Construction Task Force Update
FHWA Mix ETG

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Discussion Points

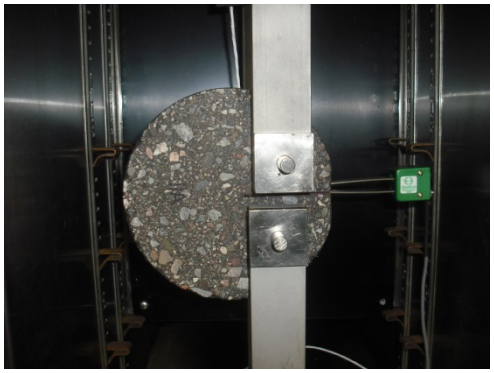
- High RAM Projects and Performance Testing
- Joint Density in-Progress Research
- Solicit Mix ETG for future task force activities

High RAM Projects

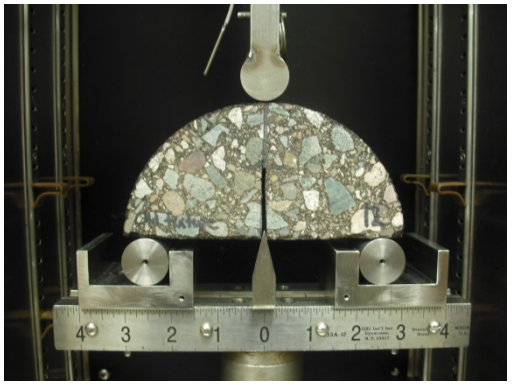
- 2014
  - STH 77 Ashland CTY WI. Part of WisDOT High RAM Pilot Program
- 2015
  - Three projects in NC WI and Central MN. One state road and two county highways.
- % Binder Replacement ~40%.
- Incorporate performance testing in mix design and production testing.

Selected Performance Tests

Thermal Cracking
DC(t)



Fatigue
Semi-Circular Bend (LSU and UIUC)



Rutting
Hamburg

LT (-18 or -24°C)

IT (15°C)-LSU
25°C - UIUC

HT (50°C)

Long Term Aging – Loose Mix Aging 12 hours @ 135°C

- SCB and DCT
- Recovered binder grade and ΔTc

High RAM General Approach

Materials Selection

1. Characterize RAM	• Obtain millings from project. • Extract/RAM binder and determine true PG. • Average LT grade of RAP ~-24°C
2. Select PBR and Virgin Binder	• Apply Blending Charts: Target Plan Grade. • Select virgin binder grade: PG 58-28, PG 52-34, PG 58-40
3. Volumetric Mix Design	• Same process as conventional mix design. • Target %AV of 3.5% of 4.0% used.

High RAM General Approach

Mix Design and Performance Testing

4. Verify Binder Properties	• Extraction and recovery on mix design pill. • Grading based on as-recovered and as-recovered + PAV. Include ΔTc • Have also used binder from loose mix aging.
5. Evaluate Hamburg	• Verify the mix has adequate stability. • Reasons for instability could be grade dumping or use of more asphalt binder.
6. Cracking Resistance	• 12 hours at 135°C – Loose Mix Aging • Mixture: SCB @ 15°C, DCT @ PG LT +10°C, Fracture Energy > 400 J/m^2

Testing Plan

- Mix Design
- Construction
  - 1st 600 ton of production
  - Every 10k ton after.
- Future Evaluation
  - Field performance surveys.
  - Coring and analysis of mixture modulus (TB), cracking tests and recovered binder properties.

