Developing and Carrying out a Preservation Research Program

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Presented at the Southeast Pavement Preservation Partnership
Nashville, Tennessee
September 13, 2010

Pavement Preservation Projects at NCSU

Completed

- Optimizing Gradations for Surface Treatments (HWY-2004-04) – ***Aggregate***
- Quantifying the Benefits of Improved Rolling on Chip Seals (HWY-2006-06) – ***Rolling***
- Performance Based Asphalt Emulsions in Bituminous Surface Treatments

$1.8 million since 2003

Ongoing

- Development of a New Chip Seal Design Method (HWY-2008-04) – *Mix Design*
- Development of a Field Testing System for Asphalt Surface Treatments (HWY-2009-01) – *Field QC Test*
- Fog Seal Effectiveness for Bituminous Surface Treatments (HWY-2010-02) – *Fog Seal*
- Extending the Use of Chip Seals to High Volume Roads by Using Polymer-Modified Emulsions and Optimized Construction Procedures (HWY-2011-03) – *High Volume Application*

Research Goals at NCSU

- Develop and introduce more advanced and performance based test and analysis methods to specifications, design, and construction of pavement preservation treatments (PPT)
- Improve the performance of PPT by refining current and developing new materials and construction techniques
- Extend the application of PPT to higher traffic volume roads

Performance Test Methods

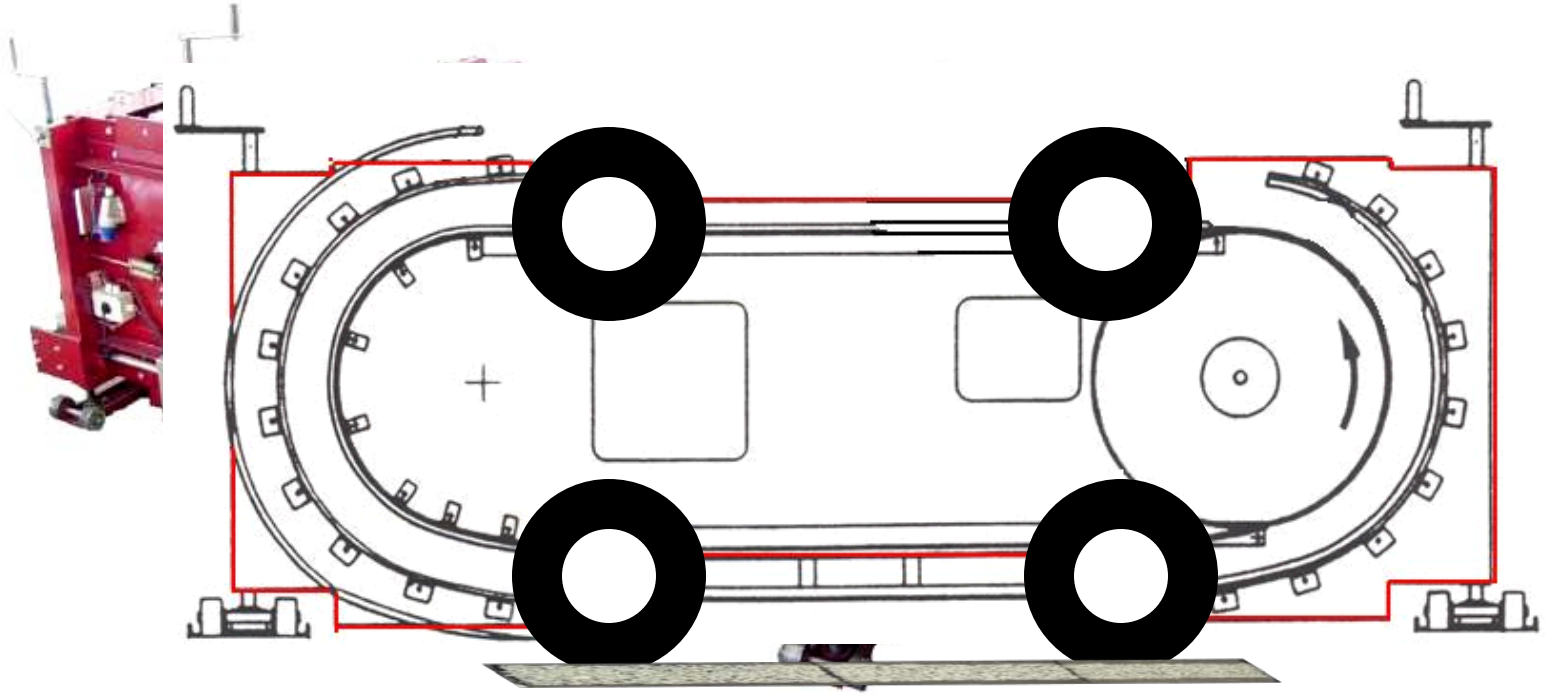
Existing Test Methods

Test	Location	Performance Properties
British Pendulum Test	Lab, Field	Skid resistance
Locked Wheel Skid Test	Field	Skid resistance
Sand Circle Test	Lab, Field	Surface texture depth
Vialit Test	Lab, Field	Adhesion between aggregate and emulsion
Flip-Over Test	Lab, Field	Amount of excess aggregates
Sweep Test	Lab	Aggregate retention performance

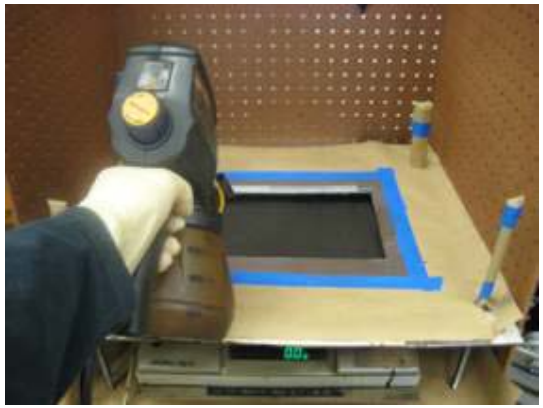
Test Methods Developed at NCSU

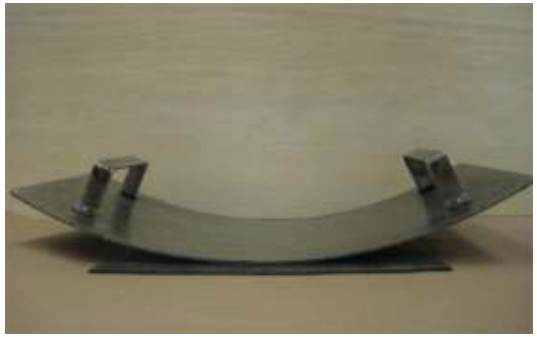
Test	Location	Performance Properties
MMLS3 Test	Lab	Aggregate retention, Bleeding
Laser Profiling Test	Lab, Field	Surface texture, Aggregate embedment depth
Surface Digital Imaging Test	Lab, Field	Bleeding evaluation
Crosssectional Digital Imaging Test	Lab	Surface texture, Aggregate embedment depth

Third Scale Model Mobile Loading Simulator (MMLS3)



