PMS: Condition of County Paved Roads, Wyoming (2017)

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April, 2018
Updated County Paved Roads

- Total Length: 2,378 miles
- Total Number of Segments: 1,974
- Minimum Length: 52.8 ft.
- Maximum Length: 25.8 miles
Data Summary

Pathway® Automated Van

Inventory and Segmentation

Video Log

IRI - Roughness

RUT – Rutting

PCI – Pavement Condition Index

Raw data on website

GPR – Ground Penetrating Radar (Pavement Thickness)

Collected In 2014
In 2014, data was collected statewide.

**West (1,185 Miles)**

- Year of Data Collection
  - 2015
  - 2017
  - 2019
  - ...

**East (1,193 Miles)**

- Year of Data Collection
  - 2016
  - 2018
  - 2020
  - ...

Received Data in February 2018

Completed
2017 Data Collection: West

West side of the State
## Summary of Roads in East and West County

<table>
<thead>
<tr>
<th>County</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Segments</td>
<td>Mileage</td>
</tr>
<tr>
<td>Big Horn</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>Fremont</td>
<td>166</td>
<td>208</td>
</tr>
<tr>
<td>Hot Springs</td>
<td>32</td>
<td>76</td>
</tr>
<tr>
<td>Lincoln</td>
<td>204</td>
<td>176</td>
</tr>
<tr>
<td>Park</td>
<td>58</td>
<td>71</td>
</tr>
<tr>
<td>Sublette</td>
<td>145</td>
<td>146</td>
</tr>
<tr>
<td>Sweetwater</td>
<td>58</td>
<td>65</td>
</tr>
<tr>
<td>Teton</td>
<td>302</td>
<td>258</td>
</tr>
<tr>
<td>Uinta</td>
<td>56</td>
<td>41</td>
</tr>
<tr>
<td>Washakie</td>
<td>55</td>
<td>44</td>
</tr>
<tr>
<td>Albany</td>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>Campbell</td>
<td>79</td>
<td>182</td>
</tr>
<tr>
<td>Carbon</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>Converse</td>
<td>49</td>
<td>90</td>
</tr>
<tr>
<td>Crook</td>
<td>21</td>
<td>40</td>
</tr>
<tr>
<td>Goshen</td>
<td>116</td>
<td>118</td>
</tr>
<tr>
<td>Johnson</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>Laramie</td>
<td>152</td>
<td>245</td>
</tr>
<tr>
<td>Natrona</td>
<td>208</td>
<td>135</td>
</tr>
<tr>
<td>Niobrara</td>
<td>4</td>
<td>3.3</td>
</tr>
<tr>
<td>Platte</td>
<td>102</td>
<td>158</td>
</tr>
<tr>
<td>Sheridan</td>
<td>43</td>
<td>22</td>
</tr>
<tr>
<td>Weston</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>806</td>
<td>1,193</td>
</tr>
</tbody>
</table>

PMS 2027: in progress...
PMS 2028: will be collected
2017 Data Collection: West

Data Collection conducted by Pathway Services, Inc.

- Collected pavement condition data in 2017.
- Received data in early 2018.
- Processing data to generate IRI, Rut, PCI, and PSI.
Road Condition Parameters

International roughness index (IRI)

Rutting

Pavement condition index (PCI)

Overall Condition: Pavement serviceability index (PSI)
Roughness (IRI)

- Ride comfort depends on roughness.
- Smoother roads require less maintenance.
- Smoother roads stay smoother longer.
- Smoother roads are safer.

Data Source: Pathway Services, Inc.
Rutting

- Defined as surface depression along the wheel paths.
- Deformation of pavement or subgrade.
- In dry condition, rutting will act as a wheel path; driver may need extra effort to get out from the rut path.
- Rutting is more hazardous in wet weather when water accumulates in the rut path and leads to hydroplaning.
- Rut depth more than 0.3” would significantly increase accidents frequency.

Data Source: Pathway Services, Inc.
How to Calculate IRI and Rut?

