Maintaining and Enhancing Statewide Levels of Service

Upper Great Plains Transportation Institute
North Dakota State University, Fargo

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Overview

- State System
  - Levels of Service
  - Current Trends and Maintenance
  - Improvements & Upgrades
  - Costs

- County System
  - Levels of Service
  - Costs
  - Inflation Impacts

- Township System
  - Levels of Service
  - Costs
  - Inflation Impacts

- Cities
Levels of Service

- State System
  - Surface Condition
  - Lane Width
  - Shoulder Width
Surface Condition

- Given current funding, overall condition will deteriorate over the next 20 years

<table>
<thead>
<tr>
<th>Surface Condition</th>
<th>Percentage of System (2010)</th>
<th>Percentage of System (2030)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>38</td>
<td>32</td>
<td>-6</td>
</tr>
<tr>
<td>Good</td>
<td>26</td>
<td>30</td>
<td>+4</td>
</tr>
<tr>
<td>Fair</td>
<td>29</td>
<td>27</td>
<td>-2</td>
</tr>
<tr>
<td>Poor</td>
<td>6</td>
<td>11</td>
<td>+5</td>
</tr>
</tbody>
</table>
Surface Condition

- How much will it deteriorate?
- Define scale

<table>
<thead>
<tr>
<th>Surface Condition</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>&gt;4</td>
</tr>
<tr>
<td>Good</td>
<td>3.4-3.9</td>
</tr>
<tr>
<td>Fair</td>
<td>3.1-3.4</td>
</tr>
<tr>
<td>Mediocre</td>
<td>2.6-3.1</td>
</tr>
<tr>
<td>Poor</td>
<td>&lt;2.5</td>
</tr>
</tbody>
</table>

- Source: Federal Highway Administration C&P Report, Chapter 3 - System Conditions
State System

- Average System Condition

<table>
<thead>
<tr>
<th>HPCS</th>
<th>2010</th>
<th>2030</th>
<th>Rating 2010</th>
<th>Rating 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide</td>
<td>3.40</td>
<td>3.24</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>Interstate</td>
<td>3.69</td>
<td>3.57</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Interregional</td>
<td>3.18</td>
<td>3.30</td>
<td>Fair</td>
<td>Fair</td>
</tr>
<tr>
<td>State Corridor</td>
<td>3.42</td>
<td>3.30</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>District Corridor</td>
<td>3.41</td>
<td>3.16</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>District Collector</td>
<td>3.24</td>
<td>2.97</td>
<td>Fair</td>
<td>Mediocre</td>
</tr>
</tbody>
</table>

- Current Funding: $160 million/year ($2010)
Projected Levels of Service Given Current Funding Level ($2010)*

Level of Service

Present 2030

Time

Current

$3,200,000,000

Present 2030

* Not Inflation Adjusted
Maintain Current Levels of Service (2010-2030)

- Analysis to estimate the cost of maintaining current system condition

<table>
<thead>
<tr>
<th>HPCS</th>
<th>2010</th>
<th>2030</th>
<th>Rating 2010</th>
<th>Rating 2030</th>
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</thead>
<tbody>
<tr>
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<td>3.40</td>
<td>3.37</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Interstate</td>
<td>3.69</td>
<td>3.79</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Interregional</td>
<td>3.18</td>
<td>3.38</td>
<td>Fair</td>
<td>Fair</td>
</tr>
<tr>
<td>State Corridor</td>
<td>3.42</td>
<td>3.41</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>District Corridor</td>
<td>3.41</td>
<td>3.28</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>District Collector</td>
<td>3.24</td>
<td>3.13</td>
<td>Fair</td>
<td>Fair</td>
</tr>
</tbody>
</table>

- Estimate to maintain: $289 million/year ($2010)
Maintain Current Levels of Service
2010-2030 ($2010)

Maintain Current

Current

$1,746,000,000

* Not Inflation Adjusted
Maintain Current Levels of Service 2010-2030 (4 % Inflation)

