Network Level Structural Evaluation with the TSD Device

Overview of TSD testing in Seven State DOTs

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VirginiaTech
Transportation Institute

Acknowledgements

- Pooled Fund Effort
  - FHWA (lead)
  - CALTRANS, GDOT, IDOT, NDOT, NYDOT, PennDOT, SCDOT
- Project Team
  - Engineering & Software Consultants, Inc. (ESCINC)
    - Project management
  - Virginia Tech Transportation Institute (VTTI)
    - Lead research team
  - Transport Research Laboratory (TRL): Brian Ferne
    - Expert advice and consulting support
  - Greenwood Engineering
    - Testing

Project Objective

- Demonstration of Network Level Structural Evaluation with the Traffic Speed Deflectometer
  - 2 years duration (started in October 2013)

Project Tasks

- Demonstrate the use of the TSD
- Assess methods to incorporate TSD structural information in a PMS
- Conduct exploratory data analysis
- Use results of “Pavement Structural Evaluation at the Network Level”

TSD testing

- Two rounds of testing (2 years)
- Each round of testing consists of two days
- First day
  - Device calibration (if needed): morning
  - 30 to 50 miles: afternoon
- Second day:
  - At least 100 miles
- In practice, more was tested

Project Status

- First round of testing completed in all participating agencies
- Obtaining auxiliary pavement data
  - e.g. pavement thickness, condition, FWD testing…
- Some analysis of the data has been performed
- Upcoming 6 months
  - Focus on data analysis
  - Get ready for second round of testing (spring): what we learned from first round and from the data analysis
  - Incorporate the results of FHWA project

TSD

What does it measure?