Example – STH 77 Comparison to Control Mix

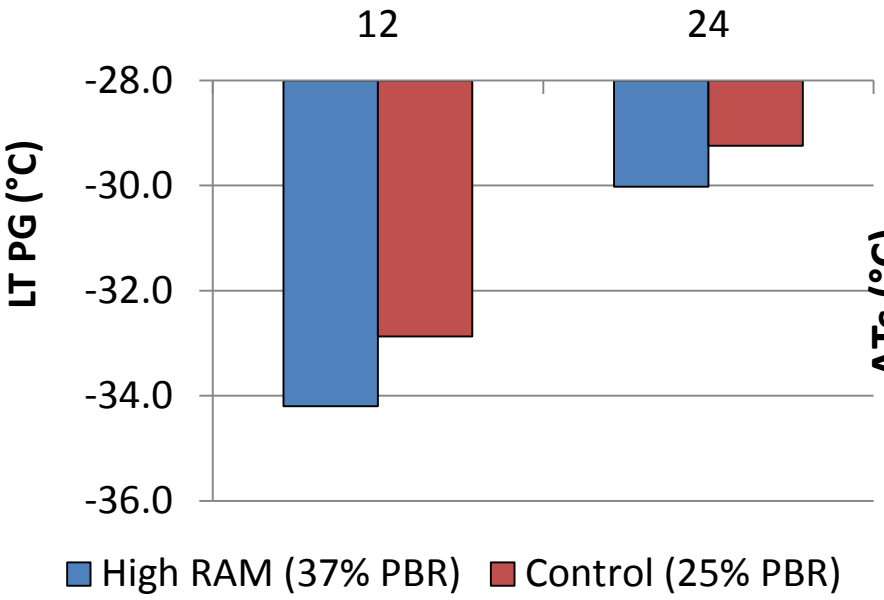
- At a minimum our expectation was that the high RAM mix would perform as well as conventional mixes placed in WI.
- Primary distress in WI is cracking, comparison will focus on
  - Recovered binder grading
  - DCT testing
  - Sensitivity to aging

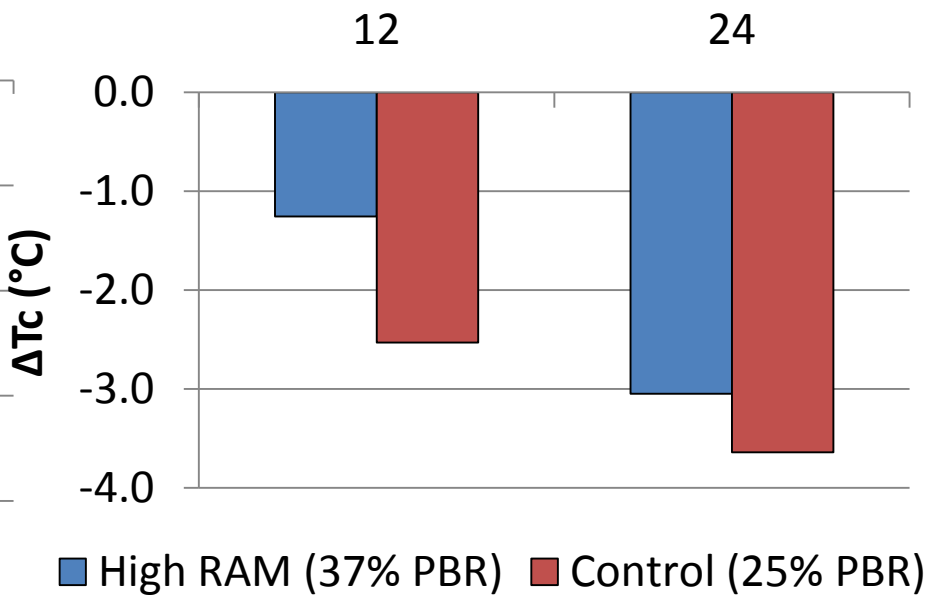
Comparison of Mix Designs

Property	Control Mix – 12.5mm	High RAM 12.5mm
% Binder Replacement	24.5%	36.7%
Design Air Void	4.0%	3.5%
VMA	15.1%	14.9%
Vbe	12.7%	13.3%
Dust to Binder Ratio	0.90	1.0
Asphalt Binder Grade	PG 58-34	PG 58-40
MSCR Jnr 3.2 kPa @ 58C	3.0	1.1
MSCR %R 2.3 kPa @ 58°C	0	43.5%