Maintain Current

Current

$2,791,000,000
Highway Performance Classification System
<table>
<thead>
<tr>
<th>HPCS</th>
<th>Load Restrictions</th>
<th>Distress Condition</th>
<th>Ride Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>Legal Weights</td>
<td>Good to Excellent</td>
<td>Good to Excellent</td>
</tr>
<tr>
<td>Interregional Corridor</td>
<td>Legal Weights</td>
<td>Good to Excellent</td>
<td>Good to Excellent</td>
</tr>
<tr>
<td>State Corridor</td>
<td>Legal Weights</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>District Corridor</td>
<td>May be restricted to 7 or 8 ton seasonal limits</td>
<td>Fair to Good</td>
<td>Fair to Good</td>
</tr>
<tr>
<td>District Collector</td>
<td>May be restricted to 6 or 7 ton seasonal limits</td>
<td>Fair</td>
<td>Fair</td>
</tr>
</tbody>
</table>
Maintain and Eliminate HPCS Deficiencies 2010-2030 ($2010)*

- Deficiency Types
  - Load (Structural Overlay)
    - 560.6 miles
    - Cost: $266,285,000
  - Distress (Minor Rehabilitation)
    - 1088.7 miles
    - Cost: $310,279,500 (Distress Alone)
  - Ride (Thin Lift Overlay)
    - 1289.0 miles
    - Cost: $238,465,000 (Ride Alone)

* Not Inflation Adjusted
Maintain and Eliminate HPCS Deficiencies 2010-2030 ($2010)*

* Not Inflation Adjusted
Enhanced Levels of Service

- Responses
  - Roadway Width (Primary Level of Service)
  - Upgrade Highway Performance Classification
  - Add Roadway Lanes
  - Add Turn/Acceleration Lanes
Roadway Widening

- Cost Estimate to Widen Existing Highways
  - Major Rehab Width - Widening Only

<table>
<thead>
<tr>
<th>HPCS</th>
<th># of Miles</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Interregional 4-Lane</td>
<td>182</td>
<td>$59,605,000</td>
</tr>
<tr>
<td>Interregional 2-Lane</td>
<td>175</td>
<td>$63,175,000</td>
</tr>
<tr>
<td>State Corridors</td>
<td>918</td>
<td>$326,808,000</td>
</tr>
<tr>
<td>District Corridors</td>
<td>1,685</td>
<td>$588,905,000</td>
</tr>
<tr>
<td>District Collectors</td>
<td>719</td>
<td>$226,844,000</td>
</tr>
<tr>
<td>Total</td>
<td>3,679</td>
<td>$1,265,340,000</td>
</tr>
</tbody>
</table>

* Not Inflation Adjusted
Segment HPCS Upgrades

- Participants in regional public input meetings identified 27 segments that they would like to see upgraded to at least the next HPCS level.
  - Total mileage of the 27 segments: 1,244 miles
  - Estimated cost per mile to upgrade a District Corridor to a State Corridor: $620,000/mile
  - Total cost: $771,280,000
Upgrade from Two to Four Lanes

- Participants in regional public input meetings identified 6 highways that they would like to see upgraded to four-lane facilities
  - Total mileage of the 6 highways: 614 miles
  - Estimated cost per mile to upgrade a two-lane facility to a four-lane facility: $2,500,000/mile
  - Total cost: $1,535,000,000
Addition of Turn Lanes

- Example Program
  - $12,000,000/year
  - 107 miles on US 85 and ND 23
Enhanced Levels of Service*

* Not Inflation Adjusted
### Summary Table*

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Time</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced LOS</td>
<td></td>
<td>$3,570,000,000</td>
</tr>
<tr>
<td>HPCS Guidelines</td>
<td></td>
<td>$815,000,000</td>
</tr>
<tr>
<td>Maintain Current</td>
<td></td>
<td>$1,746,000,000</td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td>$3,200,000,000</td>
</tr>
</tbody>
</table>

*Not Inflation Adjusted
County Levels of Service

- Survey
  - Overlay Interval
  - Overlay Thickness
  - Gravel Interval
  - Gravel Thickness
  - Blading Interval
County Levels of Service

- County Responses
  - Overlay Interval
    - Average - 18.5 years
    - Range - 15-25 years
    - Most Frequent - 20 years
  - Overlay Thickness
    - Average - 2.33
    - Range - 1.5-3.5 inches
    - Most Frequent - 2 inches
County Levels of Service

- County Responses
  - Gravel interval
    - Average – 6 years
    - Range – 3-15 years
    - Most Frequent – 5 years
  - Regional Variations
County System

- FY 2009 funding was $70,000,000 statewide (Federal, State and Mill Levies) excluding unorganized road mill levies
- 18,969 miles
- Example County Scenario
County Scenario

- Example County:
  - 300 total miles: 150 paved, 150 gravel
  - Average overlay thickness: 2”
  - Average overlay interval: 20 years
  - Average gravel thickness: 1,500 cubic yards/mile
  - Average gravel interval: 5 years
## County Scenario

