The Effect of Three Asphalt Emulsion Recovery Methods on Recovered Binder Properties

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Outline

- Emulsion Recovery Concerns
- Objectives
- Emulsion Materials
- Work Plan
- Recovery Methods
- Asphalt Residue Properties
- Conclusions

Concerns about Emulsion Recovery Methods

- *Does the method remove water efficiently?*
- Is the recovered residue like pavement residue?
- What is the equipment cost?
- How long does the method take to perform?
- How much binder is recovered (for testing)?
- How much technician effort or attention is required?
- *Does the method oxidize the asphalt?*

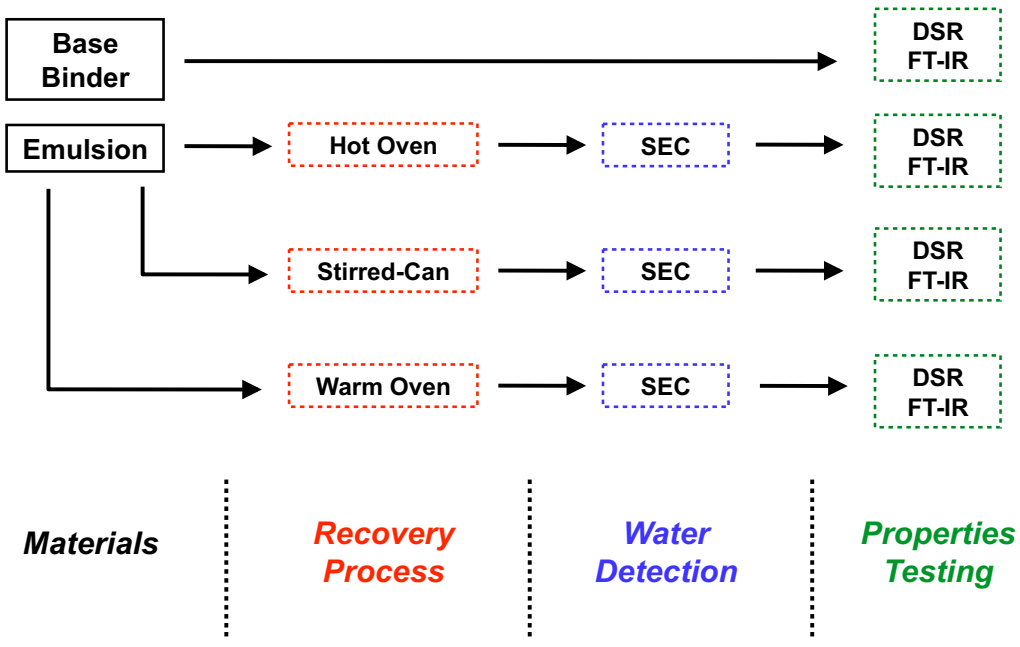
Objectives

- Determine the *water removal ability* of the selected emulsion recovery methods
- Compare *oxidation (CA)* of the recovered binders
- Compare the *rheology of the binders* recovered from the selected recovery methods

Emulsion Materials

Emulsion	Emulsion Type	Expected Base Grade	PG Grade from Tests	Polymer Modified
#1	RS-2P	PG 64-28	PG 64-34	Yes
#2	CRS-2	N/A	PG 58-28	No
#3	RS-2	PG 64-22	PG 64-22	No
#4	CRS-2P	PG 64-28	PG 64-28	Yes
#5	HFRS-2P	PG 70-28	PG 58-28	Yes

Work Plan



Recovery Methods

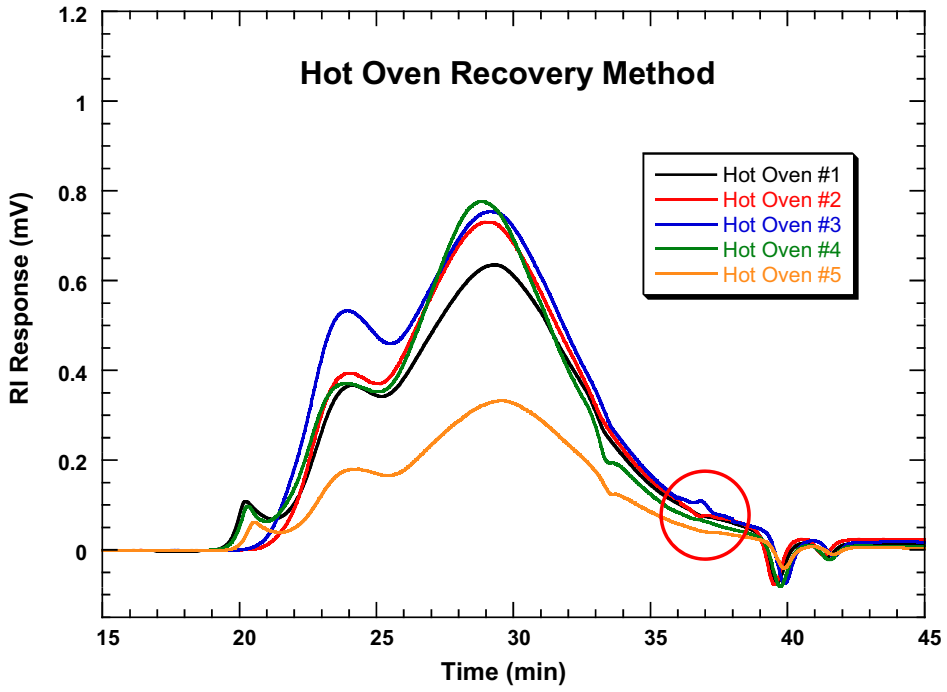
Recovery Method	Mass Charged	Recovery Time/Temperature	Purge	Agitation
Hot Oven (Similar to ASTM D-244-97C)	150 g	3 Hours @ 163 °C (325 °F)	Nitrogen	Once after two hours
Stirred-Can (Developed in FHWA-0-1710)	1250 g	100 Min @ 100 °C (212 °F) 50 Min @ 163 °C (325 °F)	Nitrogen	Yes
Warm Oven (ASTM D-7497-09)	0.15-0.2 g/cm^2	1 Day @ 25 °C 1 Day @ 60 °C	None	No