Binder Properties

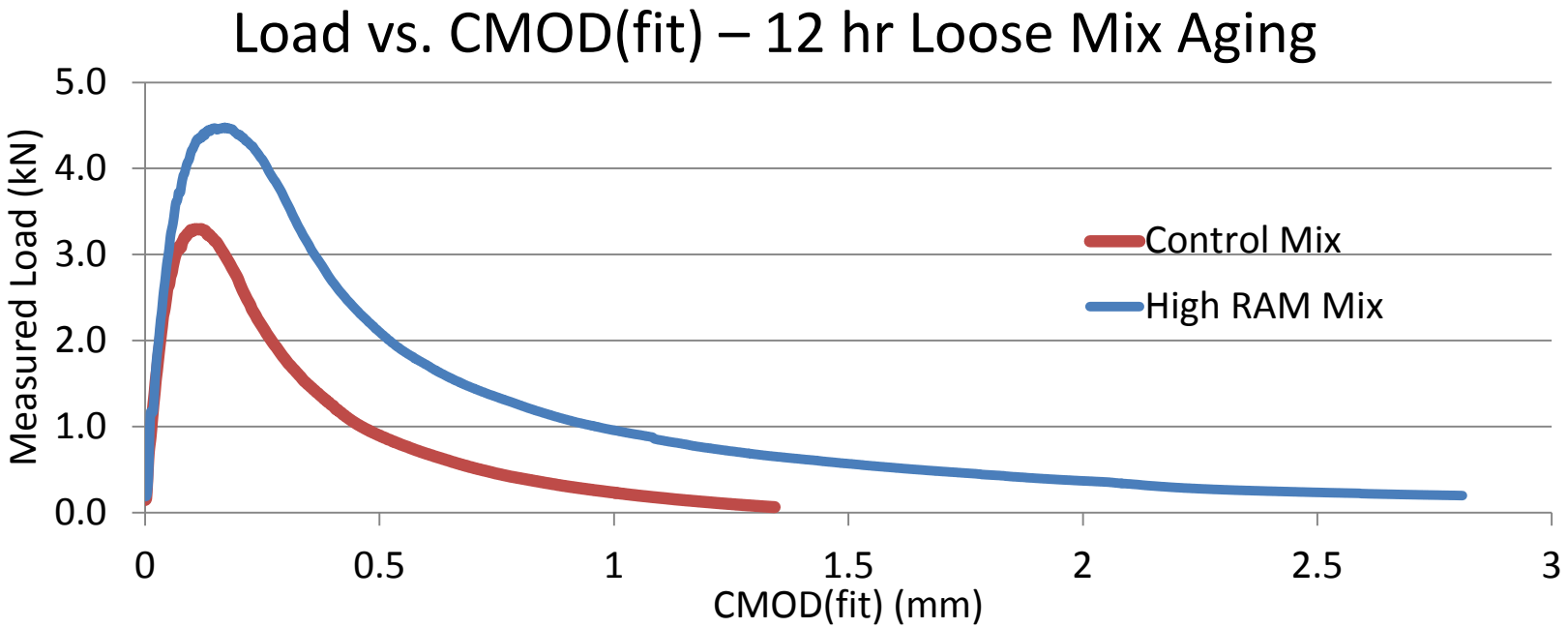
Binder recovered from mixes subjected to loose mix aging at 135°C





- High RAM mix is softer after 12 hours loose mix aging, mixes behave the same at 24 hour aging.
- Differences in R (2.8 vs. 3.0) and cross over frequency (61 rad/s vs. 12 rad/s) observed for high RAM mix.

DCT Results @ -24C



Mix	Gf: 12 Hr Loose Mix Aging (J/m2)		Gf: 24 Hour Loose Mix Aging (J/m2)	
High RAM	634.3	70.8	587.5	127.9
Control	296.1	20.4	360.4	5.0

STH 77 Observations After 1 Yr.

- High RAM Section was 4 miles long.
- Control is 9 miles.
- Overall pavement is performing well.

- Very few transverse cracks.
- Small crack width
- No difference in performance between sections.

Final Remarks

- Performance testing has evolved from a research tool to part of conventional practice in our lab.
- We have found it beneficial to adjusting mix designs or materials selection.
- With this set of projects there is an opportunity to compare actual field performance to laboratory test results.
- Possibility to compare lab conditioning vs. field aging.

