Low Temperature Cracking Implementation Activities in Minnesota

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TPF-5(132) Close Out Meeting
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Draft Mixture Specification

- Prepare sample during mix design
  - Contractor provide extra TSR pucks
  - Prepare specimens at 7% air voids
- Perform 3 replicate tests at pavement temperature per LTPPBind
  - -24 ºC for Minnesota
- Average G_f > 400 (450?) J/m^2
- Make adjustments if mix fails & retest

DCT Low Temperature Fracture Testing Pilot Project

- 2 year project (July 2012 - June 2014)
- $96,000
- Laboratory testing
- Contractor mix adjustments
- Equipment purchases

Identify Construction Projects

- 3-5 projects in 2012 or 2013
- New construction
  - Aggregate base or FDR/SFDR
- Coordinate with Bituminous Office, Contractor, Construction
- Ulland Brothers – St. Louis County CSAH 21
  - FDR + Overlay
- Commercial Asphalt/Stantec – BAB
- District 3 – TH 71 (2013)

Laboratory DCT Testing and Mix Design Adjustments

- Contractor provide samples at mix design
- UMD performing DCT tests
  - MnDOT may perform companion tests
- If mix meets spec, approved for paving
- If mix fails spec, contractor must make adjustments

Possible Mixture Adjustments

- Binder grade
  - Reduce low PG (-34 vs -28)
  - Different modifier or supplier
- Aggregate source
  - Granite/taconite instead of limestone
  - Reduce RAP/RAS content
- Aggregate gradation
  - Finer gradation
  - Increase binder content

Pavement Construction

- Construct pavement with approved mixture
  - Funding available for contractor to change materials
- Document conditions at plant and paver
- Take samples to test as-produced mixture
  - For information only

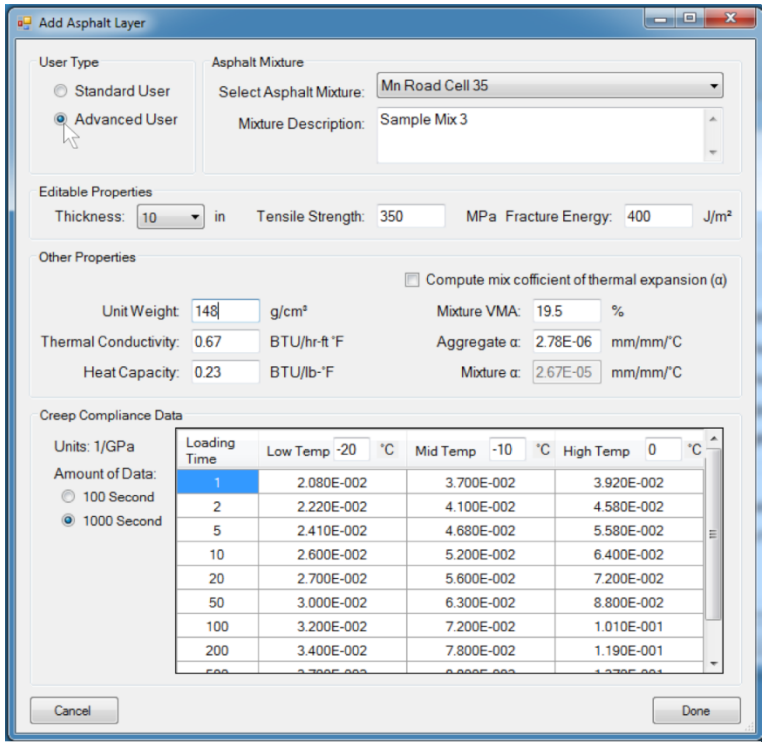
Prepare Final Report

- Summarize all work conducted during the project
  - Project selection
  - Laboratory testing
  - Mix adjustments
  - Field construction
  - Initial pavement performance

Purchasing Lab Equipment

- Test fixtures
- CMOD gauge
- Software modifications
- Wet core saw & driller
- Wet-band saw
- Temperature controller
- Core barrels (1” & 6”)
- 8” caliper

Evaluating ILLI-TC Model



- Compare ILLI-TC with DarwinME
- What inputs are needed?
- What is the output?
- Performing trial runs

