Evaluating the Impact of Various Asphalt Rejuvenating Agents on the Performance of Asphalt Binders

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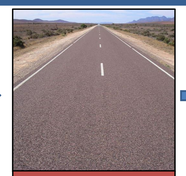
OBJECTIVES

- ❑ Evaluate effects of type and rate of rejuvenators on the high- and low-temperature performance grades of Oklahoma binders;
- ❑ Study the effect of binder and RAP source on the performance of rejuvenated binders;
- ❑ Investigate the impact of PAV-aging on the low-temperature performance and Delta Tc (ΔTC) of rejuvenated binders;

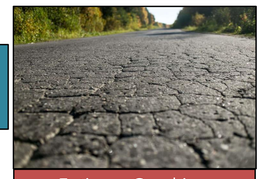
BACKGROUND

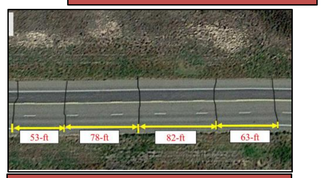

Reclaimed Asphalt Pavement (RAP)


Reduced Rutting


Economic and Environmental Benefits

Problems of using Aged Materials


Fatigue Cracking



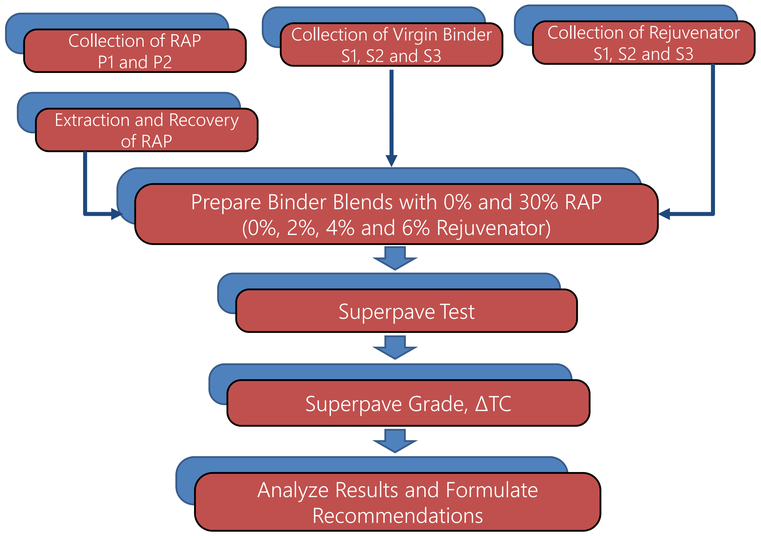
Thermal Cracking

Solution

Rejuvenator


Balanced Performance

METHODOLOGY



TEST METHODS

Extraction and Recovery of Binder from RAP


Extraction of Binder

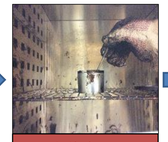

Recovery of Binder

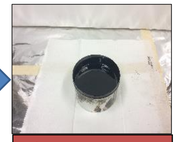

Extracted Binder

Preparation of Blended Binders


Virgin Binder


RAP Binder and Rejuvenator


Mixing


Blended Binder

Superpave Test on Blended Binders


RTFO-aging

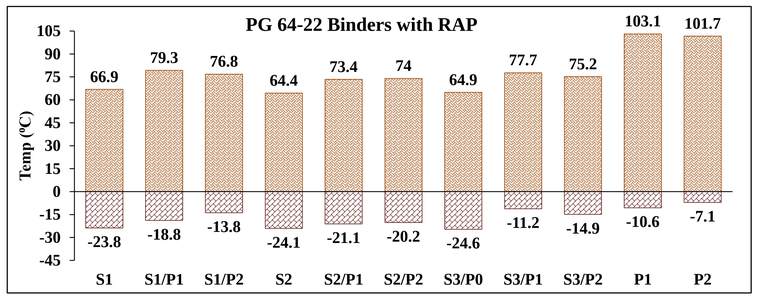

PAV-aging

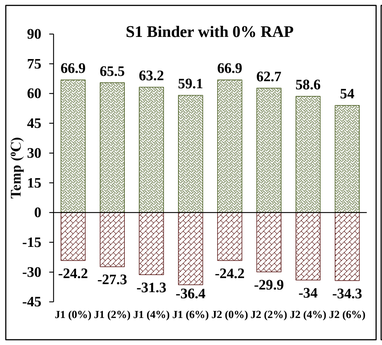

