9th International Conference on MANAGING PAVEMENT ASSETS (ICMPA9)

amec foster wheeler

Use of Emerging Technologies in support of Pavement Preservation Decision Making

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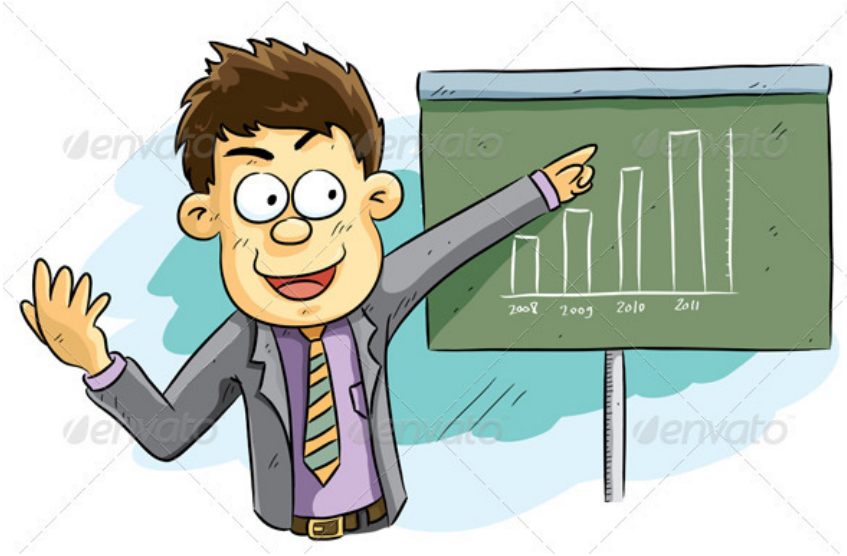
Presentation Outline

- Introduction
- Case Study Reviews
  - High Frequency Surface Wave
  - Rolling Wheel Deflectometer
- Implementation Challenges
- Summary

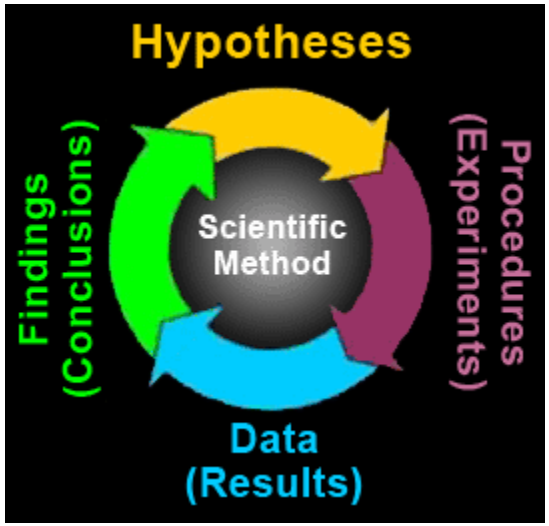


Purpose of Study

- Identify emerging technologies to better characterize:
  - Pavement conditions
  - Predict future deterioration
  - Demonstrate their applicability in the selection and timing of pavement preservation strategies

Methodology

- Literature review
- Expert interviews
- Potential technologies identified
- Evaluation of potential technologies
- Four technologies recommended



Evaluation Criteria

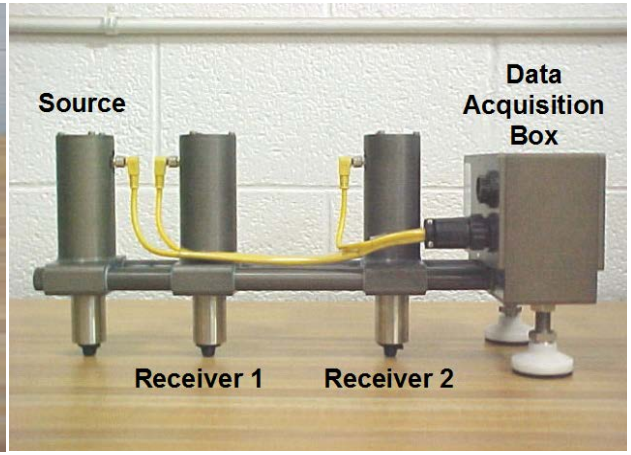
- Value (ability/effectiveness to support preservation process)
- Availability (presence in the country)
- Maturity (readiness of technology)
- Cost
- Ease of implementation
- Others (e.g., speed and safety)