1.3 mile of Roadway Segment

<table>
<thead>
<tr>
<th>IRI</th>
<th>105</th>
<th>99</th>
<th>104</th>
<th>86</th>
<th>84</th>
<th>86</th>
<th>102</th>
<th>132</th>
<th>104</th>
<th>88</th>
<th>88</th>
<th>112</th>
<th>110</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rut</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.07</td>
<td>0.07</td>
<td>0.08</td>
<td>0.07</td>
<td>0.1</td>
<td>0.09</td>
<td>0.08</td>
<td>0.1</td>
<td>0.11</td>
<td>0.12</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Average

Data Source: Pathway Services, Inc.
Change to estimate Rut in 2017?

Technology used before 2015: 1 reading every 5 feet
Technology used since 2016: many readings every inch
Pavement Condition Index (PCI)

- Cracks increase roughness.
- Cracks allow water to infiltrate pavement.
- Cracks accelerate pavement deterioration.
How to Calculate PCI?

Video Logs
How to Calculate PCI?

Pavement Surface

Until 2015

Identify distresses manually

Manual crack detection

Since 2016

Identify distresses automatically

Automatic crack estimation
Previous technology vs. new technology for PCI?

**Previous Technology**

1. Identify and measure distresses by visual inspection.
2. Takes about a month to estimate PCI for 1000 miles.
3. Only 1000 ft. samples can be considered.

**New 3D automatic Technology**

1. Identify and measure distresses automatically using imaging and crack detection software.
2. Takes about an hour to estimate PCI for 1000 miles.
3. Samples and whole segment both can be considered.
Previous technology vs. new technology for PCI?

**Interstates**

**Interstate: ML80 INC**

Majority in great condition

**Highway: ML12**
Previous technology vs. new technology for PCI?

County Roads of West Side

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>88</td>
<td>85</td>
</tr>
<tr>
<td>SD</td>
<td>13</td>
<td>9</td>
</tr>
</tbody>
</table>
Pavement Serviceability Index (PSI)

- PSI represents the overall pavement condition based on the values of: rut depth, roughness, and cracking index.

\[
PSI = 5.35e^{-0.0058*I_{RI}} - 4*RUT^2 - 3 \left(1 - \left(\frac{PCI}{100}\right)\right)
\]

Where:
- IRI is the International Roughness Index (inches/mile)
- RUT is the mean Rut Depth (inches)
- PCI is the Pavement Condition Index (based on ASTM D6433)
Categories of Performance Parameters

International Roughness Index (IRI)
- Less than 70
- 70-100
- 101-130
- 131-170
- Greater than 170

Pavement Serviceability Index (PSI)
- Greater than 3.5
- 3.01-3.5
- 2.51-3.0
- 2.0-2.5
- Less than 2

Rut Depth
- 0.3 inches or less
- More than 0.3 inches

Pavement Condition Index (PCI)
- Greater than 85
- 70-85
- Less than 70
2017 Project Deliverables

County pavement condition report

Electronic GIS Maps & Video Logs

Electronic Data

Statewide Report
Electronic Data in Hard Drive

- Weston Video Logs
- Weston_A Monitoring Program for Wyoming County Paved Roads.docx
- Weston_A Monitoring Program for Wyoming County Paved Roads.pdf
- Weston-Combined Dataset.xlsx
What’s in the Hard Drive?

• Video Logs
• An spreadsheet of combined dataset: includes IRI, rut, PCI and PSI by roadway segments.
• Electronic and pdf copy of county reports.
Online Electronic Data

- Wyoming T2 Online GIS Maps
- Pathway Online Video Logs
Pavement Condition from Website

Contents
- RUT Depth
- International Roughness Index (IRI)
- Pavement Condition Index (PCI)
- Pavement Serviceability Index (PSI)
- Asphalt Thickness
- Base Thickness
- Topographic

Legend
- **RUT Depth**
  - Red: More than 0.3 inches
  - Green: 0.3 inches or less

**RUT Depth: Albany**
- COUNTY: Albany
- Route: ML50G9B
- BegMP: 0.00
- EndMP: 0.50
- PrimaryName: Gibbs Road
- Rut: 0.31
- IRI: 350
- PCI: 64
- PSI: Missing
- AsphaltThick: 3.88
- BaseThick: 6.40
- CatRUT: Greater than 0.3 Inches
- CatIRI: Greater than 170