RESULTS

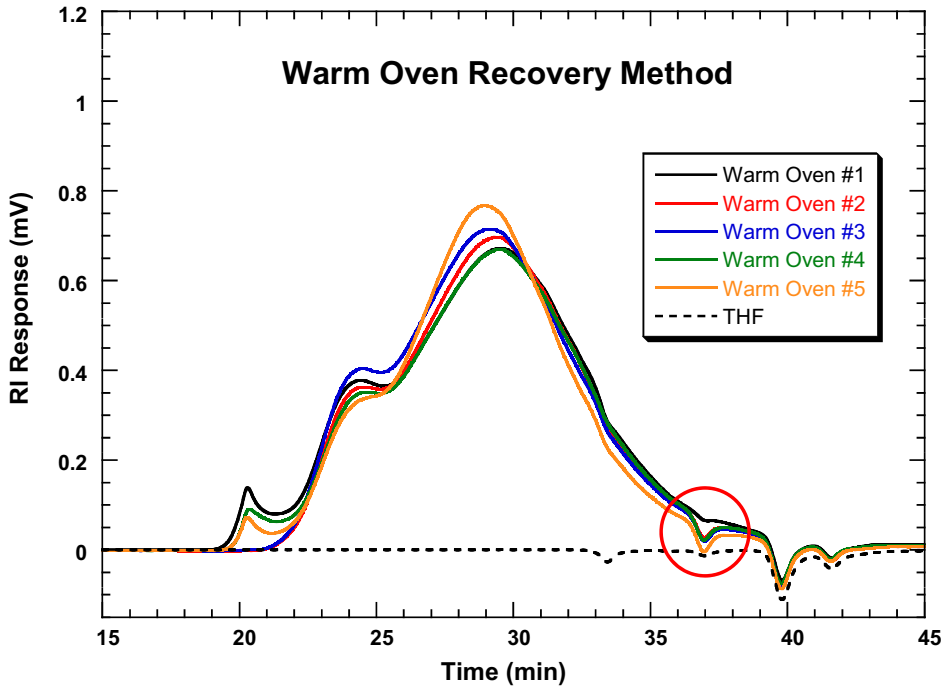
Water Removal

- Size Exclusion Chromatography (SEC) is used to detect any water residue in the recovered binders
- RI response for water appears as a negative peak at the 37 minute mark on the chromatograms