Recommended Technologies

- Dynatest Highway Friction Tester (HFT)
  - Friction and texture evaluation
- High frequency surface wave technology
  - Structural condition assessments
- ARA Rolling Wheel Deflectometer (RWD)
  - Structural condition assessments
- RoLine technology
  - Ride and texture measurements

HFSW Background

- Ultra-sonic technology uses higher frequency impulses than FWDs and can be more sensitive to the properties of the near-surface layer.
- Portable Seismic Pavement Analyzer (PSPA)
  - Evaluates damage associated with load-related cracking in the HMA layer



TxMLS Study

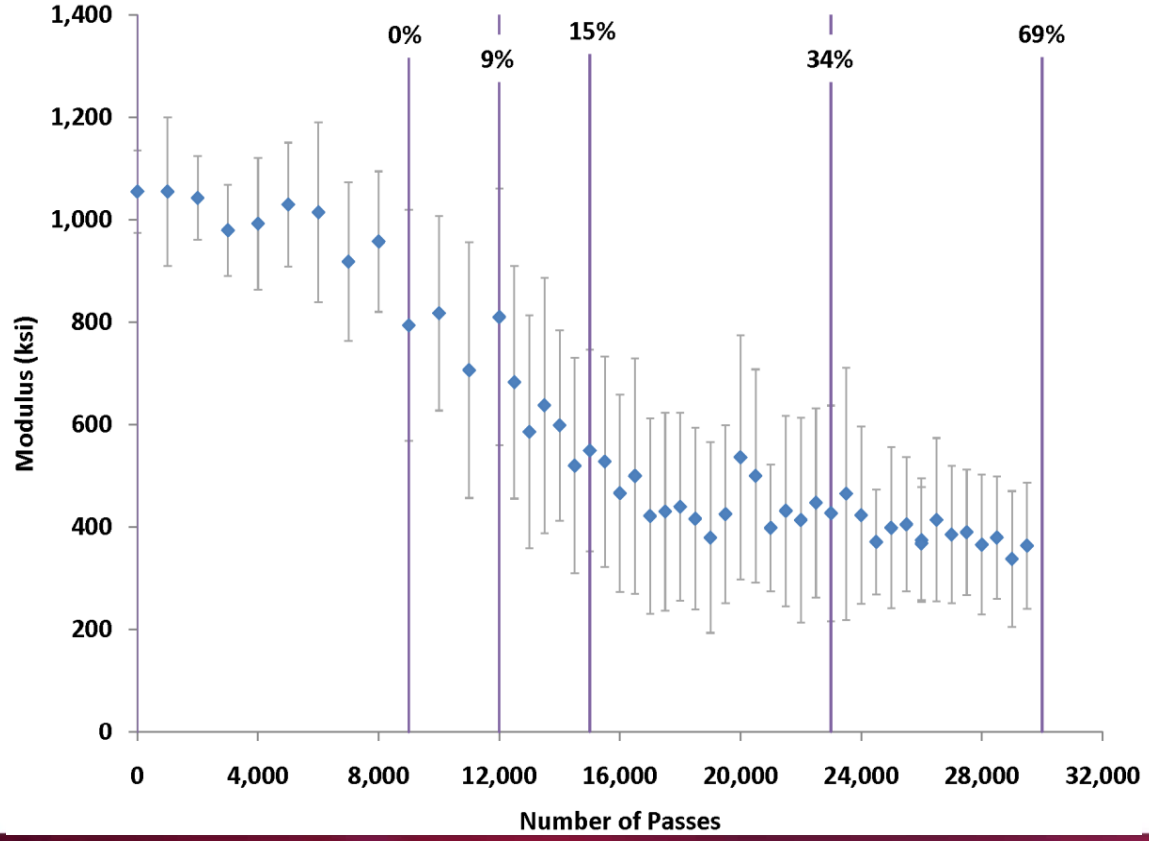
- Found that using seismic NDT technology to monitor degradation of pavements was feasible.
- Information from seismic testing makes it possible to relate degradation and remaining life of flexible pavements to measured pavement response
- Modulus of HMA layer in seismic testing is more sensitive to cracking than rutting (Yuan et al., 1999).