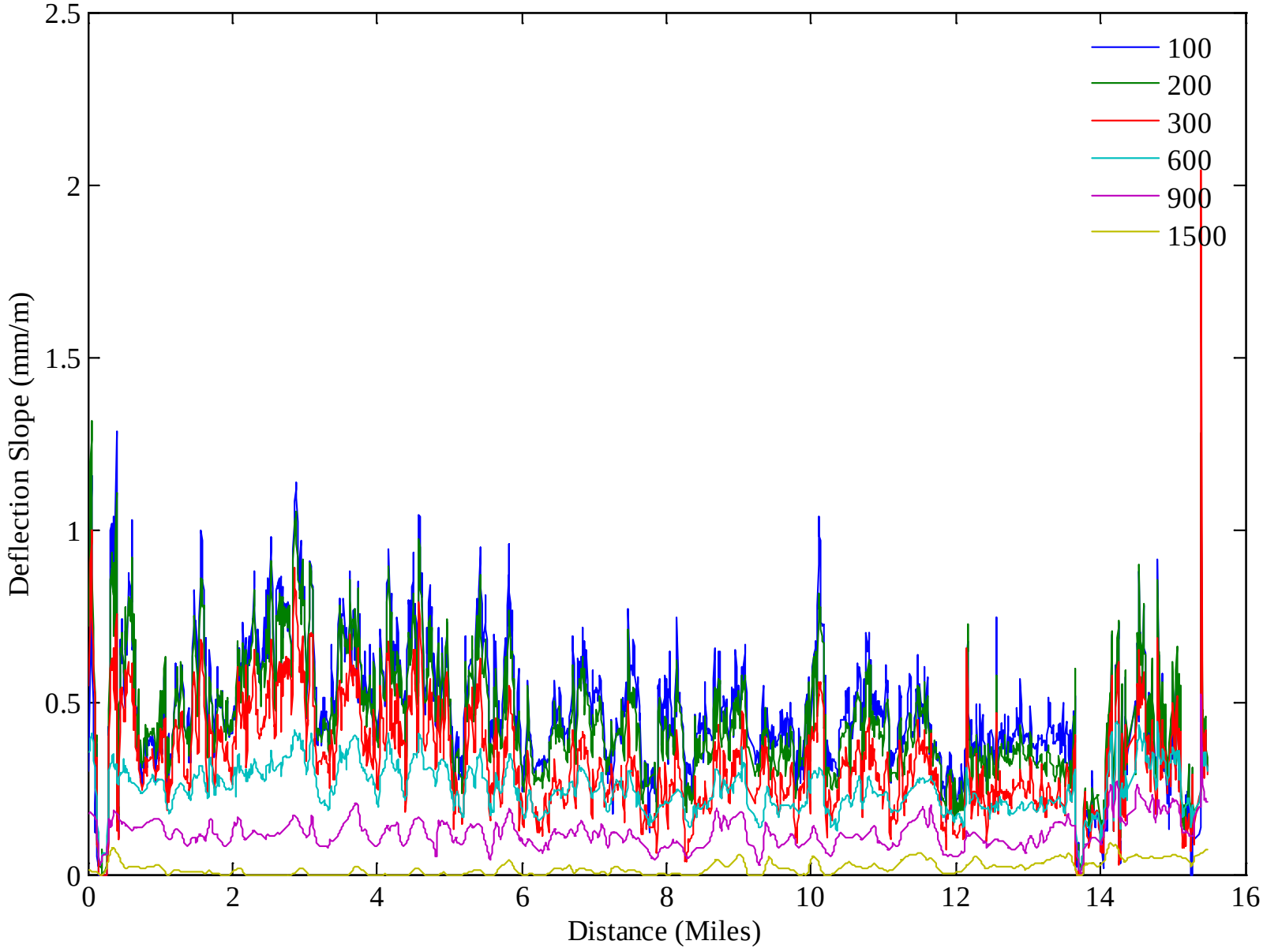
TSD

What does it measure

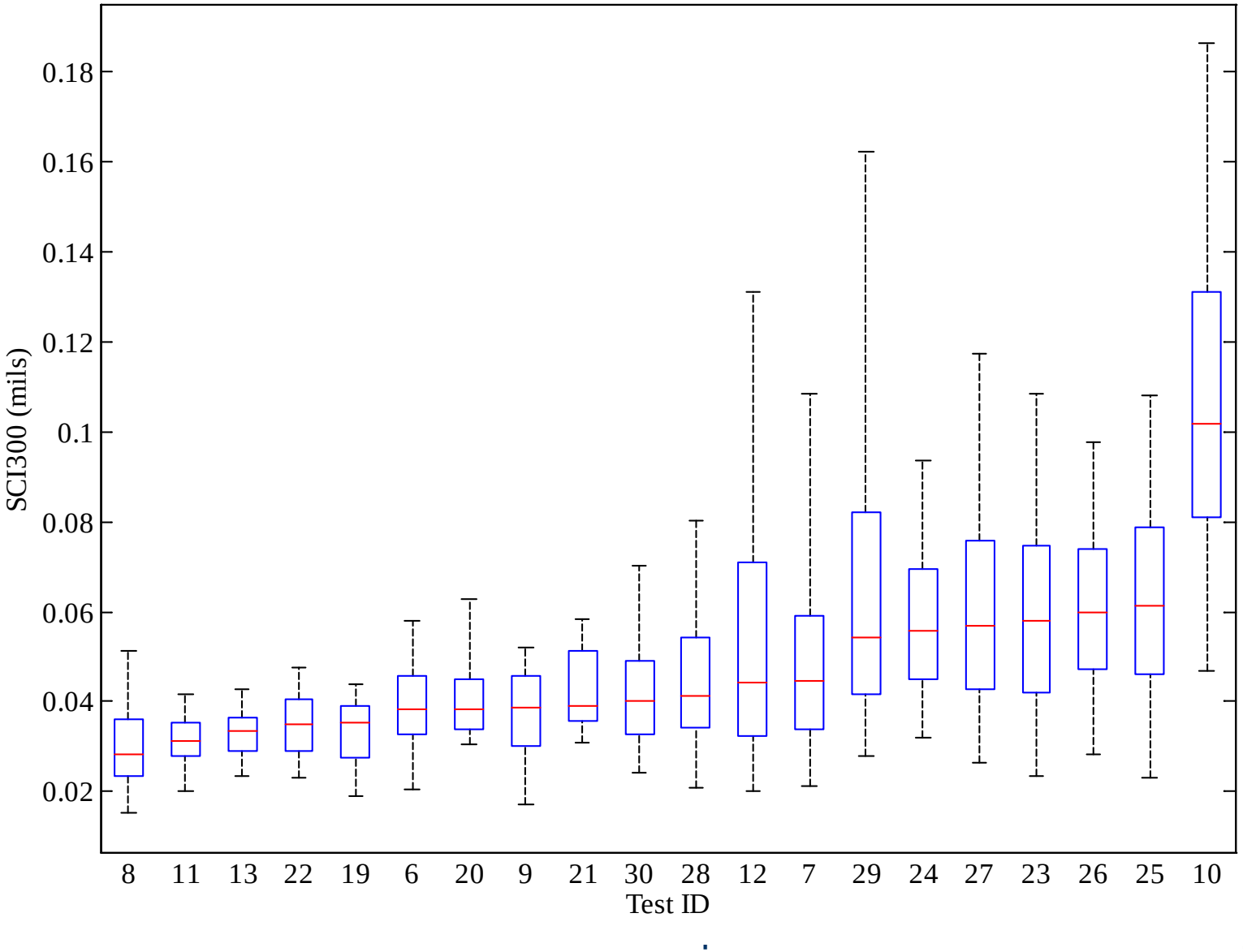
- Deflection slope NOT deflection
  - 100, 200, 300, 600, 900, and 1500 mm
- What can we get from it:
  - Deflections (integrate)
  - Surface Curvature Index (SCI): difference in deflection
  - Area Under Pavement Profile (AUPP)
  - Effective Structural Number (SN): need pavement thickness
- Data is collected at 1,000 Hz (20 mm) and summarized at 10 m

