Appendix

- Chapters on:
  - Preconstruction Activities (project selection)
  - Mix Design
  - Construction
  - QA Sampling & Testing

ARRA Best Practice Guidelines

- 100 Series - Recommended Construction Guidelines
- 200 Series - Recommended Mix Design Guidelines
- 300 Series - Recommended Quality Control Guidelines
- 400 Series – Recommended Project Selection Guidelines

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Asphalt Recycling & Reclaiming Association's
n has been to promote the
recycling of existing roadway materials throug
ethodologies, to preserve
limited natural resources and reduce costs. N
ith politics, social issues,
anti-terrorism policies and procedures, or the
ertain – America needs its
highways. Everyone acknowledges that soon
to be maintained, preserved,
and rehabilitated, and that the methods repre
e least expensive, longest
lasting alternatives for stretching available do

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TC3 Training Resources

- *Web based training classes*
- *TCCC Inspector Training for Cold In-Place Recycling (CIR) Web Based*
  FHWA-NHI-134114 – www.tccc.gov
- **HIR Class: Final Draft under review.**
- **FDR class: Draft under review.**

2-Day NHI Course

Is asphalt in-place recycling the right choice for your next low-, medium-, or high-volume roadway project?

Learn more about this viable treatment method by hosting or attending a training session!

Asphalt Pavement In-place Recycling Techniques (NHI 131050)



All photos credit Virginia Department of Transportation

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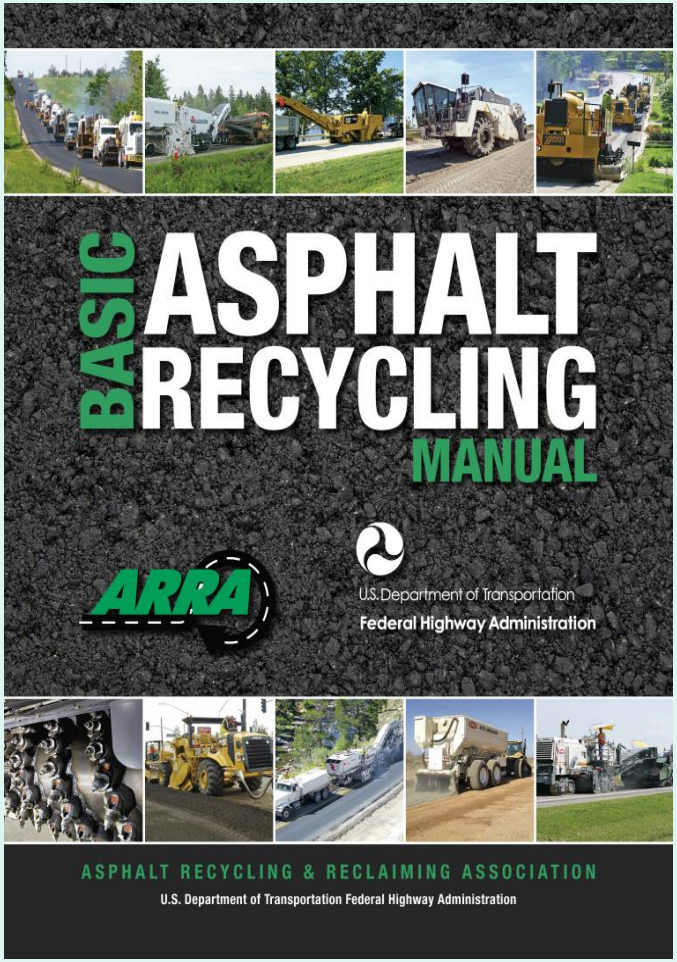
NHI 131050

- Any state, federal or local agency, contractor or industry group can host the class
- Two web based introductory modules and 2-day instructor led class
- Course is for personnel who are:
  - selecting and designing asphalt in-place recycling projects
  - writing specifications
  - inspecting projects during construction.

ARRA/NCPP 1 Day Courses

- Concentrated 1 day courses on:
  - Cold Planing
  - Hot In-place Recycling
  - Cold Recycling
  - Full Depth Reclamation
- Courses covers:
  - Project Selection
  - Mix Design
  - Thickness Design
  - Construction
  - Quality Control

BARM II



- **To obtain a copy:**
  - **See an ARRA Member**
  - **Purchase a copy on the ARRA web page**
  - **See me today**

FHWA –HIF-14-001

Thank You

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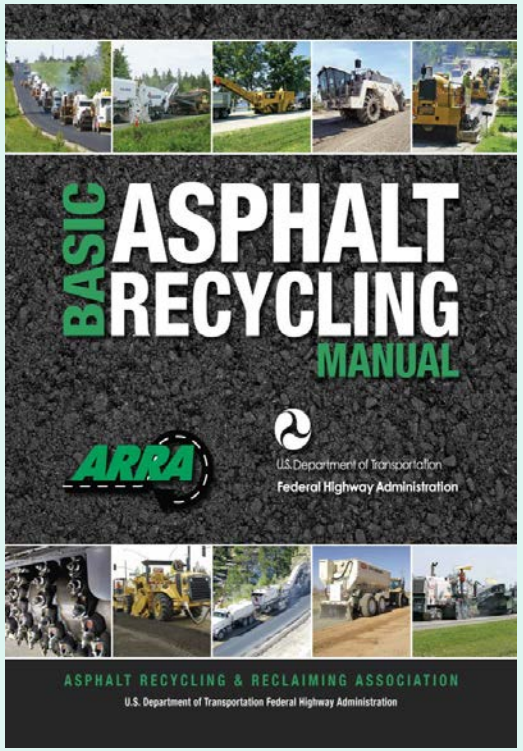

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