Driving Indiana’s Economic Growth
IRI/PCR/RUT Field Verification

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Outline

- History, Indot Inventory & Condition of Roadways
- Pavement Management System
- Pavement Condition Collection
- Pavement IRI, Rut & PCR
- Field Verification
- Conclusion
History

- Indiana Pavements:
  - Asphalt
  - Concrete
  - Aggregate
  - Brick

- Underdrains since 1950s

- Mid 1990 study showed poor performance of underdrain system due to lack of maint.
INDOT System

- Total 11,265 centerline miles
- 5,138 Interstate
- 7,573 US Routes
- 15,515 State Roads
- 318 Other Roads
Pavement Condition

- INDOT measures its pavement quality using International Roughness Index (IRI)
- IRI specifically gauges ride smoothness
- 94% of Interstate & NHS are in Excellent, Good, or satisfactory condition
- 6% in poor condition in above category
Pavement Management System

- Introduction
- Data Requirements
- Present & Future needs
- Project level & Network level
- Implementation
- New & Emerging Technology-Research
Pavement Management System

- $30 billion investment for US Interstates
- $billions are spent annually on preservation
- Good PMS is not business as usual
- PMS includes planning/programming, design, construction, maintenance, rehabilitation
- 50 years analysis period for LCCA
Data Requirements

- Pavement IRI, Rutting, & Faulting
- Pavement Distresses (PCR)
- Friction
- Pavement History
- Pavement coring, FWD
- Field survey
Pavement Condition Data

- How reliable are the data?
- Does it represent the pavement condition?
- Where do we use these data?
Roadway Asset Management

- IRI & PCR are being used in the Roadway Asset Scoring

- Call for project
Roadway Asset Team Scoring

- Cost-Effectiveness (max 40 points)
- Condition (max 40 points) PCR & IRI
- Others (max 20 points) traffic, functional class, Interstate etc
- Supplemental factors: project development, right-of-way
Field Verification of IRI, PCR, RUT

- Introduction
- Objective
- Field Verification
- Observations
- Conclusions
Introduction

- People often say “PMS data are not good”
- Do not have faith in the data
- Does not represent field condition
- The above arguments prompted this field verification
### INDOT Rating System for IRI

<table>
<thead>
<tr>
<th>Range</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 80</td>
<td>Excellent</td>
<td>No visible signs of deterioration, ride is smooth.</td>
</tr>
<tr>
<td>80 to 115</td>
<td>Good</td>
<td>Some indication of deterioration, ride still fairly smooth.</td>
</tr>
<tr>
<td>115 to 150</td>
<td>Satisfactory</td>
<td>Deterioration requires occasional routine maintenance. Ride starting to be affected.</td>
</tr>
<tr>
<td>150 to 170</td>
<td>Fair</td>
<td>Deterioration requires frequent routine maintenance. Ride is rough and may affect driving.</td>
</tr>
<tr>
<td>Above 170</td>
<td>Poor</td>
<td>Excessive deterioration requires frequent routine maintenance. Ride is rough and affects driving.</td>
</tr>
</tbody>
</table>
### INDOT Rating System for PCR

<table>
<thead>
<tr>
<th>Range</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 to 100</td>
<td>Excellent</td>
</tr>
<tr>
<td>80 to 95</td>
<td>Good</td>
</tr>
<tr>
<td>70 to 80</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>60 to 70</td>
<td>Fair</td>
</tr>
<tr>
<td>Below 60</td>
<td>Poor</td>
</tr>
</tbody>
</table>
INDOT Rating System for Rut Depth

<table>
<thead>
<tr>
<th>Range</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00” to 0.25”</td>
<td>Low</td>
<td>Rutting is barely noticeable.</td>
</tr>
<tr>
<td>0.25” to 0.50”</td>
<td>Medium</td>
<td>Rutting is readily noticeable.</td>
</tr>
<tr>
<td>Above 0.50”</td>
<td>High</td>
<td>Rutting is readily noticeable, may warrant rehabilitation or reconstruction.</td>
</tr>
</tbody>
</table>
Data Collection Van
Objective

- Validate the data with field condition
- Does IRI represent field condition?
- Does correlation exists between IRI & PCR?
- How does a driver feel at 170 IRI?
Field Verification
Field Verification
This is a 4-mile project (1 mile urban and 3 miles rural). PCR was lower and IRI higher in the urban section, and PCR was higher and IRI lower in the rural section. This was consistent with ride and PMS data.