Exploratory Data Analysis

What the data looks like

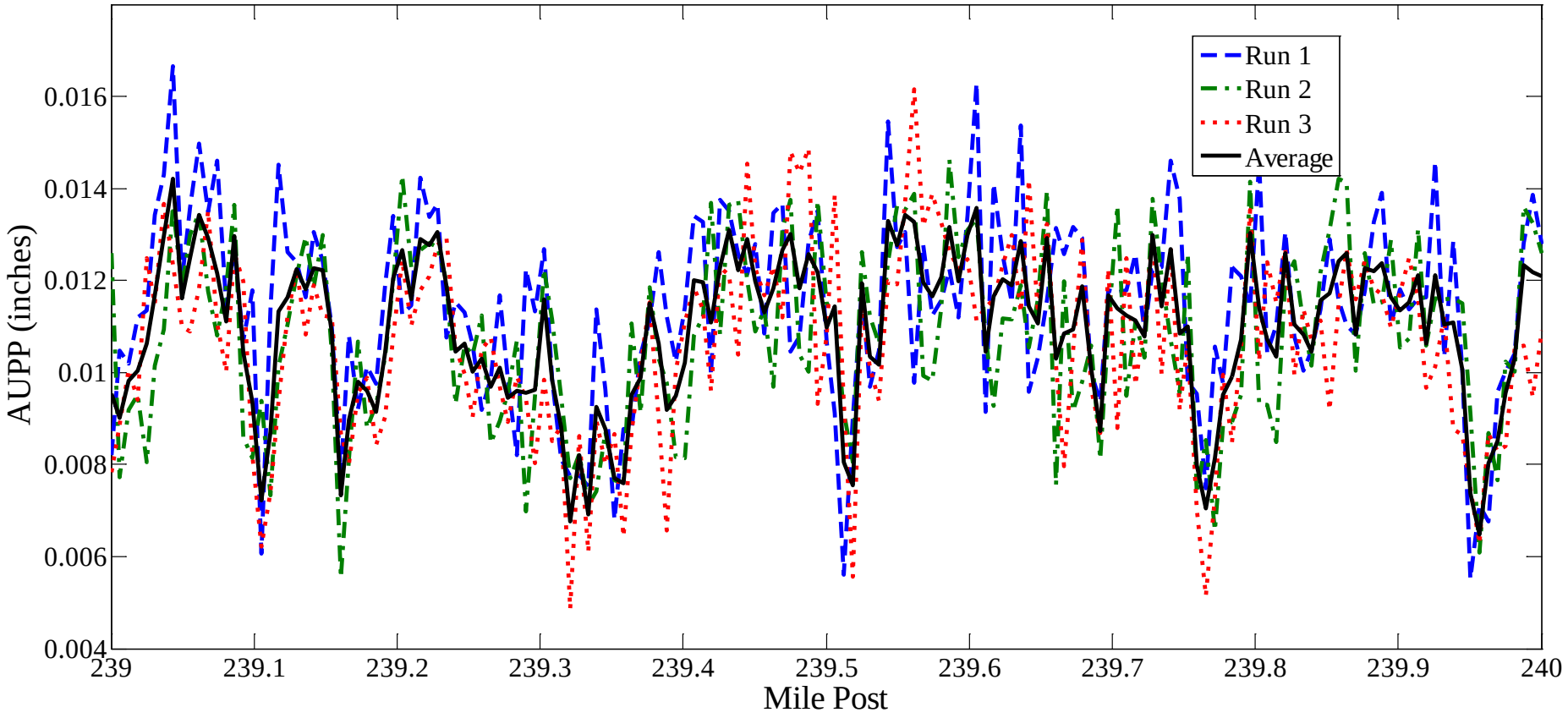


