Locating Poor Joints in Composite Pavements using TSD

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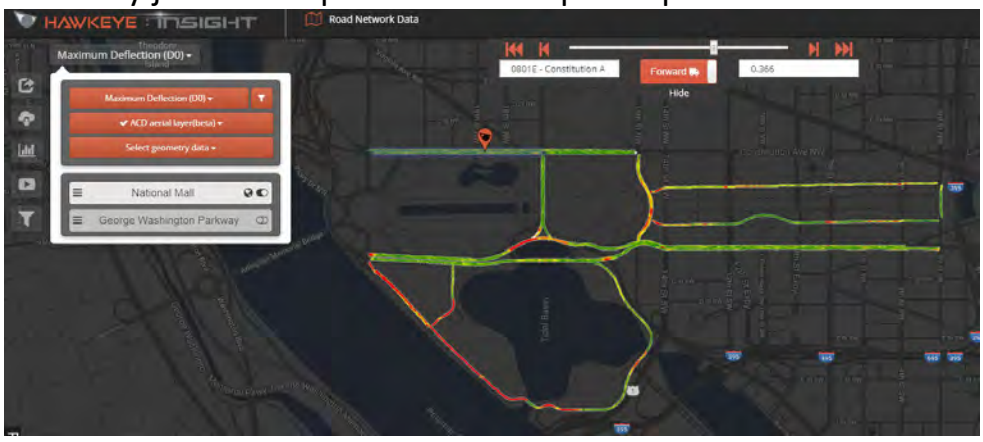
iPAVe Testing at National Mall Area

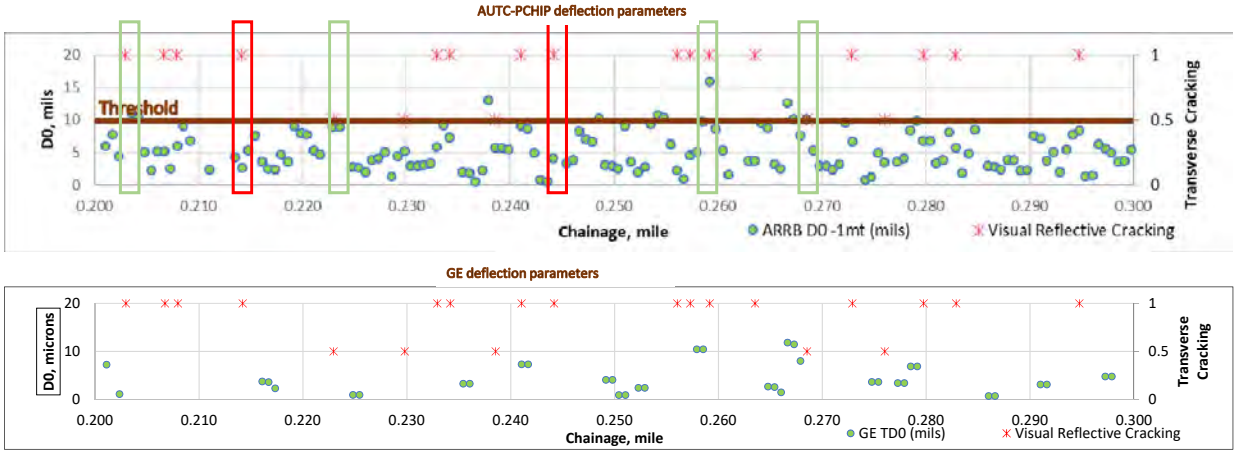
Objective:

To identify joints with poor LTE in composite pavement sections.



iPAVe Testing at National Mall Area

D0 and SCI vs Reflection Cracking in Constitutional Avenue East Bound – Outer Lane between 23rd and 17th Street.
ARRB Group Inc. and Greenwood Engineering worked to provide data at 1-meter

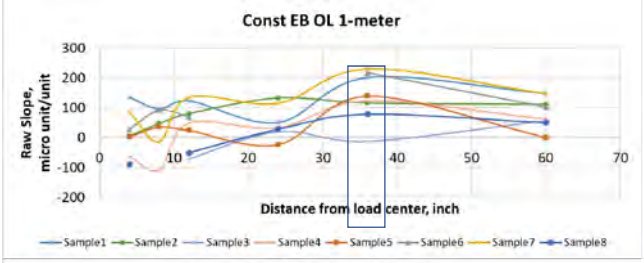


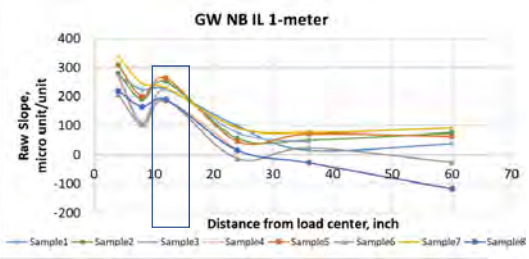
Deflection or Slope values not reported in about 12% of the total records