FHWA PTF Study

- Comprehensive field testing program undertaken on 12 test sections at FHWA accelerated loading facilities (ALF)
- Thickness of test sections above subgrade was 26 inches (4 and 6 inches of HMA)
- PSPA used to measure surface moduli during FHWA ALF loading

PSPA Modulus Trends

Average modulus decreases with time as load passes increase and micro-cracking develops



Error bars: ± 1 std deviation

Vertical lines: fatigue cracking at time of modulus measurements

Findings

- PSPA is capable of measuring significant damage before cracking begins to appear
- PSPA is considered viable device to monitor damage associated with load-related cracking in HMA in order to assess condition of pavement prior to initiation of cracks or cracks becoming visible

Implementation Challenges

- Need to determine what test data to store
  - One point
  - Average of several points
  - Entire dispersion curve
  - Raw data in time domain or frequency domain
- Requires highly trained operators

ARA RWD

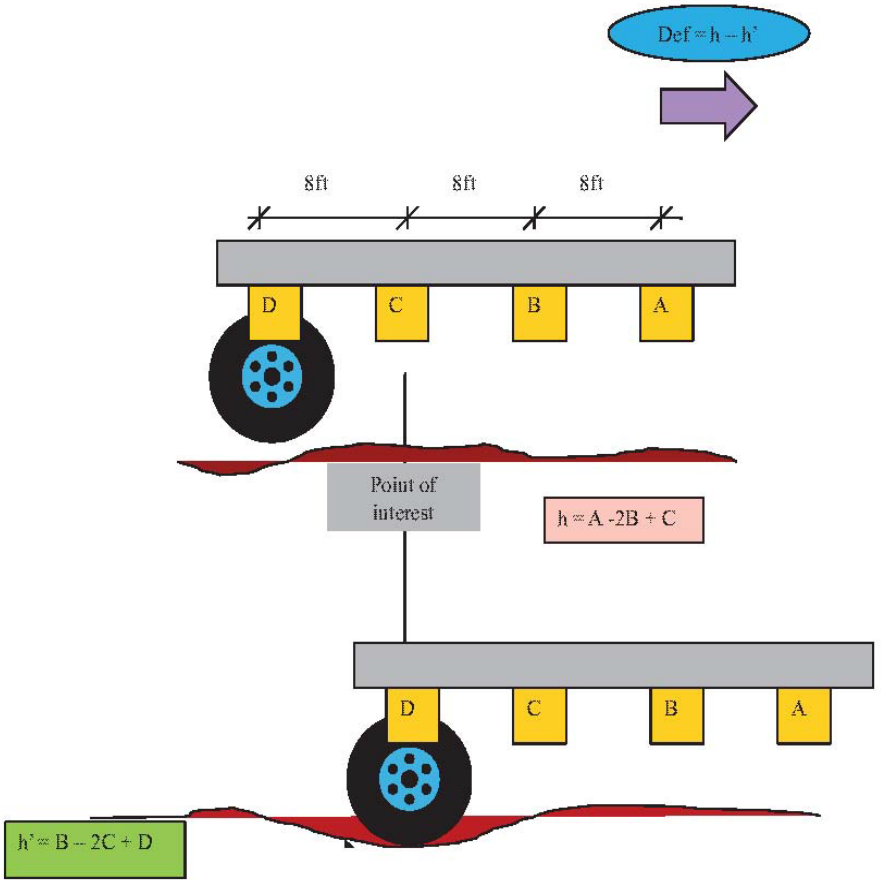
- Pavement structural evaluations at network-level can be performed at traffic speeds
- Results avoid application of treatments on structurally deficient pavements