SCI 300 of Tested Sections

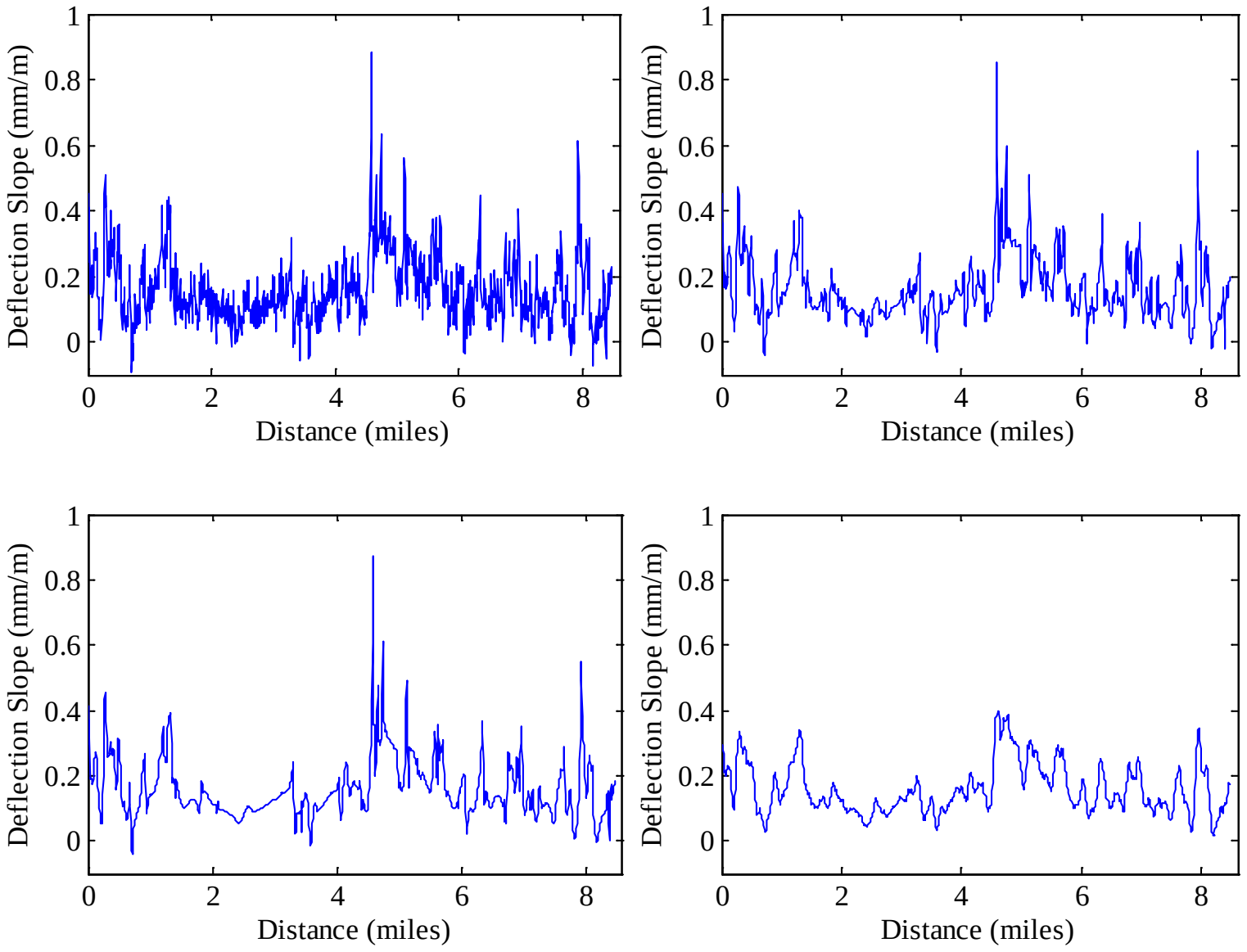


Evaluating Repeatability