Chip Seal Specimen Fabrication Using ChipSS

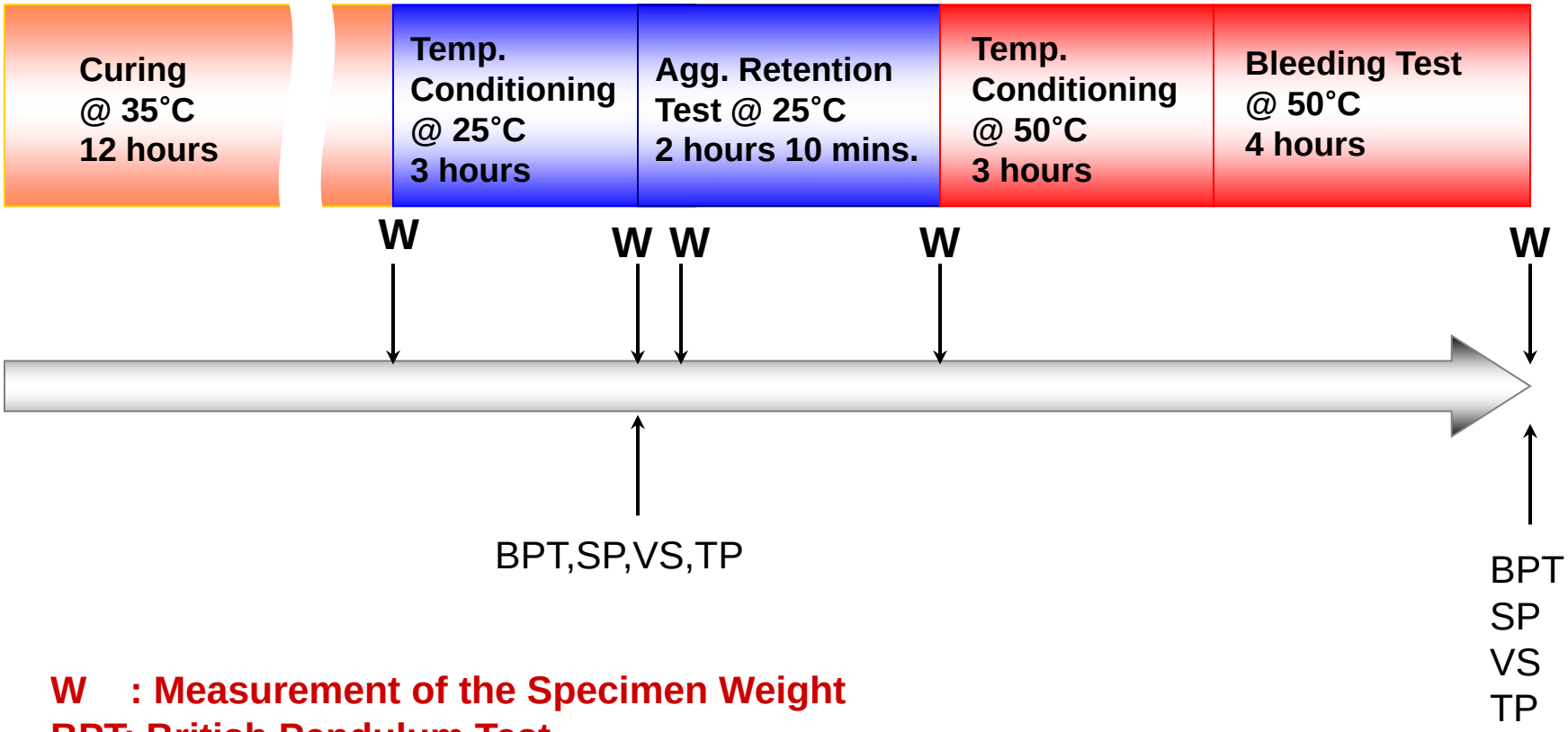




Field Sampling

MMLS3 Test Preparation

MMLS3 Test Procedure



W : Measurement of the Specimen Weight
BPT: British Pendulum Test
SP : Sand Patch Test
VS : Visual Survey
TP : Transverse Profiling

Before Loading

990 passes at 25°C

2,970 passes at 25°C

5,940 passes at 25°C

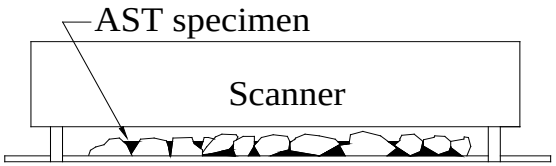
11,600 passes at 25°C

23,760 passes at 50°C

Digital Imaging of Surface

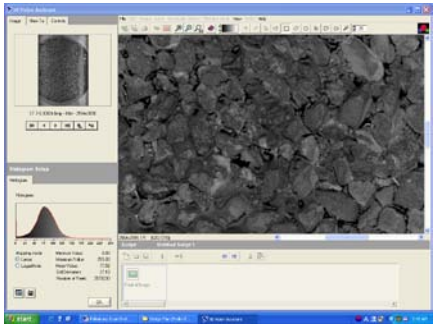
(a)

Image acquisition



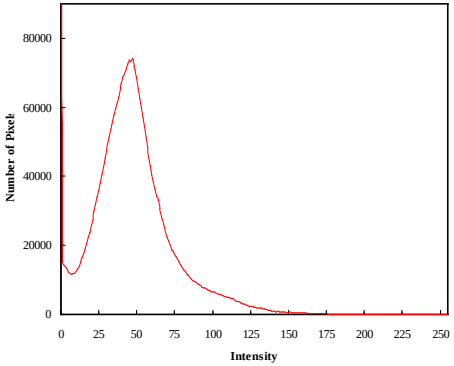
(c)

Image processing



(c)