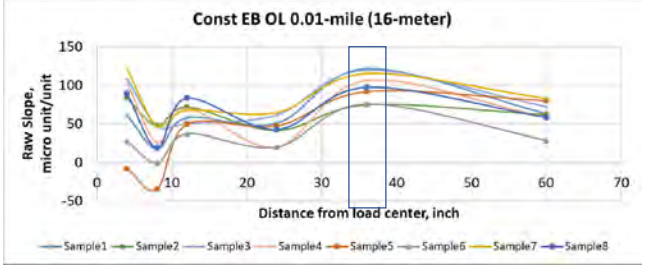
TSD data – Discussion Topic

- Slope Characteristics in Composite Pavements
  - Comparison with Slopes from flexible pavements
- Negative Velocity / Slope – is it pavement characteristics?
- Deflection Algorithm ARRB's PCHIP vs Greenwood's Asymmetric mode
  - SCI are comparable
  - Significant difference in D_0

Slope characteristics btn flexible and composite pavement

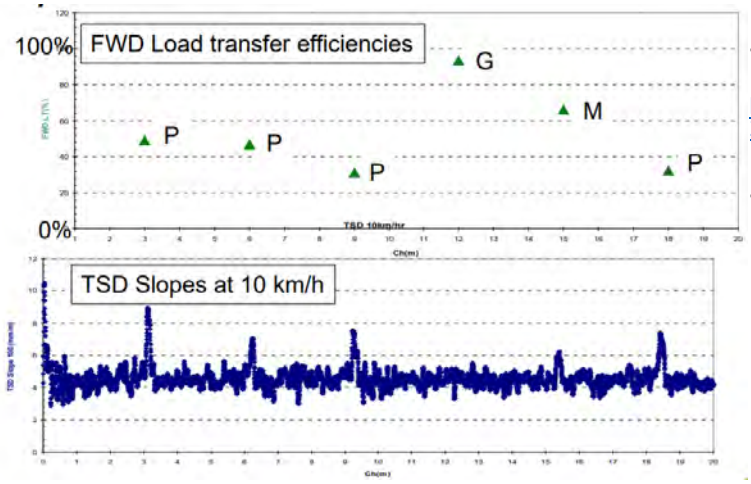






- Peak Slope location 12 vs 36 inches- pattern is similar between 1 meter and 0.01 mile interval
- In case of sensor measurements at 8,12 and 24 inches
  - 42% are negative in composite pavements
  - Almost 100% are positive in flexible pavements
- Do we need special algorithm or method for composite or JPCP pavements?
  - Can we use Slopes directly to interpret pavement response?
- In flexible pavements, is 8 inch sensor measurements affected by bulging and if so, is it used in curve fitting? Bulging was reported previously in 4 inch sensor.

Slope Vs LTE (TRL)