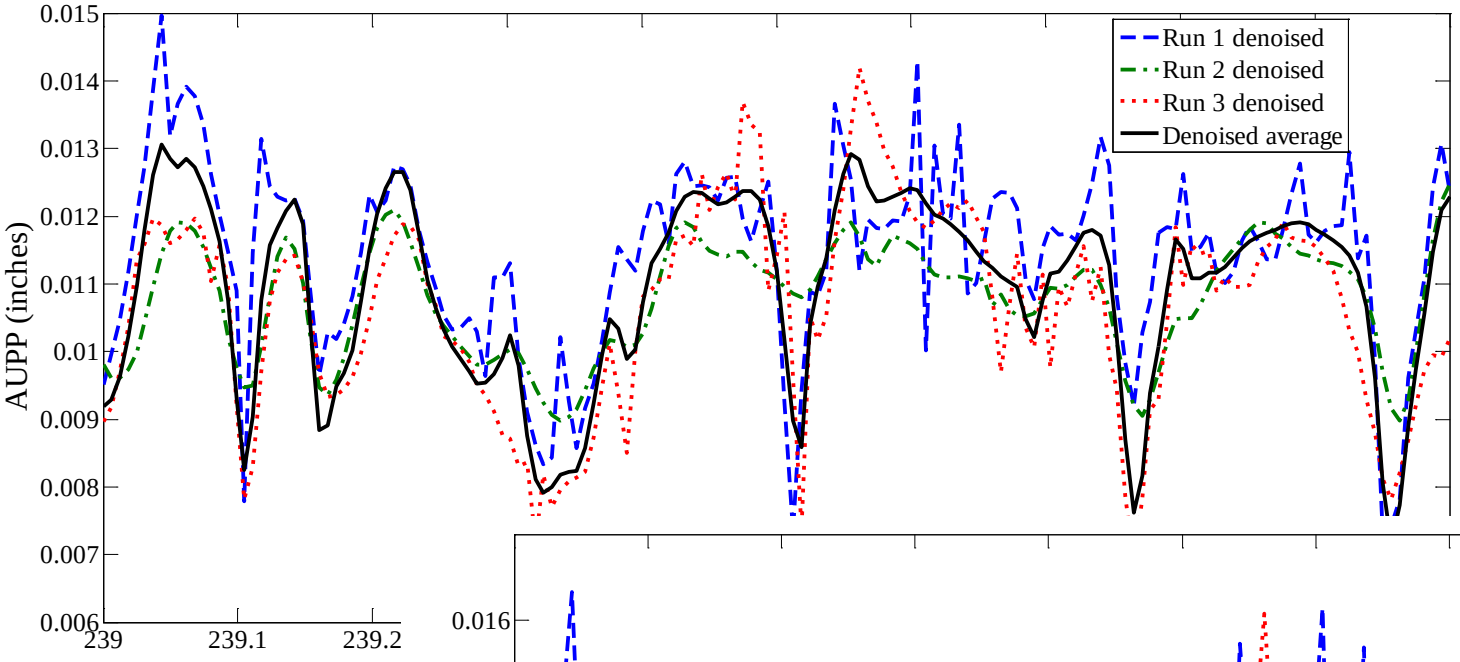
- 0.035 mm/m

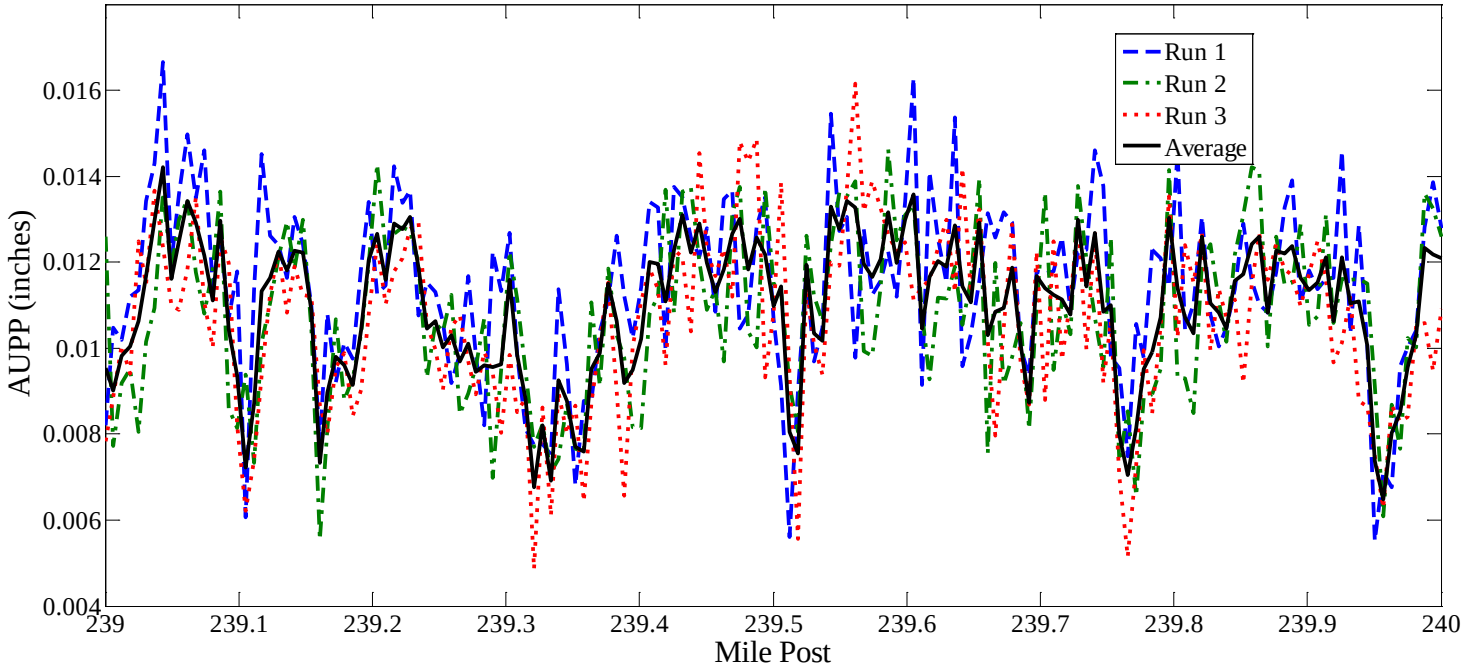