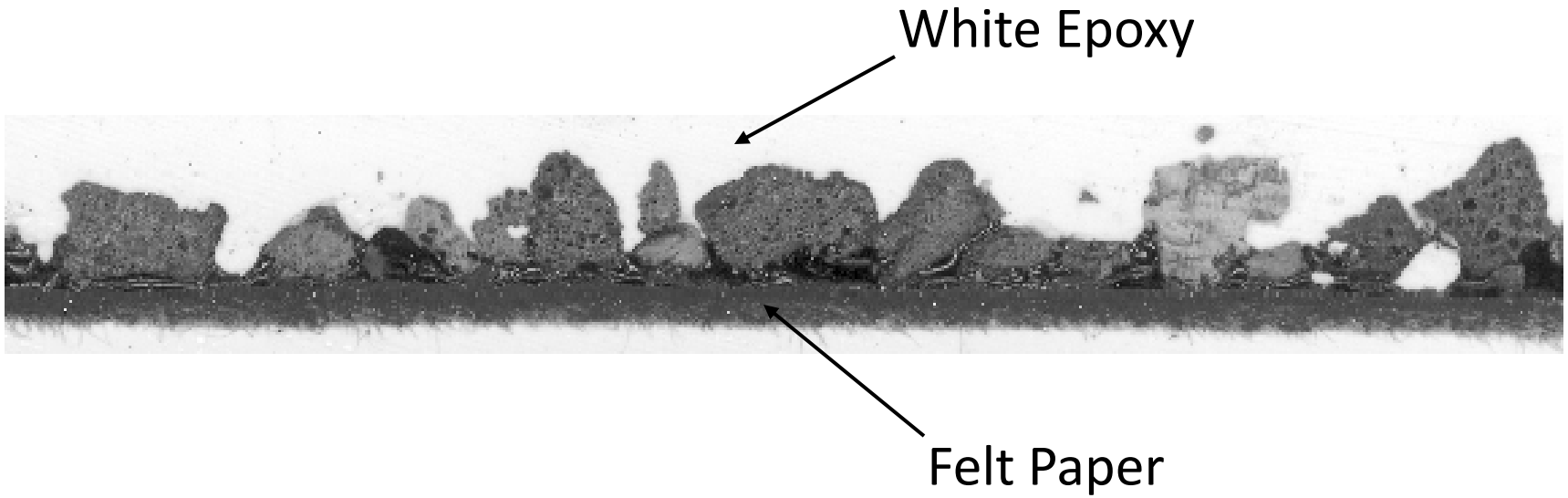
File conversion



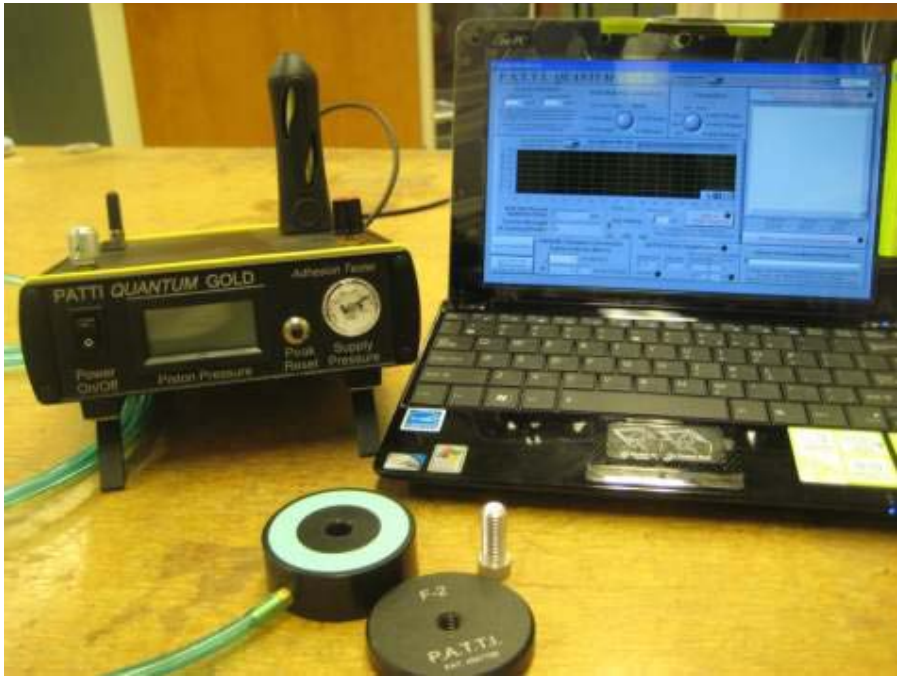
(d)

Laser Profiler

Digital Imaging for Embedment Depth Determination



PATTI Test

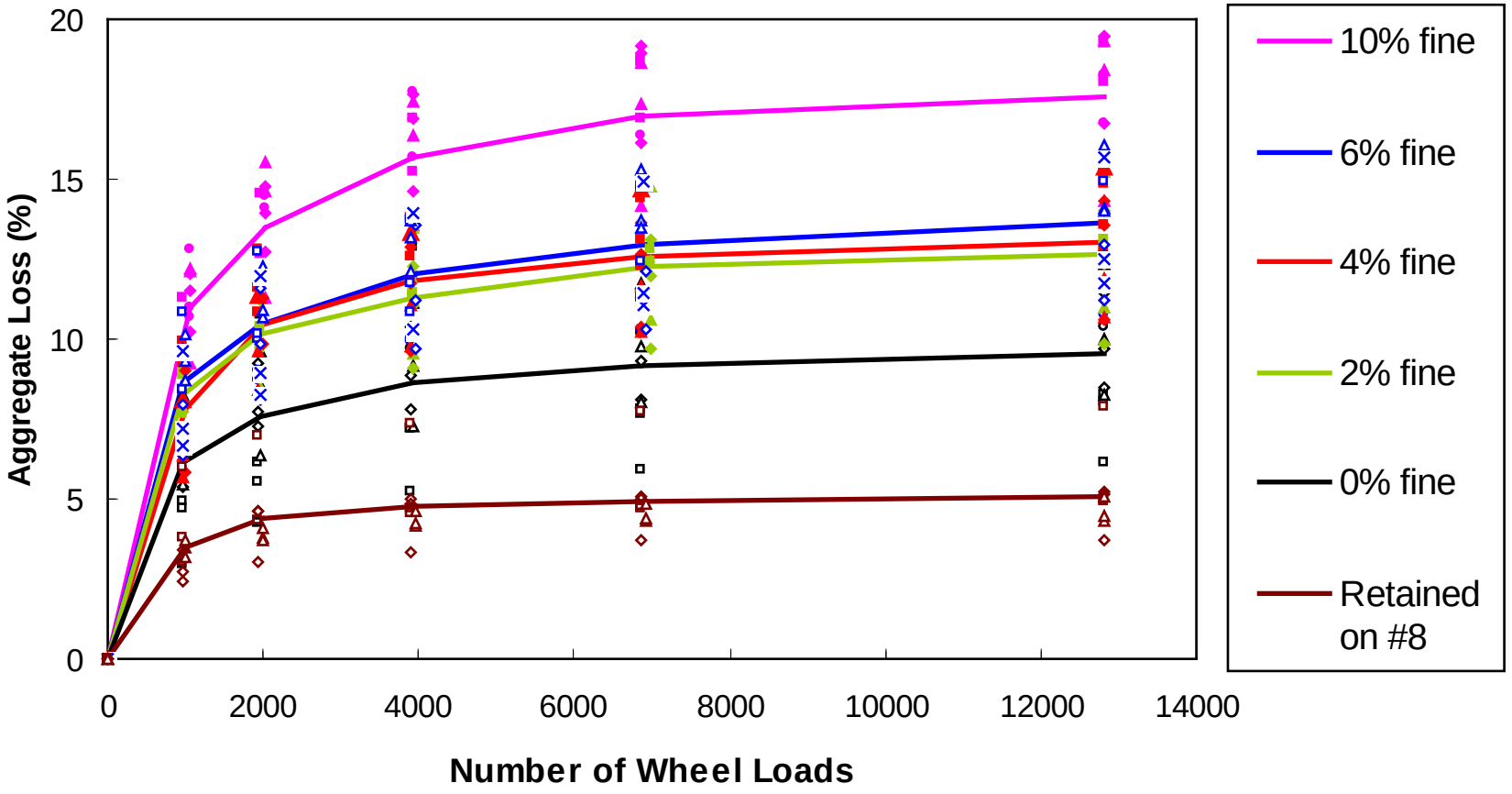

PATTI QUANTUM GOLD
Adhesion Force
Power On/Off
Piston Pressure
Peak Reset
Supply Pressure
F-2
PATTI