Future Research Activities

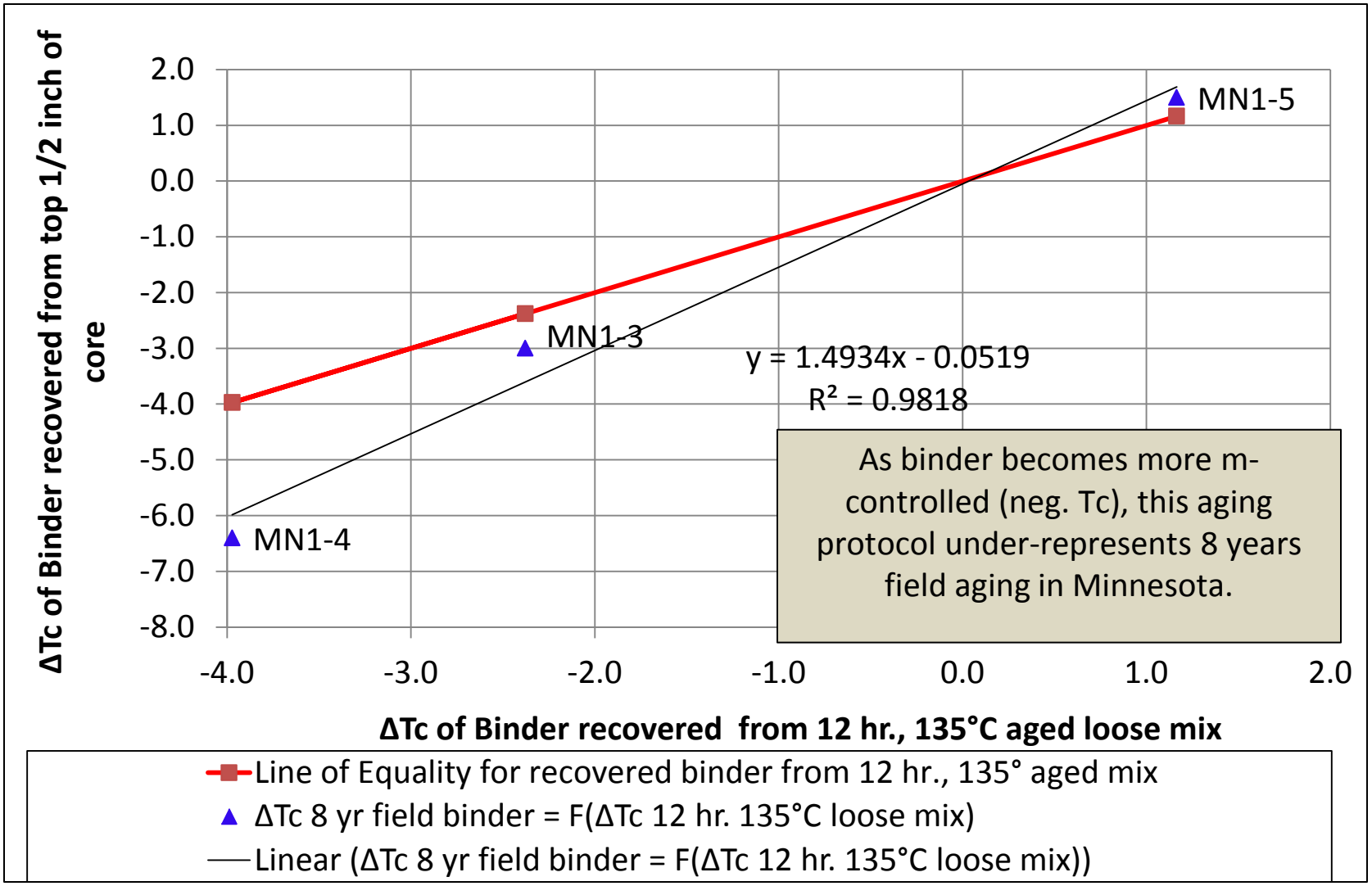
1. Effect of Laboratory Aging
   - Understand effect of aging on performance tests.
   - Compare lab aged vs. field aged materials.
   - Loose mix aging vs. PAV.
2. Comparison of High RAM to Standard Mixes
   - Establish baseline for performance properties.
   - Compare rates of aging.
3. Contribute to identifying performance based limits.

Performance Testing Challenges

- Test procedure harmonization: conditioning, sample geometry, etc.
  - Example: WisDOT vs. MnDOT DCT, Notch depth/width for different cracking tests.
- Repeatability within lab and between lab.
  - ASTM working group for SCB, cracking test study with Rutgers.
- Aging: Protocol and relation to field.
- Selecting tests and performance criteria
  - Use “standard” mixes as a baseline.