DSR

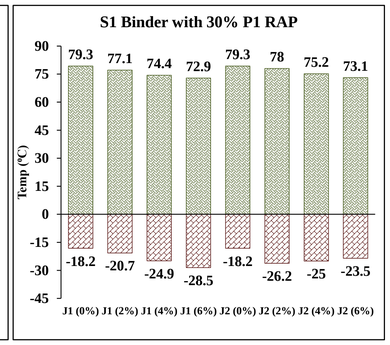

BBR Test

Results

Superpave Test Results

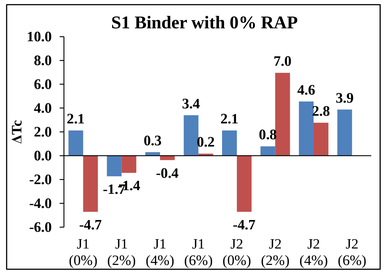


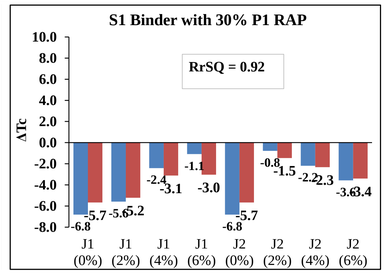


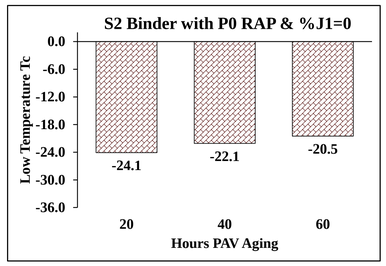


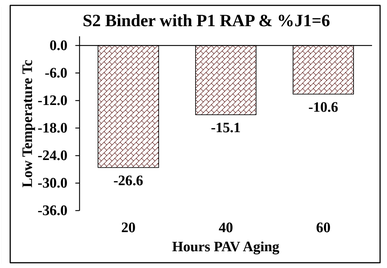
RESULTS (continue)

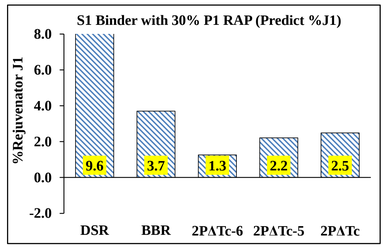
1- and 2-point ΔTc

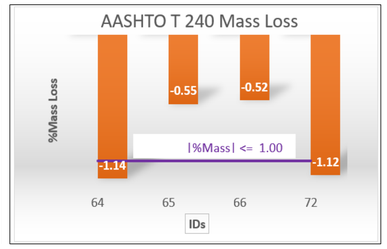












CONCLUSIONS

- ❖ Run %Mass loss on optimal %Rejuvenator;
- ❖ Set optimal %Rejuvenator by BBR Tc results;
- ❖ Reduce optimal %Rejuvenator based on mix rut test results, if needed;
- ❖ Recompute or retest blended Tc, if %Rejuvenator is reduced;
- ❖ Consider an activation factor for RAP aged binder, such as 88%
  - E.g., 30% RAP binder of total Binder will be considered as 26.4%.
- ❖ Specify %Rejuvenator additive method on mix design. Excessive %Rejuvenator may result in extra rutting.
- ❖ 40-hour PAV aging is useful for final PG at pavement end-of-life and standard practice for ΔTc
  - Not needed for %Rejuvenator determination
- ❖ 60-hour PAV aging information may be useful for rejuvenator product approval process;
- ❖ ↓High PG Tc Performance ⇒ Mix ↓Rut Performance;
- ❖ ↑Low PG Tc Performance ⇒ Mix ↑Cracking Performance.

Acknowledgement

Oklahoma Department of Transportation, Material suppliers of binders, RAP and rejuvenators.