P.A.T.T.I.
F-2

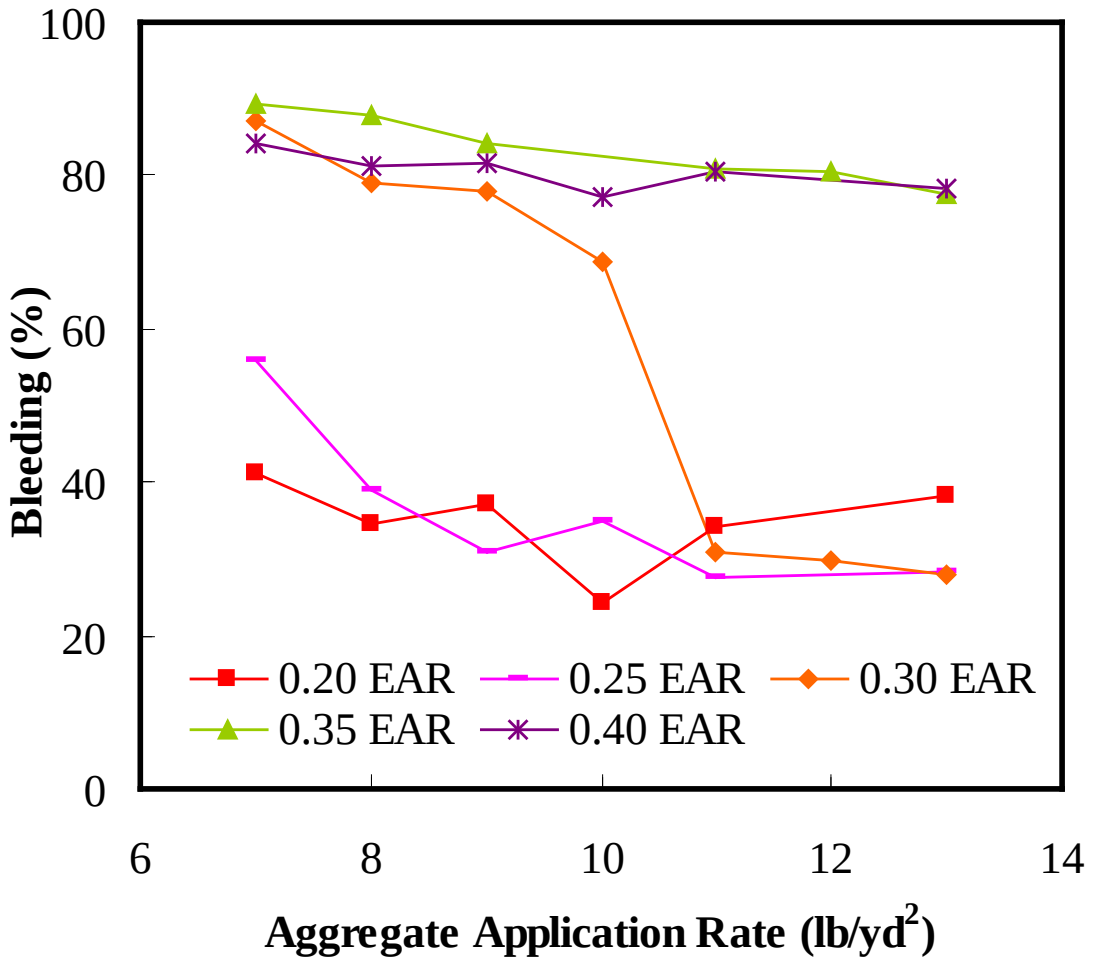
Findings

Effect of Fine Content and Gradation

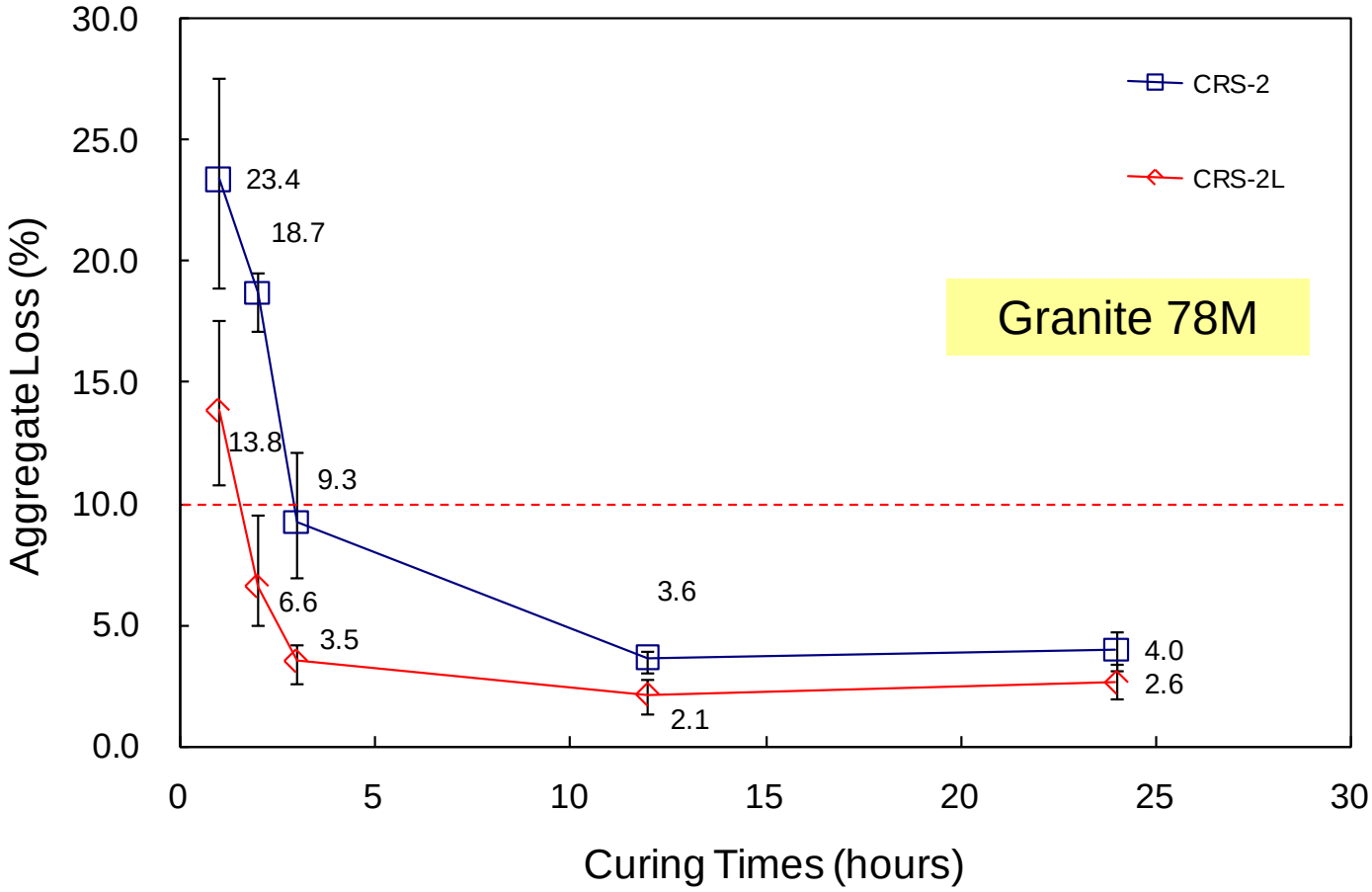
Granite