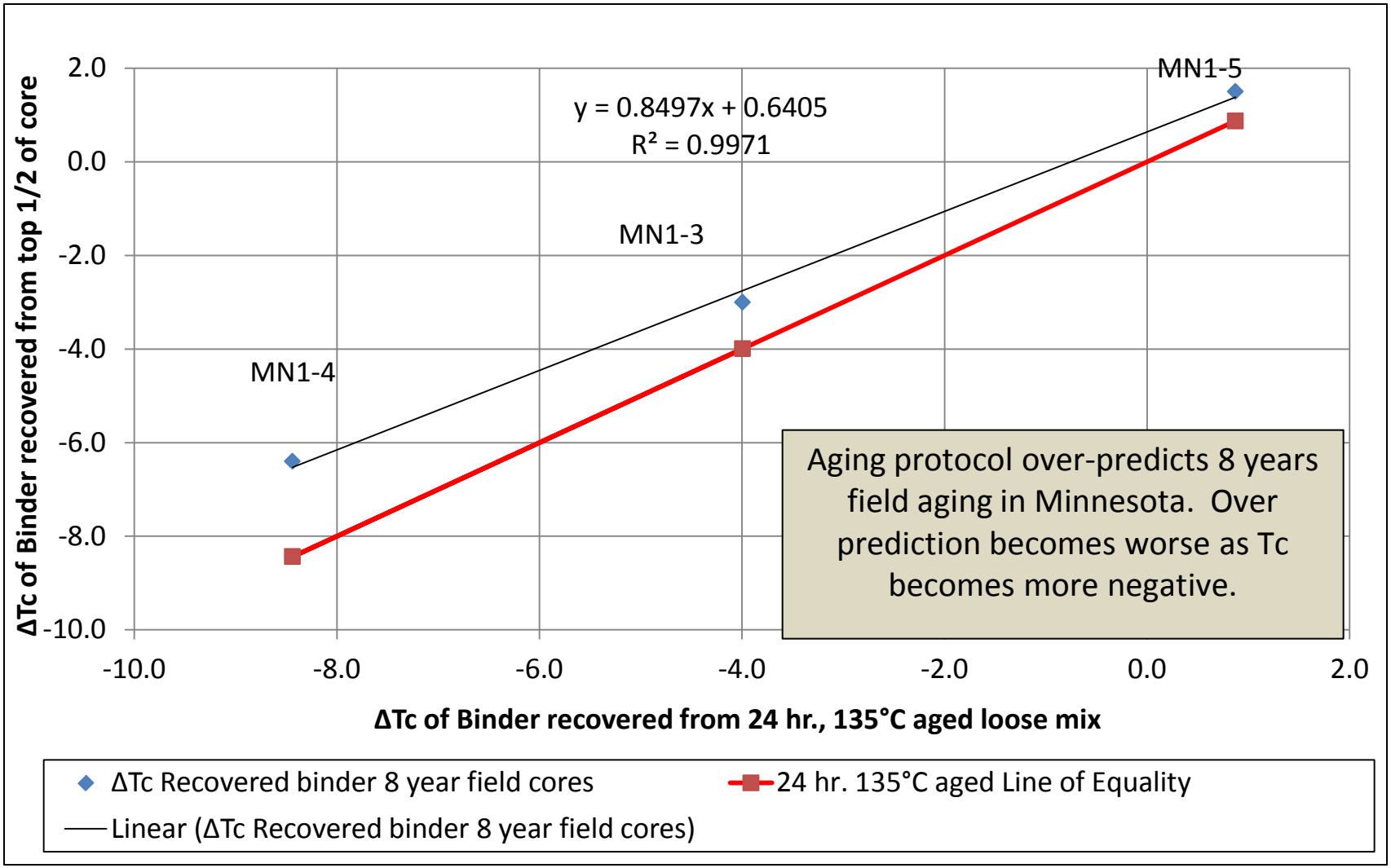
Laboratory vs. Field Aging, (Reinke, 2015 ETG)

12 Hr. Loose Mix @ 135°C



Laboratory vs. Field Aging (Reinke, ETG 2015)

24 Hr. Loose Mix @ 135°C



Longitudinal Joint Density Research

- WisDOT Funded 0092-15-09
  - Asphalt Mixture New Specifications Implementation – Field Compaction and Density Validation (end June 2016)
- Two specific initiatives that require additional field research and evaluation
  - Special provision for Thin Layer Overlays
  - Evaluate density measurements of longitudinal joints to assess construction and compaction
- Mathy is also collecting joint density data on projects in WI, MN, IA, and MI.

Open Discussion

- Task Group gave updates on two items:
  - Performance testing on lab and field produced mix. Future opportunity to compare lab measures to field performance.
  - Longitudinal Joint Density work that will be complete in 2016.
- Suggestions from the ETG for other activities?

Thank you

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