Major distresses in the urban section were transverse cracks, block cracks, and longitudinal joints. In the rural section, major distresses were transverse cracks and longitudinal joints.
Crawfordsville District

This is an urban section. The ride was bumpy due to high-severity fatigue and transverse cracks, which is consistent with IRI.

Major distresses were fatigue, transverse and block cracks.
The ride was smooth, which is consistent with IRI data.

The road has minor distresses such as low-severity longitudinal joints and transverse cracks.
This is a 3-mile urban section with a pair of two-lane one-way streets for EB and WB directions.

The ride was very rough in the EB direction from SR 9 to the west end of project, which is consistent with PMS data.

Major distresses were high severity wheel path cracks, transverse cracks and longitudinal joints.
This is a 6.5-mile rural section with a chip-sealed surface.

The ride was rougher than 2010 IRI due to delaminating of the surface.

Major distresses were high severity wheel path/fatigue, transverse, and longitudinal cracks.

Route | Des. No. | Work Type | IRI | PCR
--- | --- | --- | --- | ---
SR 18 | 0810230 | HMA Overlay, Functional | 118 (Satisfactory) | 61.5 (Fair)
This is an 8-mile rural section. The right wheel path (RWP) ride felt rougher than LWP in both directions due to a partial chip seal in 2010 from the edge of the pavement to 5 feet inside. PMS data was consistent with ride.

High severity wheel path, transverse, and longitudinal (widening) cracks, also medium to low severity block cracks, edge cracks, and longitudinal joints.
This is a 9.7-mile rural section and 2-mile urban section in NHS route.

The ride was good, consistent with IRI data in both urban and rural sections.

The ride was not matching with PCR due to no distresses in wheel path, no rutting, and well-sealed transverse cracks.

Low to medium severity transverse cracks and longitudinal joints.
This is a 9.5-mile rural section in Lake County.
The ride was consistent with PMS data but not consistent with PCR. Pavement condition was more severe than IRI data due to the fact that most of the distresses were away from the wheel paths.
Major distresses were transverse cracks, longitudinal cracks, and longitudinal joints.
LaPorte District

- This is a 4-mile rural section.
- The ride was rough and consistent with IRI data and PCR data.
- High severity transverse cracks, longitudinal joints, and longitudinal cracks. Low to medium severity edge cracks and potholes.
LaPorte District

- This is a 9-mile rural section and divided highway with 2 lanes in each direction.
- Ride was smooth and consistent with IRI data and PCR data.
- Major distresses were medium severity transverse cracks and longitudinal joints.

<table>
<thead>
<tr>
<th>Route</th>
<th>Des. No.</th>
<th>Work Type</th>
<th>IRI</th>
<th>PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 41</td>
<td>0200113</td>
<td>HMA Overlay, PM</td>
<td>91 (Good)</td>
<td>84 (Good)</td>
</tr>
</tbody>
</table>
This is a 6-mile rural section.

Ride was slightly rougher than IRI but pavement condition was true represented to the ride.

Major distresses were medium severity transverse cracks, longitudinal cracks, and longitudinal joints and also high severity wheel path cracks.
This is a 4-mile section (2.5 miles urban and 1.5 miles rural).

The ride was slightly rough in the urban section and smooth in the rural section, which is consistent with IRI data and PCR data.

Major distresses in the urban section were transverse cracks, block cracks, longitudinal cracks, and longitudinal joints. In the rural section, major distresses were transverse cracks and longitudinal joints.
This is a 10-mile divided rural section with 2 lanes in each direction.

The ride was slightly bumpy in both NB and SB direction due to transverse joints (some were sealed and some were not sealed) but not consistent with PMS data (should be good instead of excellent).

Major pavement distresses were transverse cracks and longitudinal joints.
This is a 1-mile small-town rural section.

- Ride feels suitable and some places slightly bumpy but overall consistent with PMS data and PCR.
- Major distresses were high severity wheel path cracks and raveling. It had also medium severity block and transverse cracks.