ARA RWD

ARA RWD

Uses four lasers to collect continuous deflection profiles

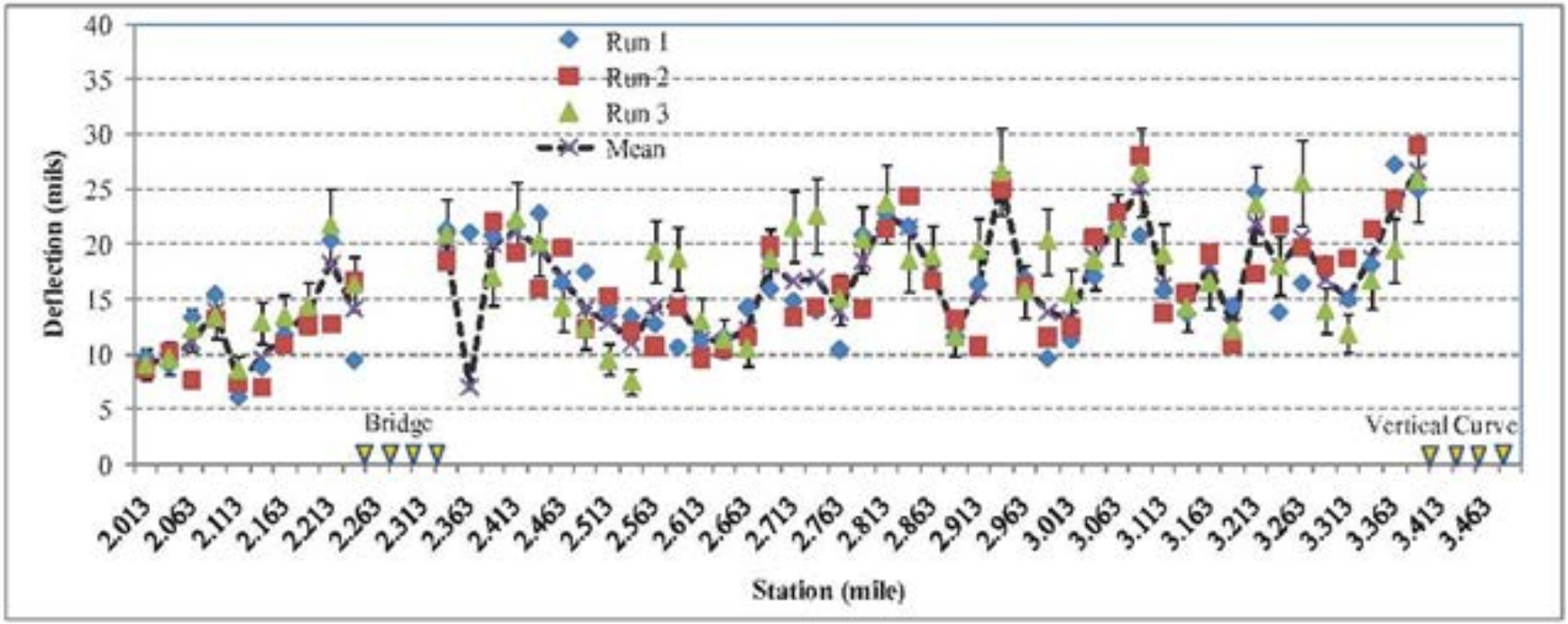
- Three lasers measure unloaded pavement surface profile
- Fourth laser located between dual tires behind rear axle of RWD truck measures deflected surface