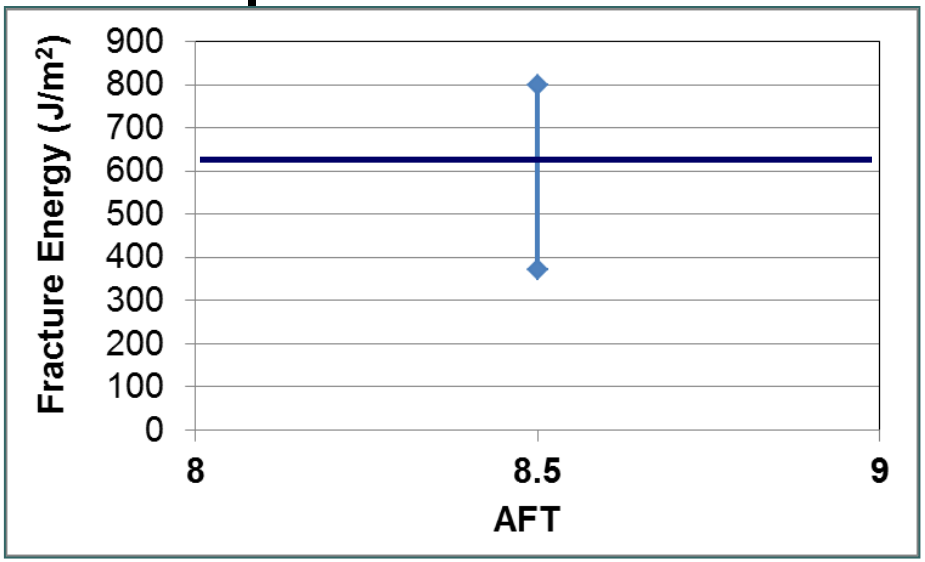
TESTING ADDITIONAL MIXTURES

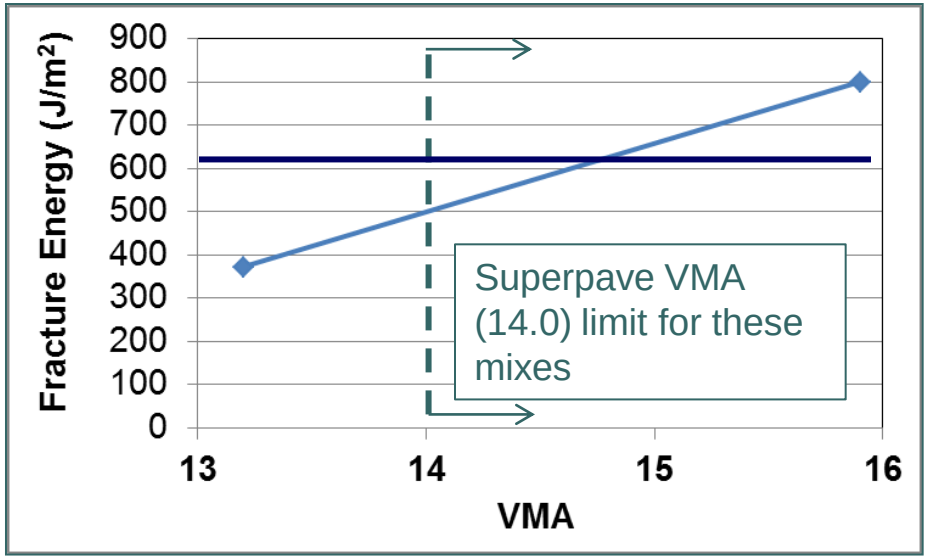
To answer questions about in-service pavements out in the districts

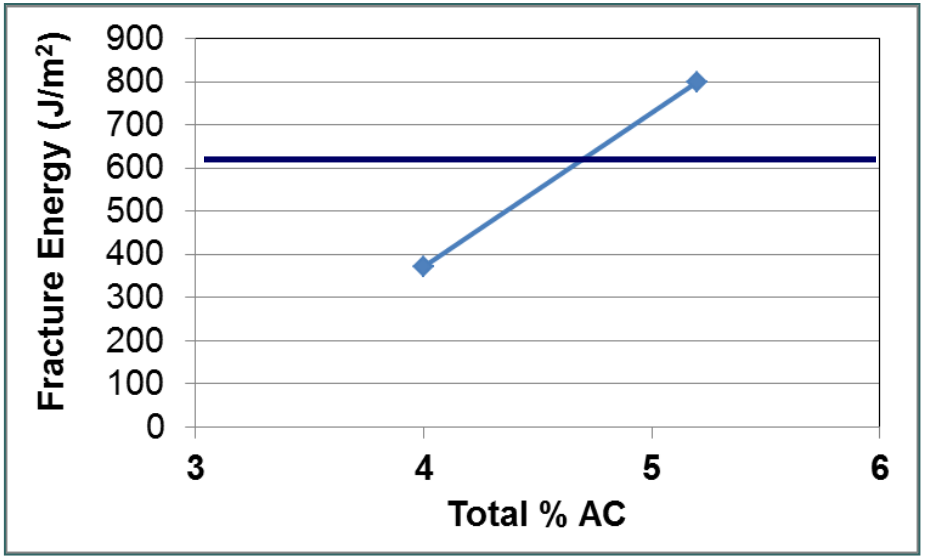
Project 1 – Materials

- TH9 (SPWEB340C)
  - Coarse Gradation
  - Virgin Binder: PG 58-34 (73% New AC, 20% RAP)
  - Total AC = 4.0%
  - AFT = 8.5
  - VMA = 13.2
- TH70 (SPWEB340C)
  - Fine Gradation
  - Virgin Binder: PG 58-34 (76% New AC, 20% RAP)
  - Total AC = 5.2%
  - AFT = 8.5
  - VMA = 15.9