<table>
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<th>Des. No.</th>
<th>Work Type</th>
<th>IRI</th>
<th>PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 61</td>
<td>0500162</td>
<td>Pavement Replacement</td>
<td>133</td>
<td>70.8</td>
</tr>
</tbody>
</table>

133 (Satisfactory) 70.8 (Satisfactory)
<table>
<thead>
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<th>Route</th>
<th>District</th>
<th>Work Type</th>
<th>IRI</th>
<th>PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 267</td>
<td>C-ville</td>
<td>HMA Overlay, PM</td>
<td>120 (Satisfactory)</td>
<td>78.9 (Satisfactory)</td>
</tr>
<tr>
<td>SR 39</td>
<td>C-ville</td>
<td>Pavement Replacement</td>
<td>151 (Fair)</td>
<td>66 (Fair)</td>
</tr>
<tr>
<td>I-74</td>
<td>C-ville</td>
<td>HMA Overlay, PM</td>
<td>59 (Excellent)</td>
<td>86.5 (Good)</td>
</tr>
<tr>
<td>SR 18</td>
<td>FW</td>
<td>HMA Overlay, PM</td>
<td>205 (Poor)</td>
<td>52 (Poor)</td>
</tr>
<tr>
<td>SR 18</td>
<td>FW</td>
<td>HMA Overlay, Functional</td>
<td>118 (Satisfactory)</td>
<td>61.5 (Fair)</td>
</tr>
<tr>
<td>SR 1</td>
<td>Gr</td>
<td>Road Rehab. (FDR)</td>
<td>106 (Good)</td>
<td>60.6 (Fair)</td>
</tr>
<tr>
<td>US 27</td>
<td>Gr</td>
<td>HMA Overlay, PM</td>
<td>70 (Excellent)</td>
<td>83.8 (Good)</td>
</tr>
<tr>
<td>I-65</td>
<td>LaPorte</td>
<td>Road Rehab. (Functional Overlay)</td>
<td>116 (Satisfactory)</td>
<td>70.6 (Satisfactory)</td>
</tr>
<tr>
<td>SR 10</td>
<td>LaPorte</td>
<td>Road Rehab. (Functional Overlay)</td>
<td>215 (Poor)</td>
<td>64.3 (Fair)</td>
</tr>
<tr>
<td>US 41</td>
<td>LaPorte</td>
<td>HMA Overlay, PM</td>
<td>91 (Good)</td>
<td>84 (Good)</td>
</tr>
<tr>
<td>SR 252</td>
<td>Seymour</td>
<td>Road Rehab. (Functional Overlay)</td>
<td>109 (Good)</td>
<td>73.5 (Satisfactory)</td>
</tr>
<tr>
<td>US 50</td>
<td>Seymour</td>
<td>HMA Overlay, PM</td>
<td>103 (Good)</td>
<td>82.1 (Good)</td>
</tr>
<tr>
<td>US 41</td>
<td>Vin</td>
<td>HMA Overlay, PM</td>
<td>77 (Excellent)</td>
<td>85.4 (Good)</td>
</tr>
<tr>
<td>SR 61</td>
<td>Vin</td>
<td>Pavement Replacement</td>
<td>133 (Satisfactory)</td>
<td>70.8 (Satisfactory)</td>
</tr>
</tbody>
</table>
Observations

- A higher IRI correlated to a rougher or bumpier ride and a lower IRI correlated to a smoother ride.
- For 3 projects, the ride felt rougher than 2010 IRI data.
- The ride was consistent with PCR for all projects except two.
- A high IRI (rough) correlates to low PCR (poor).
Conclusions

- The 2010 IRI data is consistent with the actual field condition with some exceptions

- IRI < 80 gives a smooth ride & IRI > 170 gives a rough ride

- Bridge approaches generally have > 170 IRI
Conclusions

- The IRI alone cannot be used to gauge the pavement condition
- The PCR is a true indicator of the pavement condition
- The Rut data are consistent
Conclusions

- The PMS data are reliable, however the user of the data must know how to interpret and make decisions

- Automated PCR data are recommended

- Use the latest data posted on “Y” drive
Thank You

Questions?