Filtering/Denoising

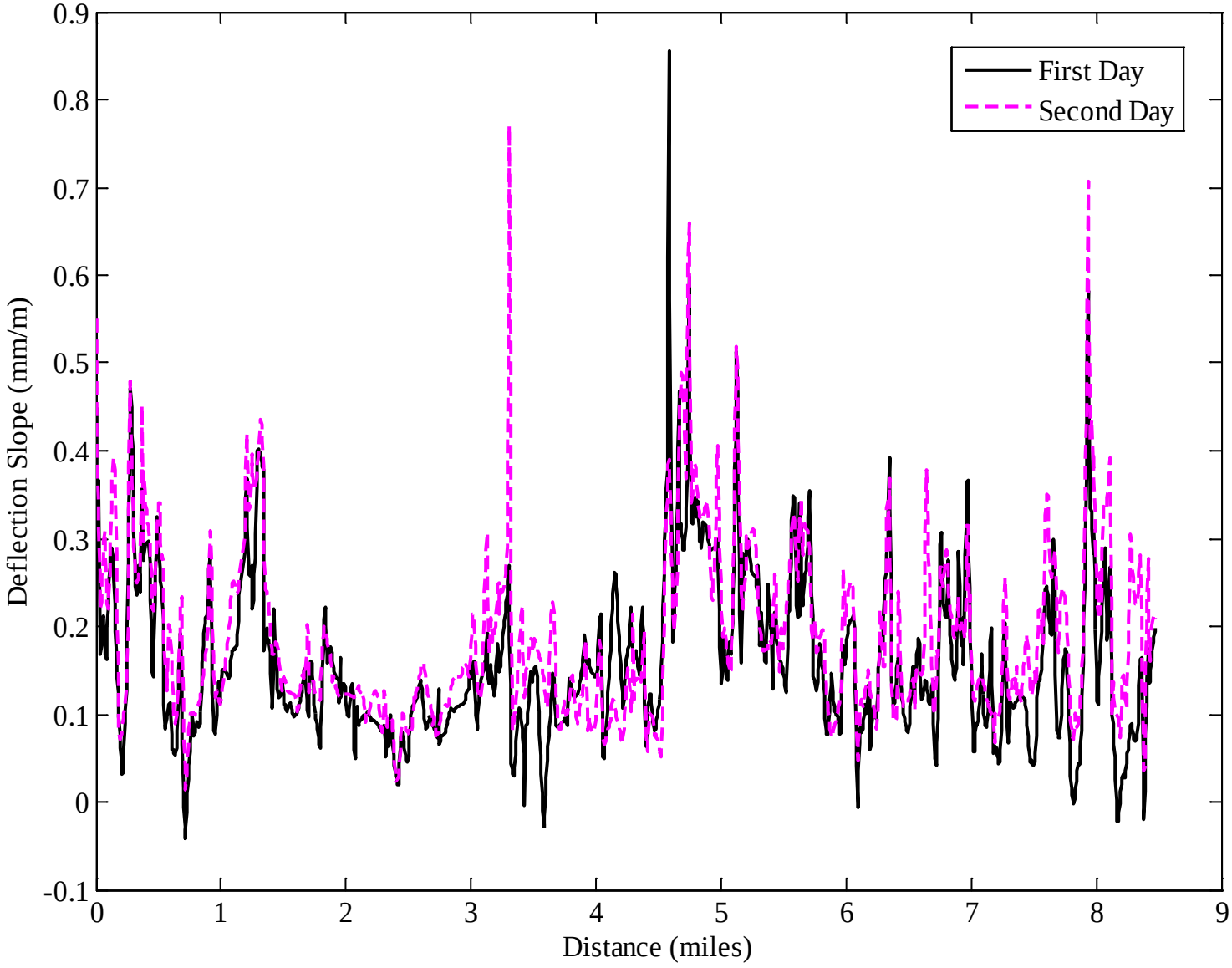


Why Filter?