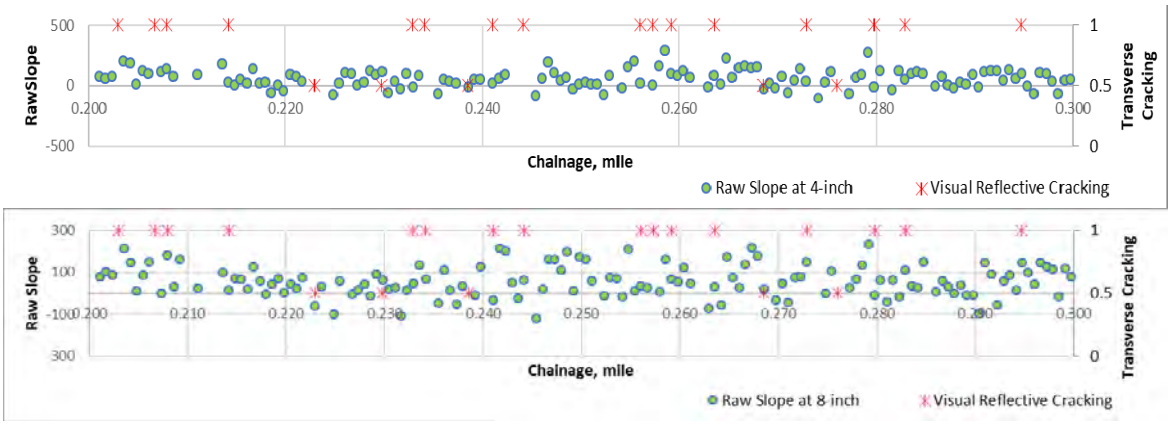


- Brian in 2014 Pavement Evaluation conference

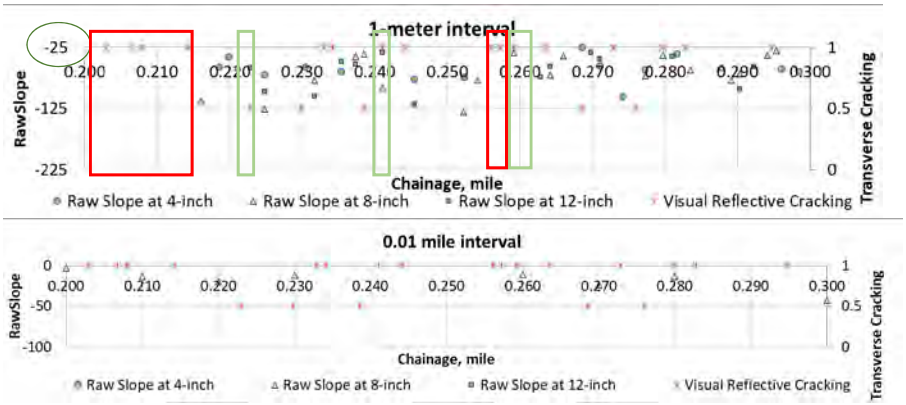
https://www.vtti.vt.edu/PDFs/PE-2014/Ferne%202.pdf

- We have Slopes averaged over 1-m interval.

Slope at 1-m average Vs LTE



Negative Slope vs Reflective Cracking



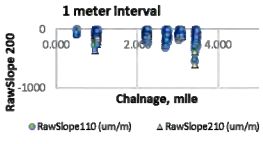
- FWD data may help investigate reason for locations with negative slopes but no reflective cracking. We are still working on it….

Slope Characteristics – Composite

Slope characteristics	1-meter data Constitution Avn	Comments
Total records at 1-meter interval	882	
Records didn't report any of the 6 raw slopes (all blanks) • Both GE and ARRB will not report any deflection values	105 or 12%	• Negative slopes are reported with flag 'Sensor Drop Off'. • Possible reason 1) stiff pavements – not enough sensor readings. 2) sensor focus affected by cracks (least possibility for all sensors to be affected)
• Records with all 6 positive Raw slopes	305 or 35%	
Records with deflection value from GE model • Reported with 6 positive slopes • Reported with 3 to 5 positive Slopes • Reported with 1 or 2 positive Slopes • Reported with 0 positive Slopes	233 or 26.4% (missing 649 or 73.5%) • 127 or 14.4% • 86 or 9.75% • 18 or 2% • 2	GE algorithm compute deflection with only negative slopes? Is this an oversight or am I ignorant?
Records with no positive Raw Slopes • GE reported deflection value	20 or 2.3% • 2 (with 5 negative slopes)	
Records with deflection value from ARRB PCHIP • Recompute Slopes from GE velocity (ARRB algorithm). Only positive slopes are reported • Computes deflection if at least 3 positive Slopes (ARRB PCHIP)	777 or 88.1% (missing 105 or 11.9%)	
Records that fit the hypothesis, Slope @300 > 600 > 900 > 1500	15 or 1.7%	

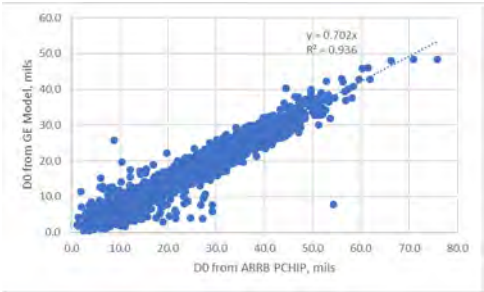
Slope Characteristics – Flexible vs Composite

Slope characteristics	1-meter data Constitution Avn	0.01-mile data Constitution Avn	1-meter GW Parkway NB Inner lane
Total records at 1-meter interval	882	54	6897
Records with GE deflection value	233 or 26.4%	52 or 96%	6294 or 91.2% (most of the missing data match with bridge location in both GE and ARRB)
Records with ARRB deflection value	777 or 88.1%	54 or 100%	6698 or 97.1%
Records with all positive slopes in sensors 4,8,12,24, and 36 inches. Except 60 inches	305 or 35%	25 or 46%	6076 or 88.1%
Records didn't report any of the 6 slopes (6 blanks)	105 or 12%	0	199 or 2.9%
Records with no positive Slopes • GE reported deflection value	20 or 2.3% 2 (with five negative slopes)	0	278 or 4% 9 (with min of 3 negative slopes)
Records that fit the hypothesis Slope @300 > 600 > 900 > 1500	15 or 1.7%	0	77.5%

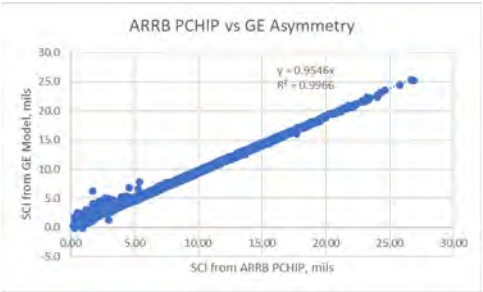


Greenwood Asymmetric Vs ARRB algorithm

Center Deflection



SCI



Thanks