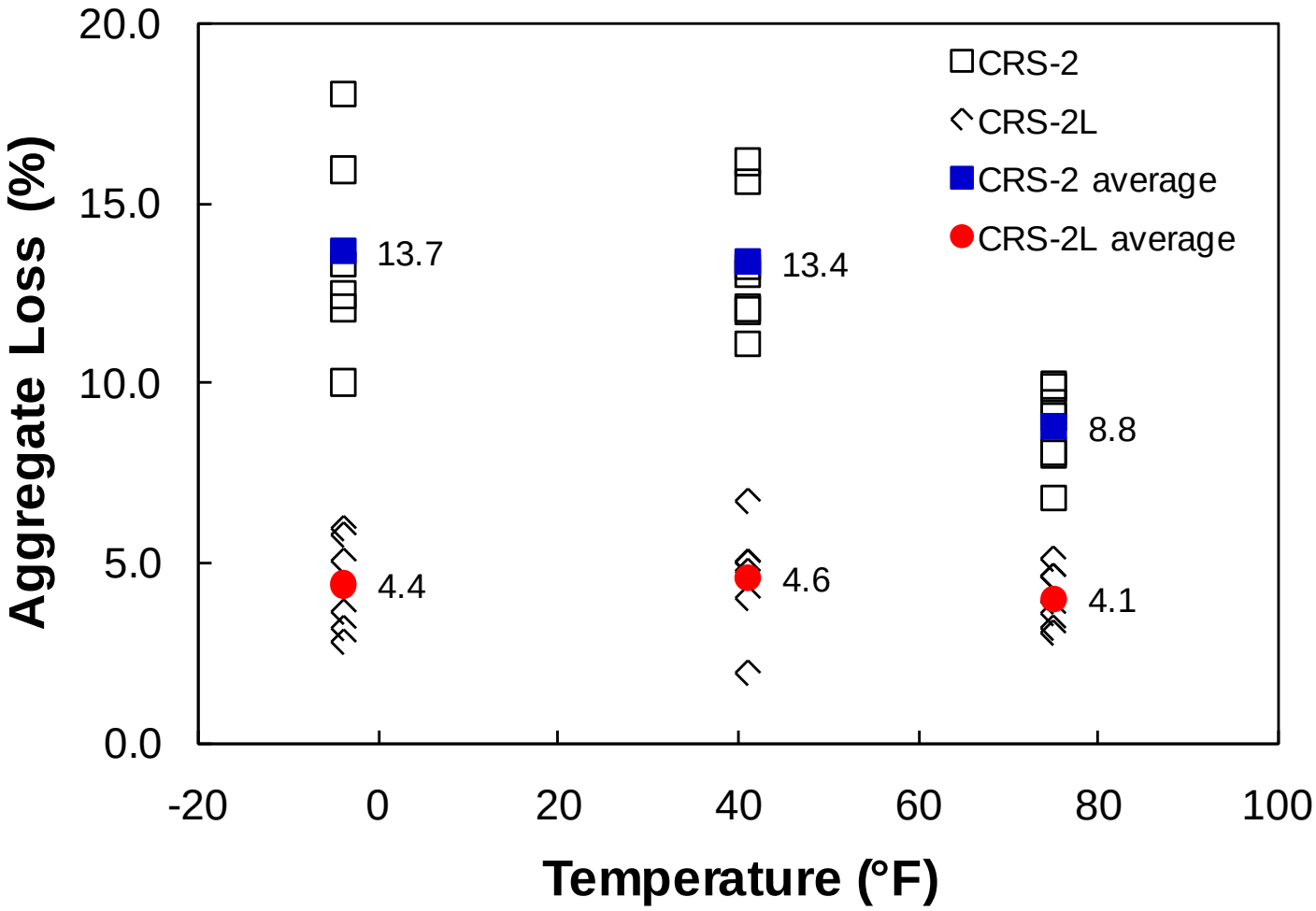
Mix Design



Effect of PME on Curing

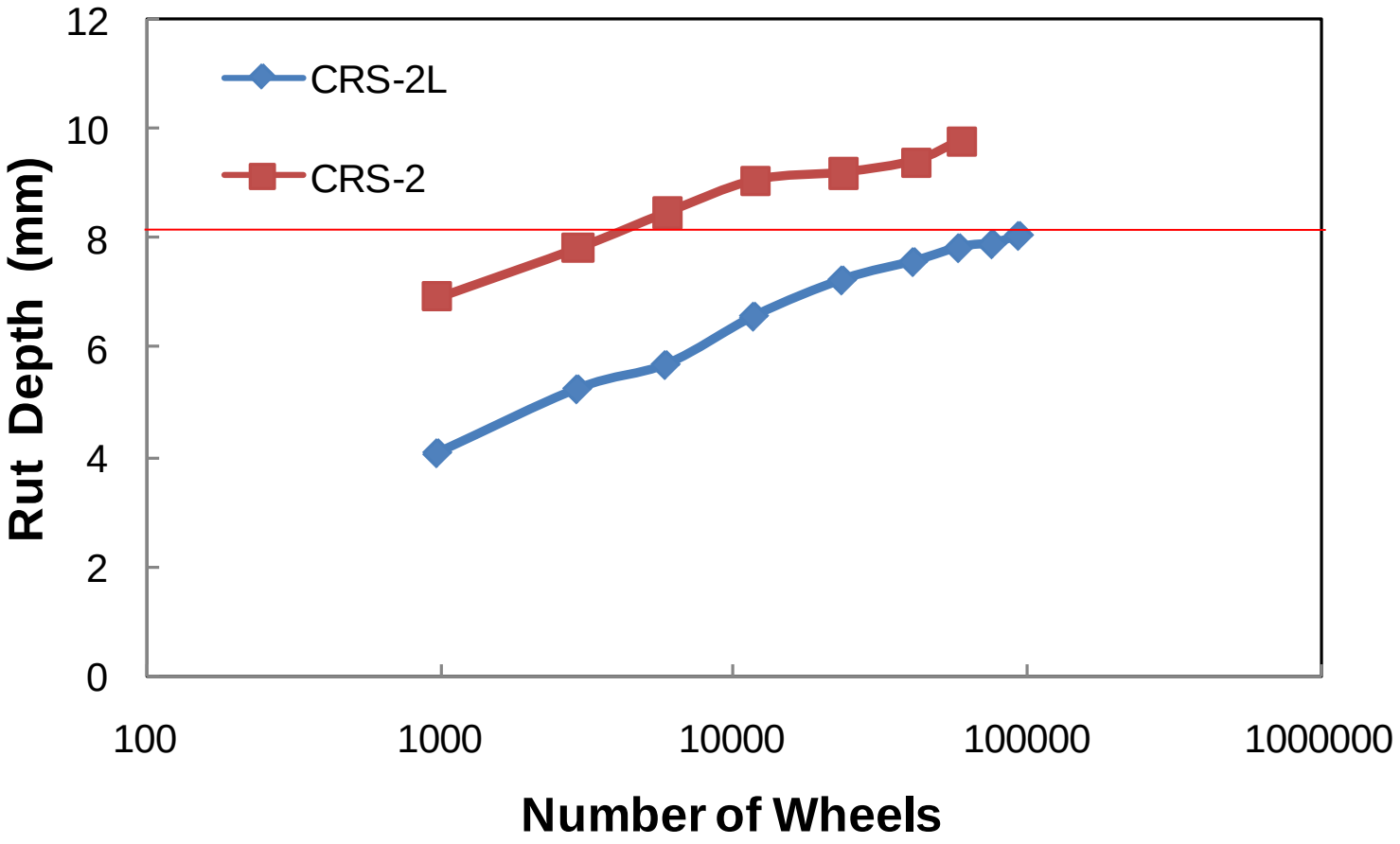


Effect of PME at Low Temperature

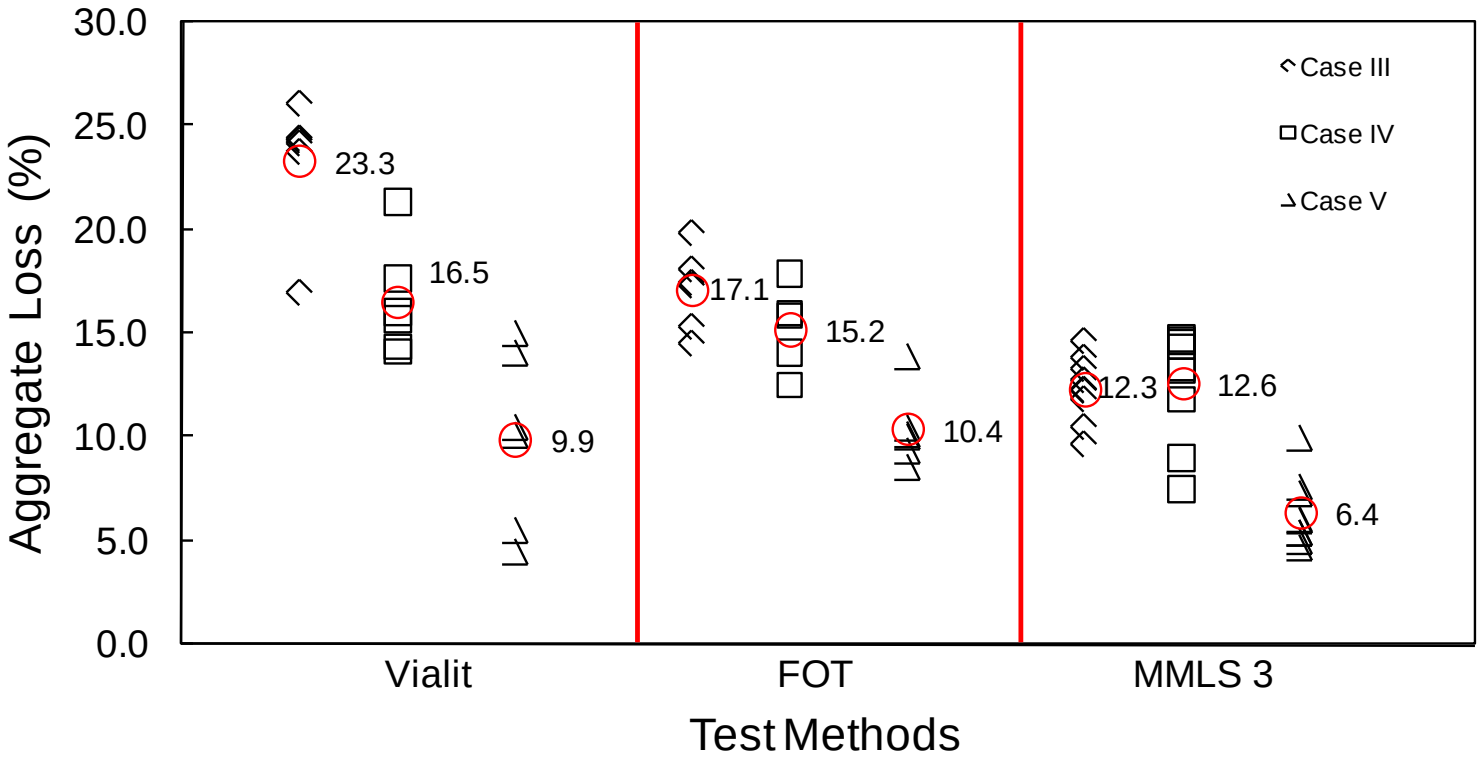