Run 1 denoised
Run 2 denoised
Run 3 denoised
Denoised average
AUPP (inches)
0.015
0.014
0.013
0.012
0.011
0.01
0.009
0.008
0.007
0.006
239
239.1
239.2


Run 1
Run 2
Run 3
Average
AUPP (inches)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
239
239.1
239.2
239.3
239.4
239.5
239.6
239.7
239.8
239.9
240
Mile Post

Why Filter?



1. Structural Health Index (cont.)

- Effective Structural Number

$$SN_{eff} = k_1 SIP^{k_2} H_p^{k_3}$$

Rhode et al. (1994)

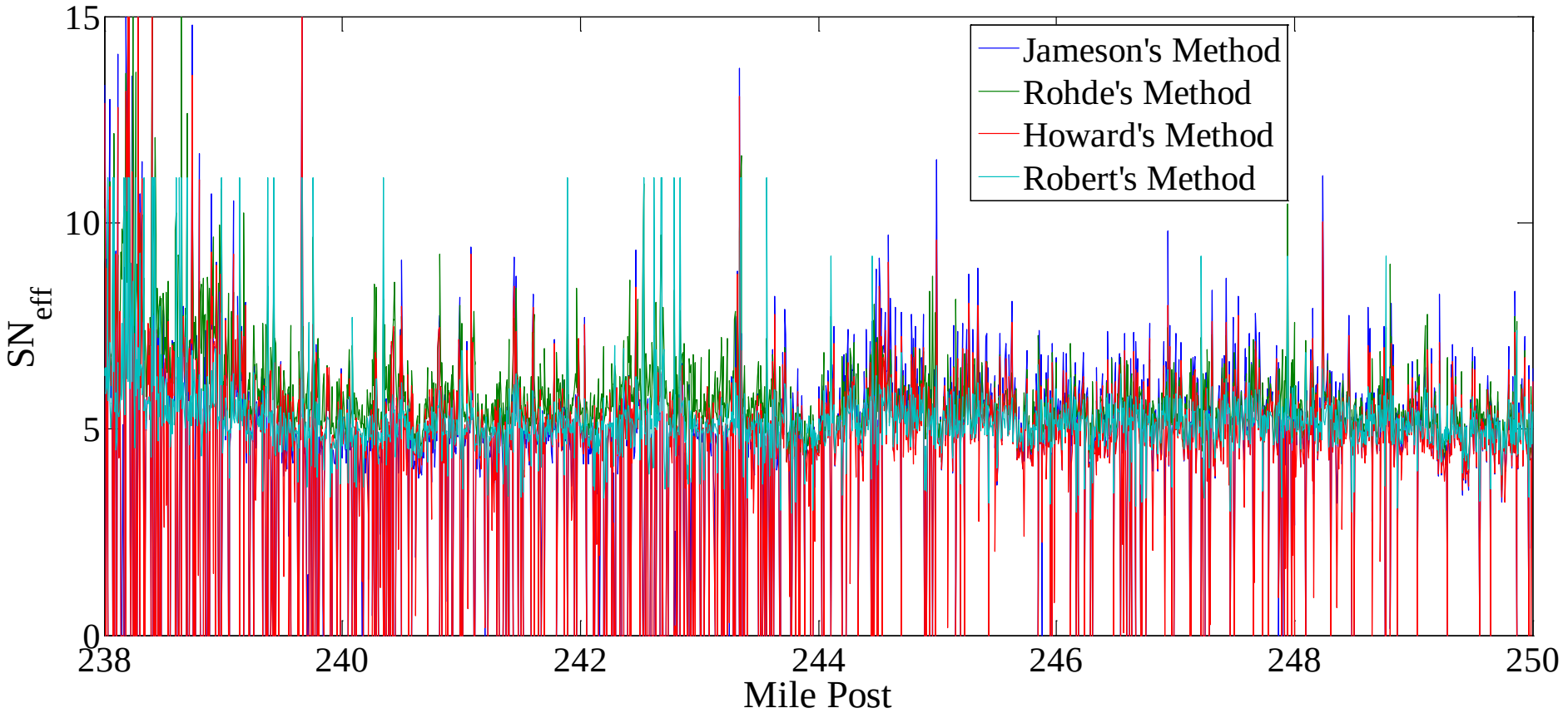
$$SIP = D_0 - D_{1.5H_P}$$

Where:

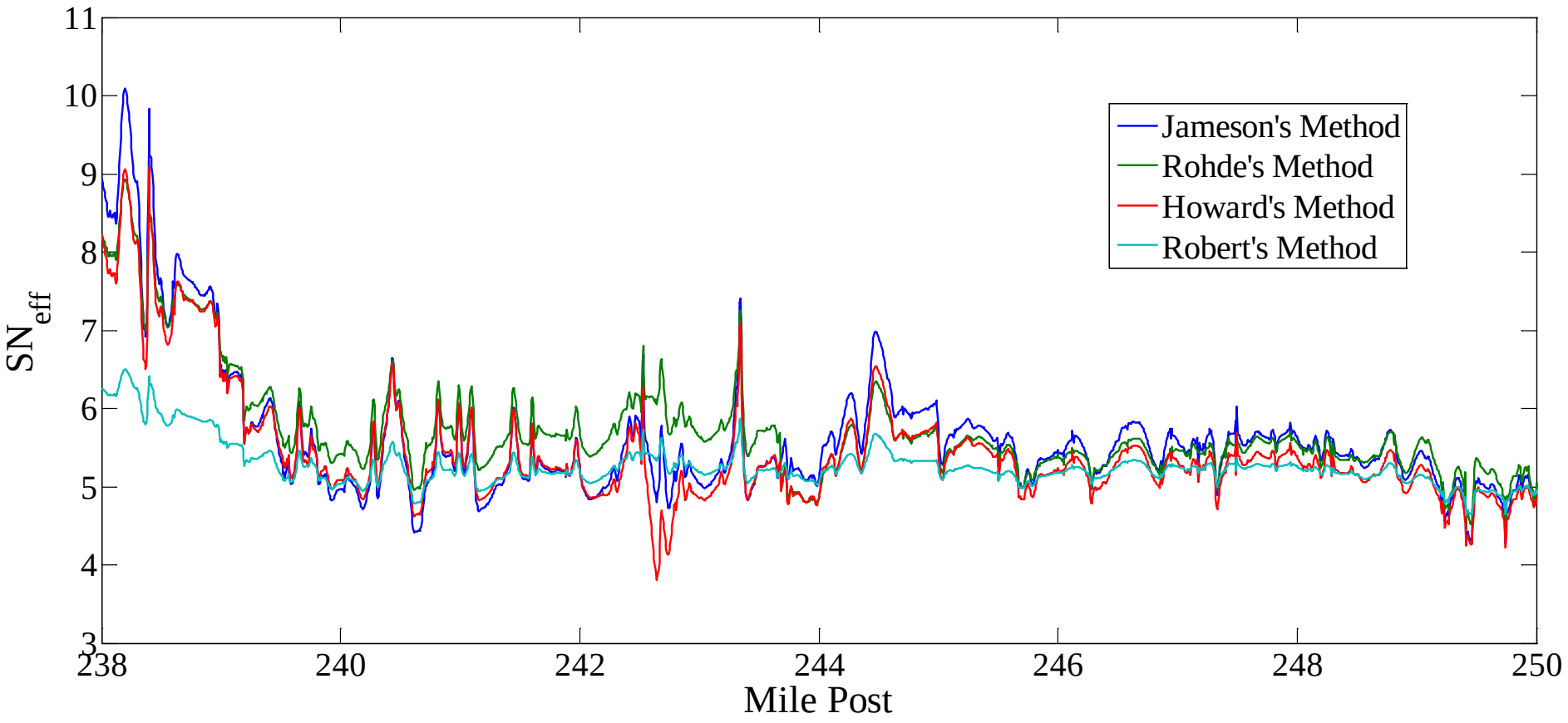
D_0 = peak deflection under the 9,000 lb load (microns)

$D_{1.5Hp}$ = deflection at 1.5 times the pavement depth (microns)

Structural Number (Original)



Structural Number (Denoised)



Back to Main Objective

- Incorporate TSD test results into PMS
  - What is the right index?
    - FHWA project “Pavement Structural Evaluation at the Network Level”
    - Input from DOTs
    - SN, remaining service life, SCI, strain in asphalt layer
    - What about CRCP, JCP
- Other PMS data
  - Functional condition

Thank you… Questions?