Zoom to
Combined Dataset

Example

<table>
<thead>
<tr>
<th>County</th>
<th>RID</th>
<th>Begin MP</th>
<th>End MP</th>
<th>Primary Name</th>
<th>Asphalt / Concrete Thickness (Inch)</th>
<th>Base Thickness (inch)</th>
<th>2014</th>
<th>2015</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Park</td>
<td>ML7776B</td>
<td>0</td>
<td>1.94</td>
<td>Old Highway 292</td>
<td>4.01</td>
<td>5.60</td>
<td>0.16</td>
<td>108</td>
<td>87</td>
</tr>
<tr>
<td>Park</td>
<td>ML7776B</td>
<td>1.94</td>
<td>2.85</td>
<td>Old Highway 292</td>
<td>4.06</td>
<td>7.20</td>
<td>0.16</td>
<td>100</td>
<td>87</td>
</tr>
<tr>
<td>Park</td>
<td>ML7776B</td>
<td>2.85</td>
<td>3.47</td>
<td>Old Highway 292</td>
<td>3.82</td>
<td>4.70</td>
<td>0.16</td>
<td>83</td>
<td>87</td>
</tr>
<tr>
<td>Park</td>
<td>ML7776B</td>
<td>3.47</td>
<td>4.13</td>
<td>Old Highway 292</td>
<td>4.31</td>
<td>5.50</td>
<td>0.16</td>
<td>98</td>
<td>86</td>
</tr>
</tbody>
</table>

Where,

- **RID**: Road identification designation
- **MP**: Mile post
- **IRI**: International roughness index
- **PCI**: Pavement Condition index
- **PSI**: Pavement serviceability index

2017 Data is added here
Example County Report using 2017 Data

Big Horn County
What’s in the Report?

• Summary of pavement condition parameters (IRI, RUT, PCI and PSI) in different categories.

• IRI, RUT, PCI and PSI will be shown in map produced by ArcGIS.

• The data will also be compared with previous data collection in 2015.

• Combined database showing IRI, Rut, PCI and PSI data for year 2014, 2015, and 2017.
Comparison among 2014, 2015 and 2017 Data

Big Horn County, 2014
- 93 (84%)
- 13 (12%)

Big Horn County, 2015
- 94 (85%)
- 15 (15%)

Big Horn County, 2017
- 100 (100%)

Western side of the State, 2014
- 1080 (88%)
- 121 (10%)

Western side of the State, 2015
- 1106 (90%)
- 104 (9%)

Western side of the State, 2017
- 1157 (98%)
- 28 (2%)

Statewide, 2014
- 2122 (87%)
- 227 (9%)
- 95 (4%)

Legend:
- Green: 0.3 inches or less
- Red: More than 0.3 inches
- Gray: Not Available (N/A)

Rut Depth
Rut Depth, 2017

Rut Depth

- More than 0.3 inches
- 0.3 inches or less
- State Highways
- All Roads

Miles

N
Comparison among 2014, 2015 and 2017 Data

**Big Horn County, 2014**
- Less than 70: 63 (62%)
- 70 - 100: 11 (10%)
- 101 - 130: 11 (10%)
- Greater than 170: 6 (6%)

**Big Horn County, 2015**
- Less than 70: 74 (67%)
- 70 - 100: 10 (9%)
- 101 - 130: 9 (8%)
- Greater than 170: 1 (1%)

**Big Horn County, 2017**
- Less than 70: 52 (52%)
- 70 - 100: 12 (12%)
- 101 - 130: 21 (21%)
- Greater than 170: 9 (9%)

**Western side of the State, 2014**
- Less than 70: 735 (60%)
- 70 - 100: 192 (16%)
- 101 - 130: 103 (8%)
- Greater than 170: 28 (2%)

**Western side of the State, 2015**
- Less than 70: 755 (61%)
- 70 - 100: 163 (15%)
- 101 - 130: 83 (7%)
- Greater than 170: 18 (2%)

**Western side of the State, 2017**
- Less than 70: 89 (7%)
- 70 - 100: 262 (22%)
- 101 - 130: 587 (50%)
- Greater than 170: 147 (12%)