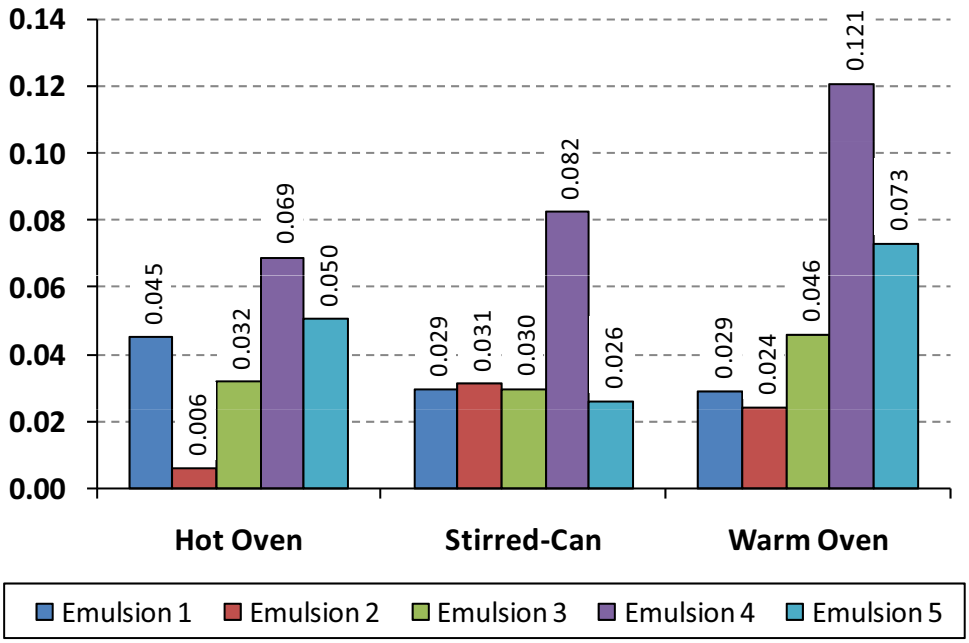
Chromatograms of Recovered Binders



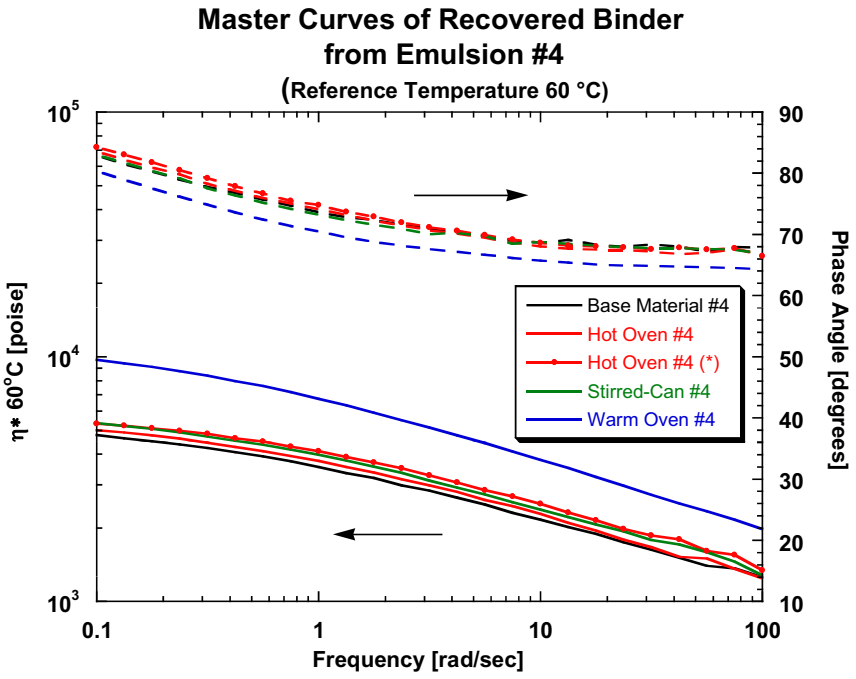
Chromatograms of Recovered Binders



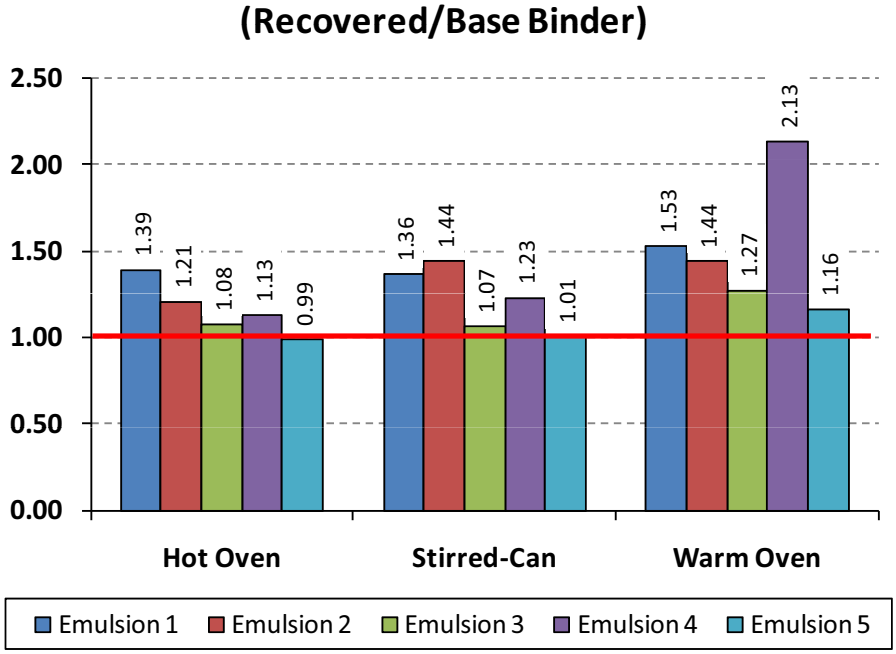
CA Difference (Recovered – Base Binder)



Low Shear Rate Viscosity #4



Low Shear Rate Viscosity Ratio



Conclusions

- Water Removal:
  - Hot oven &Stirred-can method: no sign of water
  - Warm oven samples: some small amount of water
- Oxidation:
  - Hot oven/Stirred-Can: High recov temp, but no O_2
  - Warm Oven: Low recovery temperature, but O_2
  - Differences in oxidation uncertain
- Hardening:
  - Hot oven, Stirred-Can: Slight residue hardening
  - Warm oven: Somewhat more hardening, *but* perhaps due to disruption of the polymer network *by the other methods ("right" answer is warm oven?)*

Acknowledgments

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QUESTIONS?