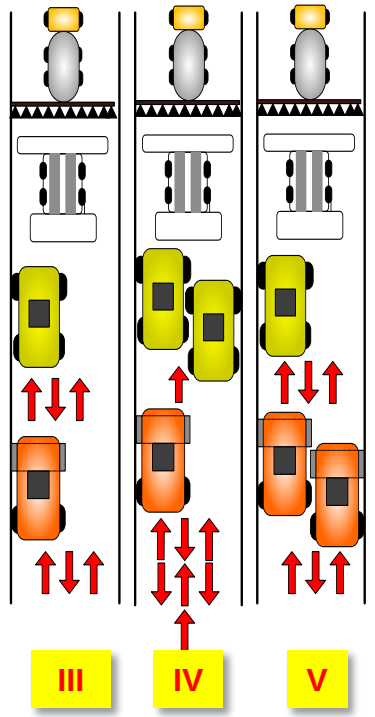
Rut Depth

40°C

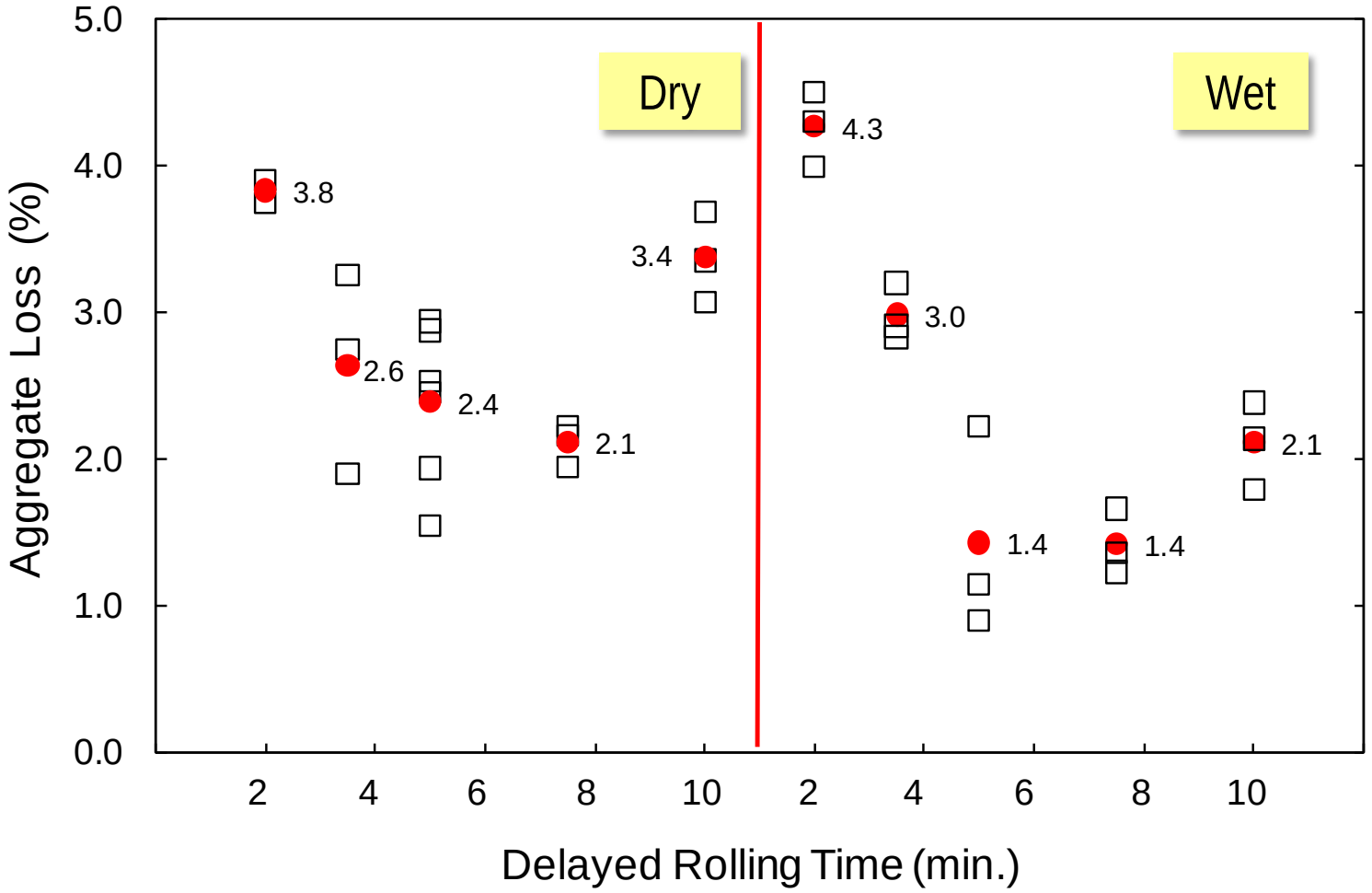


Effect of Rolling Pattern



