Long-term Testing and Analysis on Asphalt Mix Rejuvenator Field Sections

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University of New Hampshire

NRRA National Road Research Alliance

MTE Mathy Technology and Engineering Services

Study Motivation and Objectives

- Rejuvenators used to incorporate higher amounts of RAP
- Very little long-term performance information (lab or field)
- Some concerns with extent of effectiveness over time
- Field test sections in Emily, MN constructed in August 2019
  - Wearing course with 40% RAP
  - Seven different RA products to meet PG XX-34 target for extracted & recovered binder
  - Control mixtures with 40% RAP and 30% RAP
- Evaluate effectiveness of the seven RA products placed in the test sections over time
- Compare performance to control sections

Project Details

TH6 from south of Emily to Outing, MN

- 5 inch existing asphalt
- 2 inch mill and fill
- 1.5 inch wearing course overlay (SPWEA340B)
  - Rejuvenators in this lift only
- All Research Sections placed in southbound direction

Field Test Sections

- Cell 6001 – Cargill
- Cell 6002 – Poet
- Cell 6003 – US Soybean
- Cell 6004 – Ingevity (WMA)
- Cell 6005 – Kraton
- Cell 6006 – Asphalt and Wax Innovations
- Cell 6007 – Georgia Pacific (terminally blended)
- Cell 6010 – 30% RAP control
- Cell 6011 – 40% RAP control (day 1)
- Cell 6012 – 40% RAP control (day 2)

Research Approach

- Binder and mixture characterization and performance testing to capture:
  - physical-mechanical properties of the asphalt binders over time
  - chemical properties of the asphalt binders over time
  - mechanical properties of the mixtures over time
- Various laboratory aging levels
- Testing of field cores
- Field performance of test sections over time

Project Tasks

1. Literature Review and Monitoring Coordination
2. Annual Interim Update 1st Year - Initial Construction Results
3. Plant Produced Mixture and Field Core Testing
4. Binder Testing
5. Annual Interim Update 2nd and 3rd Year
6. Final Report

Project Schedule

Year	2020				2021							
Month	S	O	N	D	J	F	M	A	M	J	J	A
Task 1: Workplan finalize												
Task 2: Construction Results												
Task 3: Mixture testing												
Task 4: Binder testing												
Task 5: Summary Reports												
Task 6: Final Report												
Reports						Task 1						Task 2
TAP meetings/presentations												

- Year 2: binder and mixture testing, Task 3, 4 & 5 reports
- Years 3&4: binder and mixture testing, Task 5 & 6 reports

Task 1: Literature Review and Monitoring Coordination

- Review NRRA Mix Rejuvenator Synthesis and recent publications
- Determine additional long-term aging condition
- Establish monitoring and coring plan
  - Coring each year in fall
  - Field monitoring in early spring and during coring
- Adjustments based on literature review, testing results, field performance over time
- Acquire materials for testing

Task 2: Annual Interim Update 1st Year - Initial Construction Results

- Summarize as-built information for field sections
  - Structure, mix details, RA info, QA data
- Rheological and chemical characterization of binders sampled during production and recovered from plant mix
- Comparisons between different RA materials and recovered and virgin/in-line sampled binders

Task 3: Plant Produced Mixture and Field Core Testing

Mixture Performance Test	Laboratory Conditioning			Field Cores
	Unaged	6 hours at 135°C	Additional long-term condition	
Disk-shaped Compact Tension (DCT)	✔	✔	x	-
Hamburg Wheel Track Testing (HWTT)	✔	-	-	-
Tensile Strength Ratio (TSR)	✔	✔	-	-
Ideal Cracking Test (CT-Index)	✔	✔	-	-
Complex Modulus (E*)	x	x	o	x
Direct Tension Cyclic Fatigue (DTCF)	x	x	o	x
Stress Sweep Rutting (SSR)	o	-	-	-

✔: conducted by NRRA members x: conducted by research team

o: conducted based on need determined from other test results and availability of materials

Task 4: Binder Testing

Binder Type	Unaged	Binder Conditioning Levels				Plant Produced Loose Mixture Conditioning Levels	
		RTFO	20 hours PAV	40 hours PAV	60 hours PAV	6 hours at 135°C	2nd aging condition
Virgin (tank/inline sampled) Binder	✔	✔	✔	-	-	NA	NA
Binder Extracted and Recovered from Plant Produced Loose Mixture	✔	-	✔	✔	✔	✔	✔
Binder Extracted and Recovered from Field Cores (top 1/2 inch)	✔	-	-	-	-	NA	NA
RAP only	✔	-	-	-	-	NA	NA

- Rheological characterization: master curves, indices, PG
- Chemical characterization: SARA, FTIR
- Binder fatigue: LAS

Task 5: Annual Interim Update 2nd and 3rd Year

- Summary of additional testing and analysis on project materials and field cores
- Field performance to date
- Presentation to TAP and/or through NRRA Research Pays Off webinar series

Task 6: Final Report

- Draft final report following MnDOT publication guidelines
- Review by Technical Advisory Panel (TAP)
- Develop and deliver close-out presentation
- Technical brief on key project findings and outcomes
- Draft procedures on selection and evaluation of rejuvenators
- Revisions to incorporate TAP review comments
- Incorporate editorial review
- Final publishable report

Thank you for your attention!

Questions and Comments?

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