Effect of Volumetrics





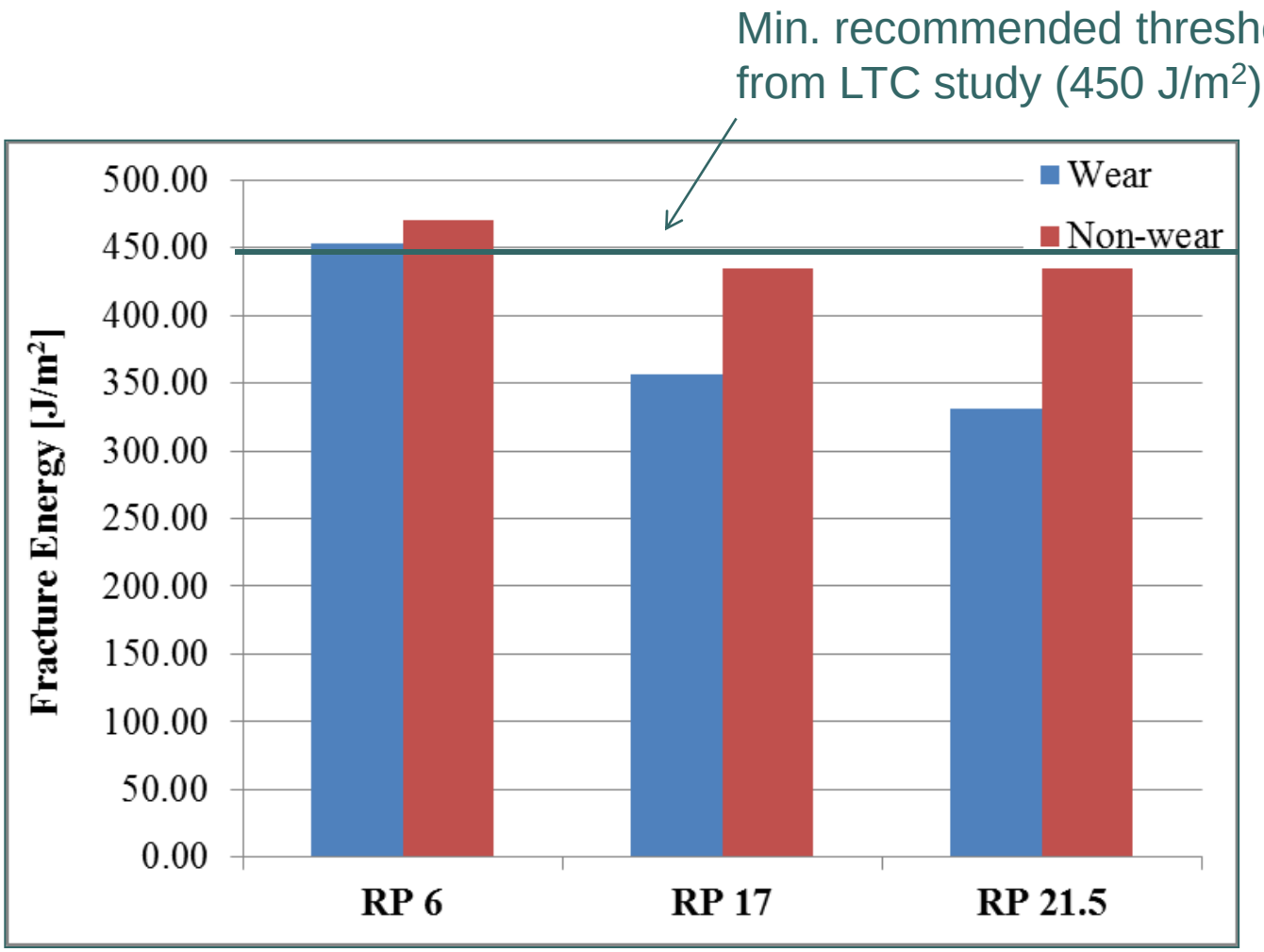


- Same AFT but very different fracture energies
- As VMA increases fracture energy increases (also seen in previous studies)
- More AC = Better Fracture Energy

Project 2 – Materials

- TH371
  - RP6 (2005)
    - Wear: WEB440C, 12.5 mm, **PG 58-34**
    - Base: NWC430H, 19.0 mm, PG 70-28
  - RP17 and RP21.5 (2004)
    - Wear: WEB440F, 12.5 mm, **PG 64-34**
    - Base: NWC430B, 19.0 mm, PG 58-28
- Significant cracking was observed near RP 21.5 (more than other areas)
- RP6 showed minimal cracking

Results



* The fracture energies aligns well with field cracking

Summary

- Implementation project is underway
- Support from Bituminous Office, Districts, Industry
- Tool to evaluate in-service pavements
- HMA Performance Testing project
- Eventually extend to other types of cracking
  - Fatigue, Top Down, Reflective

Thank You!

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