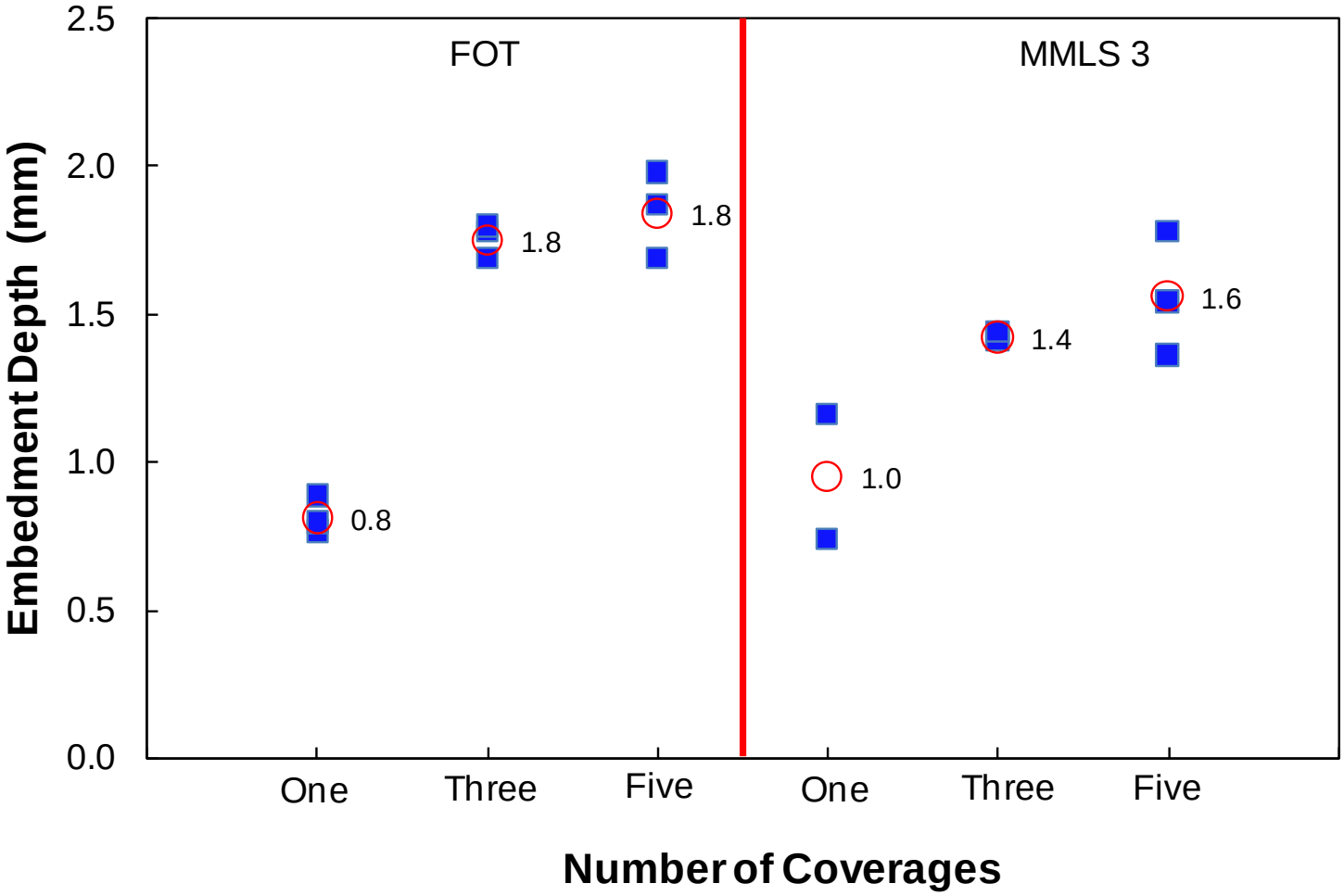


Effect of Delayed Rolling Time



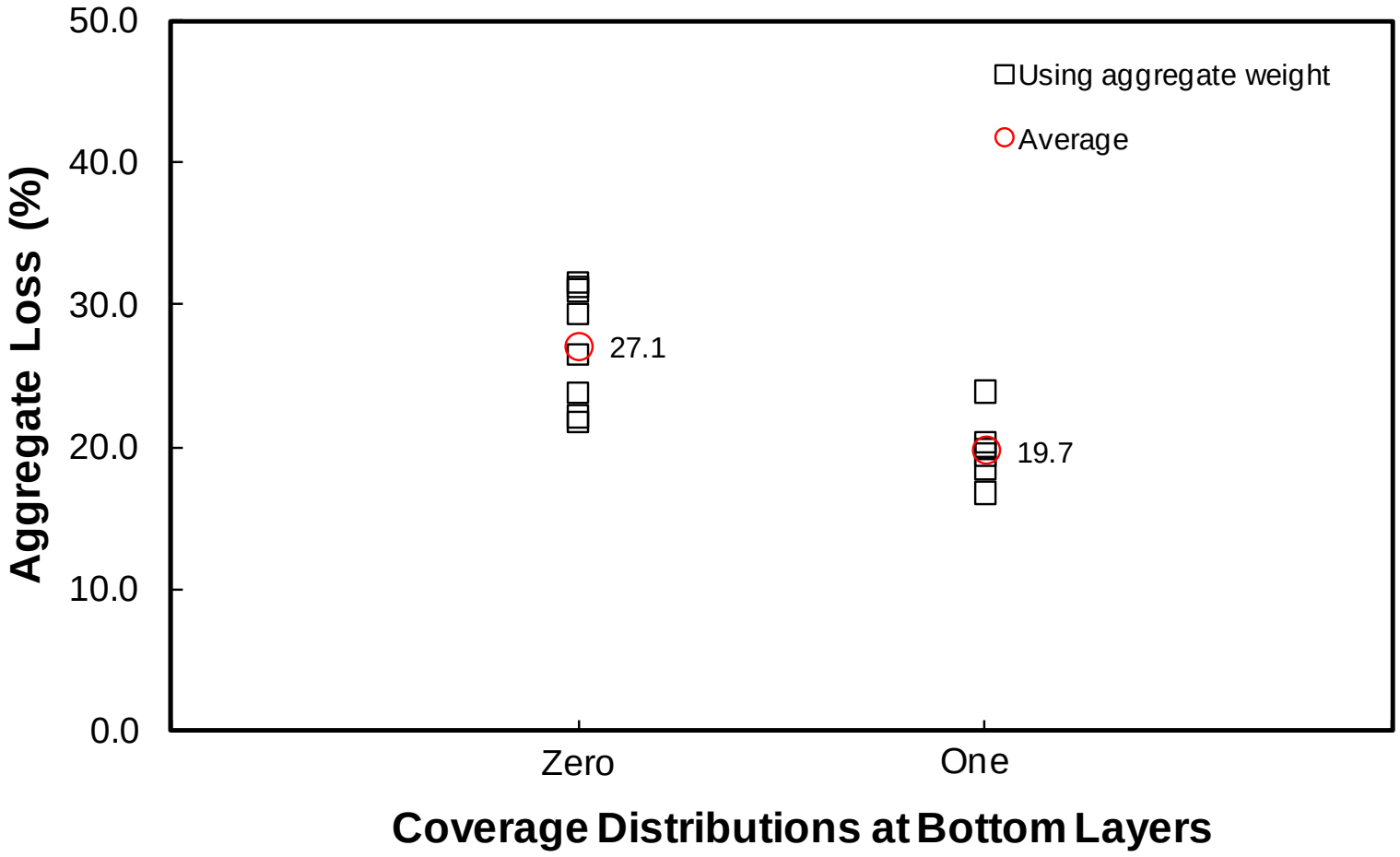
Optimal Rolling Coverages

Modified Sand Circle Test (Straight Seal)