<table>
<thead>
<tr>
<th>Category</th>
<th>Current Annual</th>
<th>2015 with 4% Inflation</th>
<th>2019 with 4% Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overlays</td>
<td>$1,125,000</td>
<td>$1,316,090</td>
<td>$1,601,225</td>
</tr>
<tr>
<td>Graveling</td>
<td>$180,000</td>
<td>$210,574</td>
<td>$256,196</td>
</tr>
<tr>
<td>Snow Removal</td>
<td>$36,000</td>
<td>$42,114</td>
<td>$51,239</td>
</tr>
<tr>
<td>Blading</td>
<td>$63,750</td>
<td>$74,578</td>
<td>$90,736</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$1,404,750</td>
<td>$1,643,358</td>
<td>$1,999,397</td>
</tr>
</tbody>
</table>

| Number of Miles Graveled Per Year | 30 | 26 | 21 |
| Ave. Graveling Interval         | 5 Years | 6 Years | 7 Years |
| Number of Miles of Overlay Per Year | 7.5 | 6.5 | 5 |
| Average Overlay Interval        | 20 Years | 23 Years | 28 Years |
Timeliness of Improvements

**Pavement Preservation is Cost Effective**

- **Typical Pavement Deterioration**
  - 40% Drop in Quality
  - 75% of Life
- **Spending $1 on pavement preservation before this point...**
  - ...eliminates or delays spending $6 to $14 on rehabilitation or reconstruction here.
- **12% of Life**

Source: National Center for Pavement Preservation.
Township System

- Levels of Service
  - Gravel Interval
  - Gravel Thickness
  - Blading Interval
Township System

- FY 2009 funding was $23,200,000 statewide (state and mill levies)
- 56,621 miles
- Translates to roughly $400 per township road mile
- What does $400 per mile buy?
Township System

- Example:
  - Township with 50 road miles
  - 50% maintained & kept open during the winter months (25 miles)
  - Total annual present funding = $20,000
- Costs:
  - Snow Removal: 25 miles
  - Blading: Once every 2 months
  - Gravel: Applied at 500 cu.yd./mile
## Township Scenario

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>2014 with 4% Inflation</th>
<th>2019 with 4% Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graveling</td>
<td>$13,185</td>
<td>$15,422</td>
<td>$18,763</td>
</tr>
<tr>
<td>Snow Removal</td>
<td>$3,275</td>
<td>$3,831</td>
<td>$4,661</td>
</tr>
<tr>
<td>Blading</td>
<td>$3,541</td>
<td>$4,143</td>
<td>$5,040</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$20,000</td>
<td>$23,397</td>
<td>$28,466</td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Miles Graveled Per Year</strong></td>
<td>4.4</td>
<td>3.4</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Ave. Graveling Interval</strong></td>
<td>6 Years</td>
<td>7 Years</td>
<td>9 years</td>
</tr>
</tbody>
</table>

Does not include flood/weather damages
Urban Systems

- 2009 Federal and State Funding for Cities: $62,181,000 (not including local funding)
- Estimated from long range plans and past survey responses from Urban Street and County Road Assessment Study
- Amount of detail varies from city to city
- Each plan includes lists of expected improvements for next 15 to 20 years
Urban Systems

- Assumed that long range plans would maintain the level of service
- Some plans include expected maintenance costs
- When maintenance costs could not be determined, the survey results from the previous study were used and indexed
- Estimated funding to implement long range plans in 2010 dollars for all 13 cities is $77 million annually
Small Cities

- Diverse needs within small cities
- Discussions with small city governments confirmed the findings of the 2002 Small City and Township Report
- Gap between current funding and cost to maintain current levels of service
- Focus is on maintenance and preservation
North Dakota's Overall Construction Cost Index

Source: NDDOT
Improvement Costs

- Inflation Implications
  - The same funding “buys” fewer improvements than it did five years ago
  - Backlog of improvement projects
  - Timeliness of improvements can not be met in many cases
  - Repair vs. resurface vs. reconstruct vs. reduce level of service
Summary

- Levels of Service
  - Where are we now?
    - State – 64% Good or better
    - County – Average gravel every 6 years, average overlay every 18 years
  - Where will we be 20 years from now?
    - With existing revenue, overall system condition will decrease and inflation may continue to devalue the buying power of the revenue
- Maintaining Levels of Service
- Choices/Prioritization