**Statewide, 2014**
- Less than 70: 386 (16%)
- 70 - 100: 121 (5%)
- 101 - 130: 346 (14%)
- Greater than 170: 1245 (51%)
- Not Available (N/A): 248 (10%)

**Statewide, 2015**
- Less than 70: 386 (16%)
- 70 - 100: 121 (5%)
- 101 - 130: 346 (14%)
- Greater than 170: 1245 (51%)
- Not Available (N/A): 248 (10%)

**Statewide, 2017**
- Less than 70: 386 (16%)
- 70 - 100: 121 (5%)
- 101 - 130: 346 (14%)
- Greater than 170: 1245 (51%)
- Not Available (N/A): 248 (10%)
Comparison among 2014, 2015 and 2017 Data

PCI

Big Horn County, 2014

Big Horn County, 2015

Big Horn County, 2017

Western side of the State, 2014

Western side of the State, 2015

Western side of the State, 2017

Statewide, 2014

Less than 70  | 70 - 85  | Greater than 85  | Not Available (N/A)

Wyoming Technology Transfer Center
Local Technical Assistance Program
Comparison among 2014, 2015 and 2017 Data

- **Big Horn County, 2014**
  - Less than 2: 4 (4%)
  - 2.00 - 2.50: 3 (3%)
  - 2.51 - 3.00: 12 (10%)
  - 3.01 - 3.50: 8 (8%)
  - Greater than 3.5: 79 (72%)

- **Big Horn County, 2015**
  - Less than 2: 2 (2%)
  - 2.00 - 2.50: 3 (3%)
  - 2.51 - 3.00: 7 (6%)
  - 3.01 - 3.50: 82 (74%)
  - Greater than 3.5: 9 (8%)

- **Big Horn County, 2017**
  - Less than 2: 10 (10%)
  - 2.00 - 2.50: 8 (8%)
  - 2.51 - 3.00: 10 (10%)
  - 3.01 - 3.50: 72 (72%)
  - Greater than 3.5: 7 (7%)

- **Western side of the State, 2014**
  - Less than 2: 32 (33%)
  - 2.00 - 2.50: 49 (51%)
  - 2.51 - 3.00: 66 (69%)
  - 3.01 - 3.50: 92 (95%)
  - Greater than 3.5: 7 (7%)

- **Western side of the State, 2015**
  - Less than 2: 25 (29%)
  - 2.00 - 2.50: 68 (75%)
  - 2.51 - 3.00: 80 (90%)
  - 3.01 - 3.50: 79 (90%)
  - Greater than 3.5: 6 (7%)

- **Western side of the State, 2017**
  - Less than 2: 66 (69%)
  - 2.00 - 2.50: 89 (95%)
  - 2.51 - 3.00: 80 (90%)
  - 3.01 - 3.50: 833 (95%)
  - Greater than 3.5: 117 (13%)

- **Statewide, 2014**
  - Less than 2: 106 (4%)
  - 2.00 - 2.50: 177 (78%)
  - 2.51 - 3.00: 239 (10%)
  - 3.01 - 3.50: 1658 (68%)
  - Greater than 3.5: 187 (8%)
  - Not Available (N/A): 8 (3%)

- **Statewide, 2015**
  - Less than 2: 25 (29%)
  - 2.00 - 2.50: 68 (75%)
  - 2.51 - 3.00: 80 (90%)
  - 3.01 - 3.50: 79 (90%)
  - Greater than 3.5: 6 (7%)

- **Statewide, 2017**
  - Less than 2: 66 (69%)
  - 2.00 - 2.50: 89 (95%)
  - 2.51 - 3.00: 80 (90%)
  - 3.01 - 3.50: 833 (95%)
  - Greater than 3.5: 117 (13%)
Update database for 2018 data collection

Please let us know if you would like to add any roadway segment in the database or update any existing road. So that, you receive the up-to-date pavement condition data in future.
Detail pavement condition data is provided in the hard drive electronically.

Or

Please contact the Wyoming Technology Transfer Center. We will provide you the data as per your request.
PMS 2017 Deliverables

• Reports – completed.
• Data preparation in hard drive – in progress.
• Data published in website – in progress.

Reports and data will be mailed soon.
Questions
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