Rolling Wheel Deflectometer: Integrating Data in Pavement Management

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U.S. Department of Transportation
Federal Highway Administration
Coming Up…

- Managing Pavements, Why Deflection
- Deflection Measurements
- State of the Practice
- Case Study
- Summary
Managing Pavements: Why Deflection?

Cracking
Rutting
Ride Quality
Material Failures
Traffic

Pavement Failures

Traffic
Managing Pavements:
Why Deflection?

As an Indicator for Structure..
When will it needs attention?
Does Preservation make sense?
Did we figure traffic correctly?
Were there construction issues?
Measuring Deflection

Manual Methods:

Laboratory

Field
Measuring Deflection

Static Device Methods:

Benkelman Beam
Measuring Deflection

Static Device Methods:

LaCroix Deflectograph
Measuring Deflection

Static Device Methods:

Falling Weight Deflectometer
Measuring Deflection

Steady-State Vibratory Methods:

Dynaflect
Road Rater
Measuring Deflection

Dynamic Vibratory Device Methods:
Texas Rolling Dynamic Deflection (RDD)
Measuring Deflection

High-Speed Device Methods:

- Danish Traffic Speed Deflectometer
- Swedish Road Deflection Tester
- American Rolling Wheel Deflectometer
The RWD

• Measures the continuous pavement deflection profile due to an 18-kip single axle truck load
• Provides a measure of the overall structural capacity of highway sections
• Information can be used for network-level evaluation and management
• Pre-screener for where to focus project-level efforts (i.e., FWD, coring, etc.)
RWD Benefits

• Increased safety. Does not require lane closures.
• Mixes with traffic stream. No interruption to traveling public.
• Operates over a broad range of speed (5 to 65 mph).
• High data collection productivity.
• Rapid data processing.
Potential

\[ \hat{A} \]

RWD Role in DOT Operations

**Network-Level**

**Project-Level**

- PSI
- IRI
- RWD
- Preservation
- 10,000 lane-miles
- Rehabilitation or Reconstruction
- 100 lane-miles
- FWD
- Coring
- Lab
Indiana SR 1 – 3 Structures

Deflection, mils

Mile Marker

Poor

Good

Good
### Significant Difference Tests for Deflection Data

<table>
<thead>
<tr>
<th>Sec</th>
<th>Route</th>
<th>County</th>
<th>Avg. d0 FWD (mils) *</th>
<th>Avg. d0 RWD (mils)</th>
<th>Length (mi)</th>
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* Year of FWD Testing
## Significant Difference Test for SN_{eff}

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* Year of FWD testing
CHAMPAIGN COUNTY
RWD-BASED PMS IMPLEMENTATION
Background

- Champaign County’s network:
  - 400 lane-miles
  - Low-volume (farm-to-market) roads
  - Asphalt-surfaced. Multiple resurfacings
  - Variable surface, ride, and structural conditions

- Current highway budget is approximately $2M per year
Key Inputs

- RWD
- Video images
- Smoothness data
- Construction history
- Traffic
- Cost data
County Road 32

Deflection, mils

- AC over a granular base - Good uniformity
- AC over a cold millings base - Strongest section
- Thin AC over a surface treatment - High deflections

Mile Marker

RWD

FWD
Pavement structural conditions vary widely.

Structural Conditions

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<th>Representative RWD deflection, mils</th>
<th>Percent of mileage</th>
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<td>&lt; 10</td>
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<td>&gt; 50</td>
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Excellent
Very Good
Good
Fair
Poor
# Complete Treatment Matrix

## Representative RWD Deflection, mils

<table>
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<tr>
<th>PCI Value</th>
<th>PCI Rating</th>
<th>&lt; 35</th>
<th>35 - 50</th>
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<th>High Traffic</th>
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</table>

- **Excellent**
  - Defer Maintenance
- **Very Good**
  - Crack sealing (maximum 1 time)
- **Good**
  - Chip seal, Microsurfacing (maximum 2 times)
  - Defer Improvements
- **Fair**
  - 2-in AC Mill and Overlay
- **Poor**
  - 4-in AC Mill and Overlay
  - Reconstruction
Network Condition vs. Funding

- Unlimited: $3M per year
- $2.5M per year
- $2M per year (No PM)
- Do Nothing
PMS Results

• Produced a 5-year maintenance and rehabilitation plan
  – Prioritized projects
  – Recommended treatments

• RWD helped identify the most appropriate treatment for each road
  – Pavement preservation
  – Functional improvement
  – Structural improvement

• 5-year budget analysis showed the consequences of various funding scenarios
Conclusions

• It’s not just about Ride Quality!!
• Cracking and Rutting are important parameters.
• Pavement Structure is too important to ignore.
• Don’t abandon the proven methods.
Conclusions

- RWD is an effective means of measuring continuous pavement deflections and structurally characterizing pavement sections
- Accuracy and repeatability are suitable for network- and project-level evaluation
- Compares well to other references (i.e., FWD data)
- Can be used in PMS to optimize treatment selection, candidate projects, and funding allocation
Updates

• RWD is now available for commercial testing. ARA is the service provider.
• Two pilot programs have been funded in 2008, anticipating more in 2009.
• Focusing testing on states that are interested in incorporating RWD data into their PMS activities
Thank You!

For more information, please contact:
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