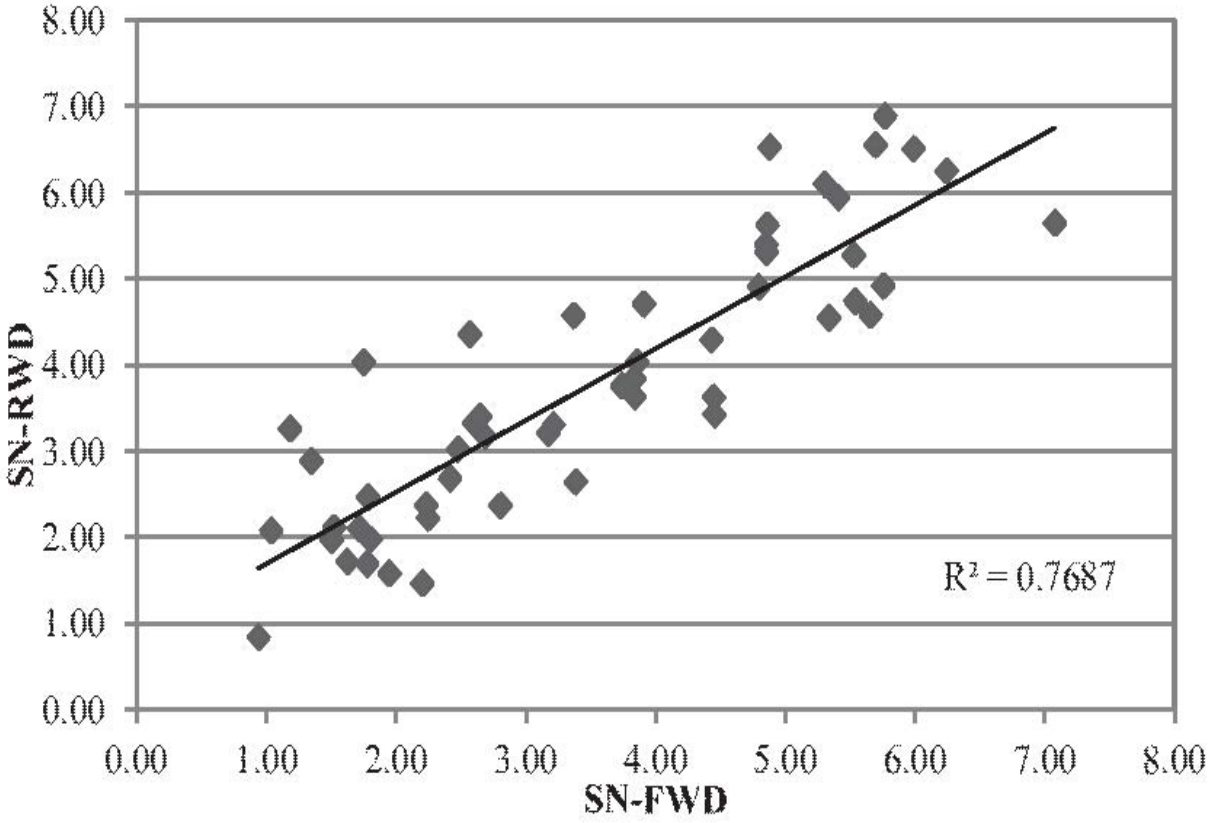
Louisiana DOTD RWD ARA Study

- Objectives of study:
  - Quantify repeatability and effects of testing speed
  - Study relationship between RWD and FWD measurements
  - Develop simple model to estimate pavement SN from RWD deflections
- Comprehensive field testing program involving complete HMA network of ~1,250 miles in District 05

RWD Repeatability Results



RWD-SN Relationship



RWD Study Conclusions

- RWD productivity and data collection costs are significantly better than for FWD
- If implemented within Louisiana PMS, RWD would be used as screening tool at network-level to identify structurally deficient sections
- Funding is an issue, but Louisiana still interested in implementing RWD for ~26,000 miles of HMA pavements

RWD Challenges

- Buy in of the technology by the highway agency
- Funding for evaluation and implementation
- Availability of the RWD. Only one unit is available in the country

Implementation Challenges

- Acceptance of technology within agency
- Readiness of technology
- General technology implementation issues
- Technology implementation funding requirements
- Actual technology implementation process

Summary

- Significant advancements in technology to better characterize pavement condition
- Implementation Guidelines developed for State DOTs considering implementing technology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Thank you!