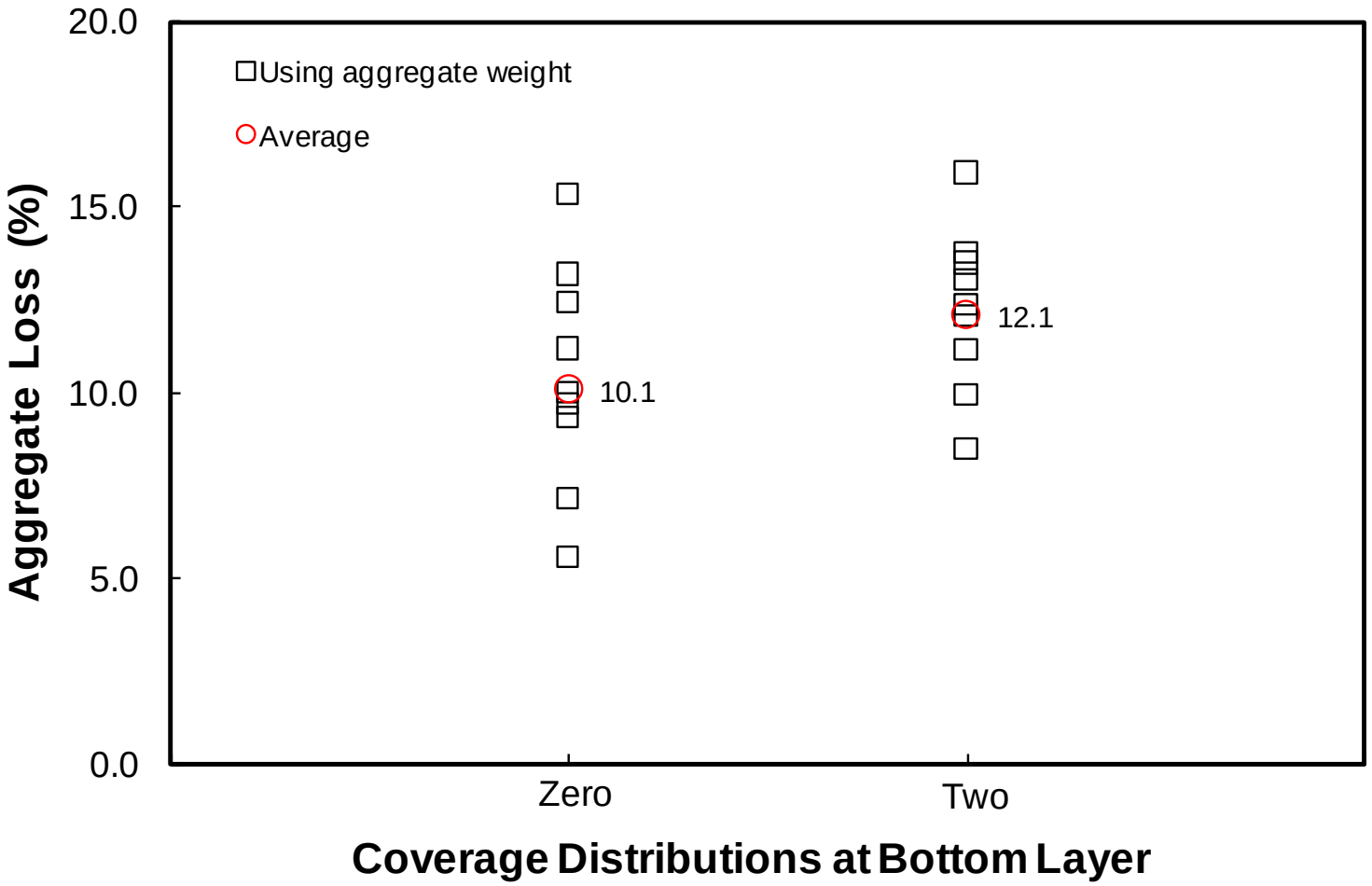
Bottom Layer Coverage

Double Seal (MMLS3)

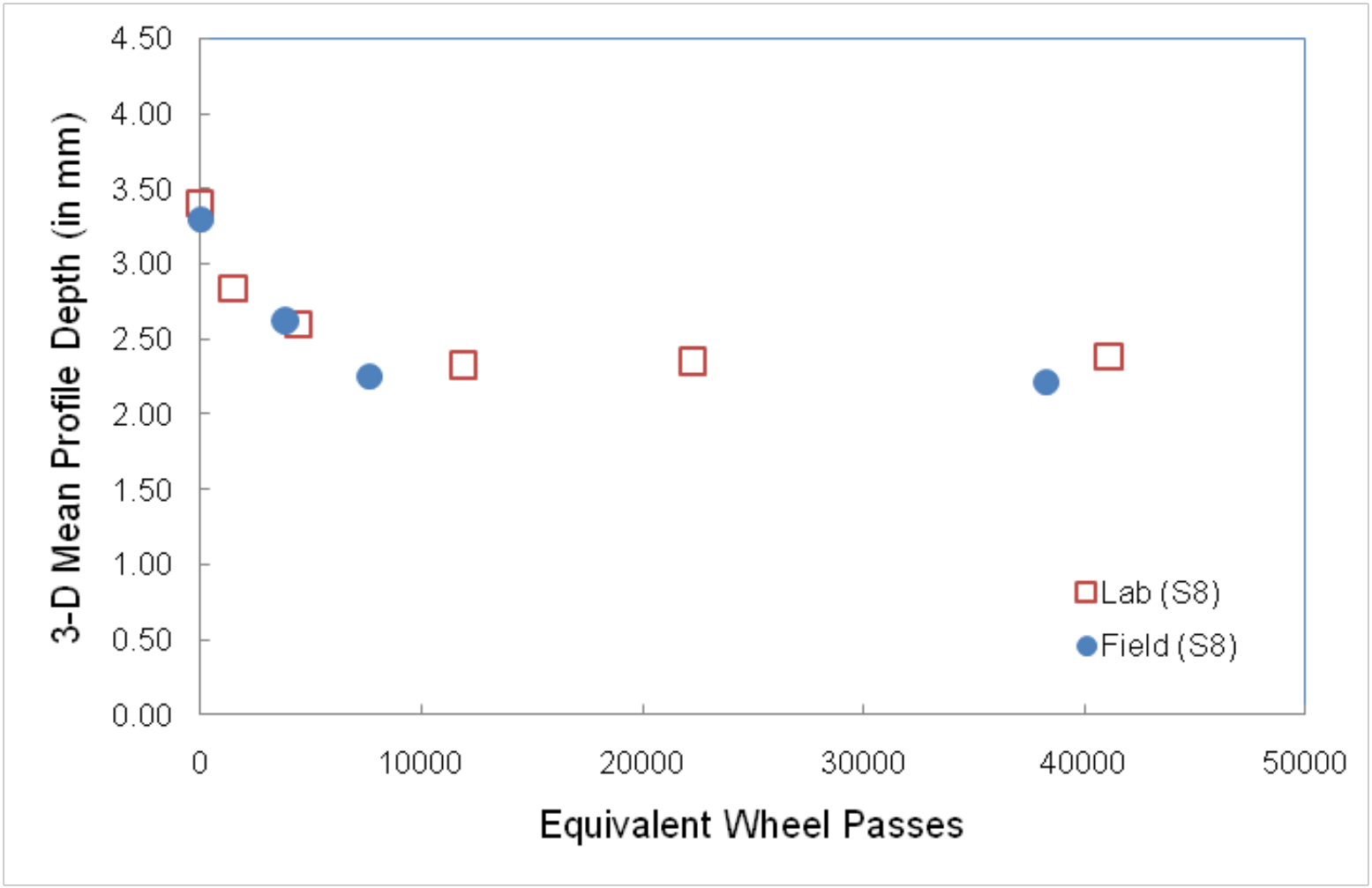


Bottom Layer Coverage

Triple Seal (MMLS3)



MMLS3 vs. Field



Key Implementation Points

Aggregate

- Importance of uniform gradation (use agg. retained on #8)
- Fine content less than 1.5%

Emulsion

- Use of polymer modified emulsion strongly recommended
  - Excellent aggregate retention, bleeding, rutting, and low temperature performance of polymer-modified chip seals
- LCCA shows PME to be cost effective on condition that the service life of the PME is two years longer than that of an unmodified chip seal.

Key Implementation Points – Cont'd

Rolling

- Pneumatic tire roller and combination roller recommended
- Optimal number of rolling coverages of three
- No rolling required for the bottom layer of triple seal
- Recommended Rolling Protocols:
  - Two roller case: Two combination rollers side-by-side
  - Three roller case: Two pneumatic tire rollers side-by-side followed by one combination roller

Acknowledgment

- Financial and field support from the North Carolina Department of Transportation


Thank you!