

Infrastructure Needs:
North Dakota's County, Township, & Tribal
Roads & Bridges
2017-2036

Draft Report

Regional Meetings

Dickinson, Stanley, Mandan, Devils Lake & Valley City
October 13, 14, 15, 28, 29 - 2016

Upper Great Plains Transportation Institute
North Dakota State University

Outline of Today's Presentation

- Introductory Remarks/general findings
- Quick History of Studies
- General Changes in Study Process
- Data Collection Details
- Data Analysis Processes/Issues
- Summation of Needs Presentation
- Open Discussion

Introductory Remarks

- This study is again an improvement over the past studies.
 - Utilization of Legislative Support of Asset Management
 - GRIT – Geographic Roadway Information Tool
 - Better pavement history Data
 - Improved Unpaved Road Survey Instrument
 - Built with a user group
 - Provided Webinar based Training – Recorded
- Less interest from Legislature at this time.
 - In Past Studies We Reported to Budget Section First
 - Legislative Council OK with us going to jurisdictions with draft and reporting later

General Findings

- Overall Ride and Pavement Ratings are Improving
- County participation in Asset Management (GRIT) has enhanced quality of pavement history/thickness data.
- Pavements are thicker based on GRIT and Final GPR resulting in less structural failure and more overlays.
- Unit costs are lower than in last study with no differential between oil and non-oil counties
- Gravel costs have had much more attention by locals
- Gravel costs are up a bit (depending on how we adjust)
- Paving costs are down for the 20 year period as expected due to recent investments
- Bridges are generally unchanged – up slightly
- More wells are being drilled with fewer rigs

Quick History of Studies

- 2010 study: UGPTI estimated road investment needs for the 2011 session
 - 21,500 new wells & increased ag. production
- 2012 study: updated investment needs
 - 46,000 new wells, ag. production, & initial bridge study
- 2014 Study: more comprehensive data
 - Higher roadway costs, ag. production, & 60,000 new wells
- 2016 Study: First Study with GRIT and Reduced Oil Exploration: 30, 60, & 90 Rigs

2016 Study Horizon

- 20 year time frame
- Traffic and investment needs estimated annually
- Results summarized by:
 - Biennium
 - Region
- Detailed results by:
 - County
 - Jurisdiction

Feedback from Counties and Legislators - 2015

- Interactive map was effective in communicating results
- First time many had objective pavement ratings available to them
- Study provided basis for investing in transportation infrastructure

Concerns from Counties and Legislators - 2015

- Pavement condition scores may not reflect age of lower layers of pavement
 - More accurate shoulder width and pavement thickness
- Counties not uniformly reporting gravel costs
- No costs for minor structures
- Some counties unaware of data requests

2015-17 Study Priorities

- Emphasis on uniformity of gravel costing submissions (revised survey instrument)
- Additional improvements to county pavement condition data
- Continued improvement to traffic data and forecasting
- Updated costing and modeling concepts
- Capture more accurate data history from counties – asset inventory too
- Continued emphasis on maintaining system – not providing for major upgrades

General Changes in Study Process

- Finished county paved FWD/GPR coverage for majority of paved roads
- Obtained age, width and project data from many counties through GRIT.
- Enhanced unpaved roads survey with revised survey and extensive training
- Traffic Model Sensitivity Process
 - 30, 60 and 90 rig traffic models
 - 20 to 22 wells per rig per year

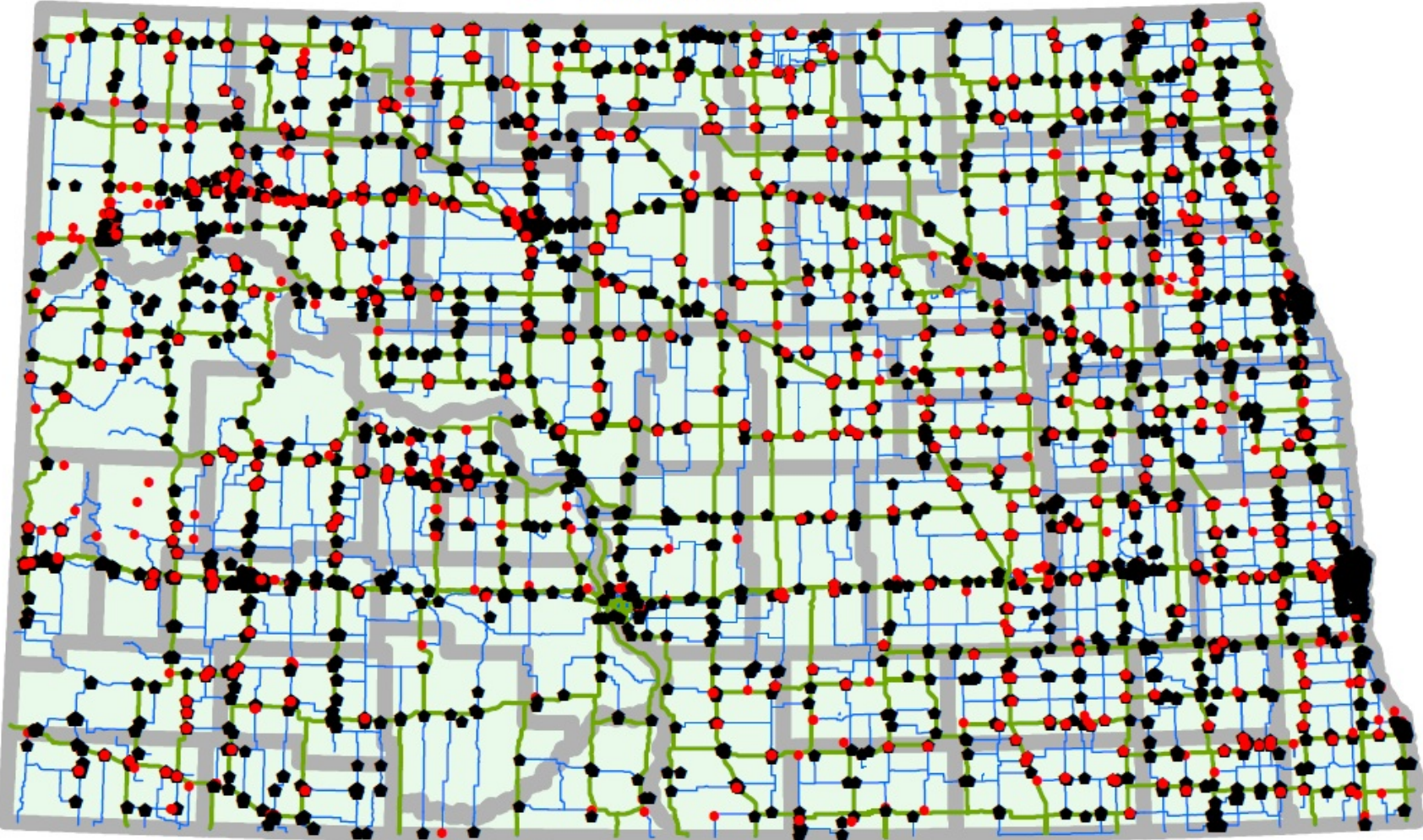
Data Collection Details

- Traffic counts
- Pavement ride & distress (Pathways)
- Falling weight & GPR
- County gravel mtce. information
- Oil data
- Crop data
- NBIS data
- County jurisdictional data

County Traffic Counts

- Volume Only
- Truck Classification

2015



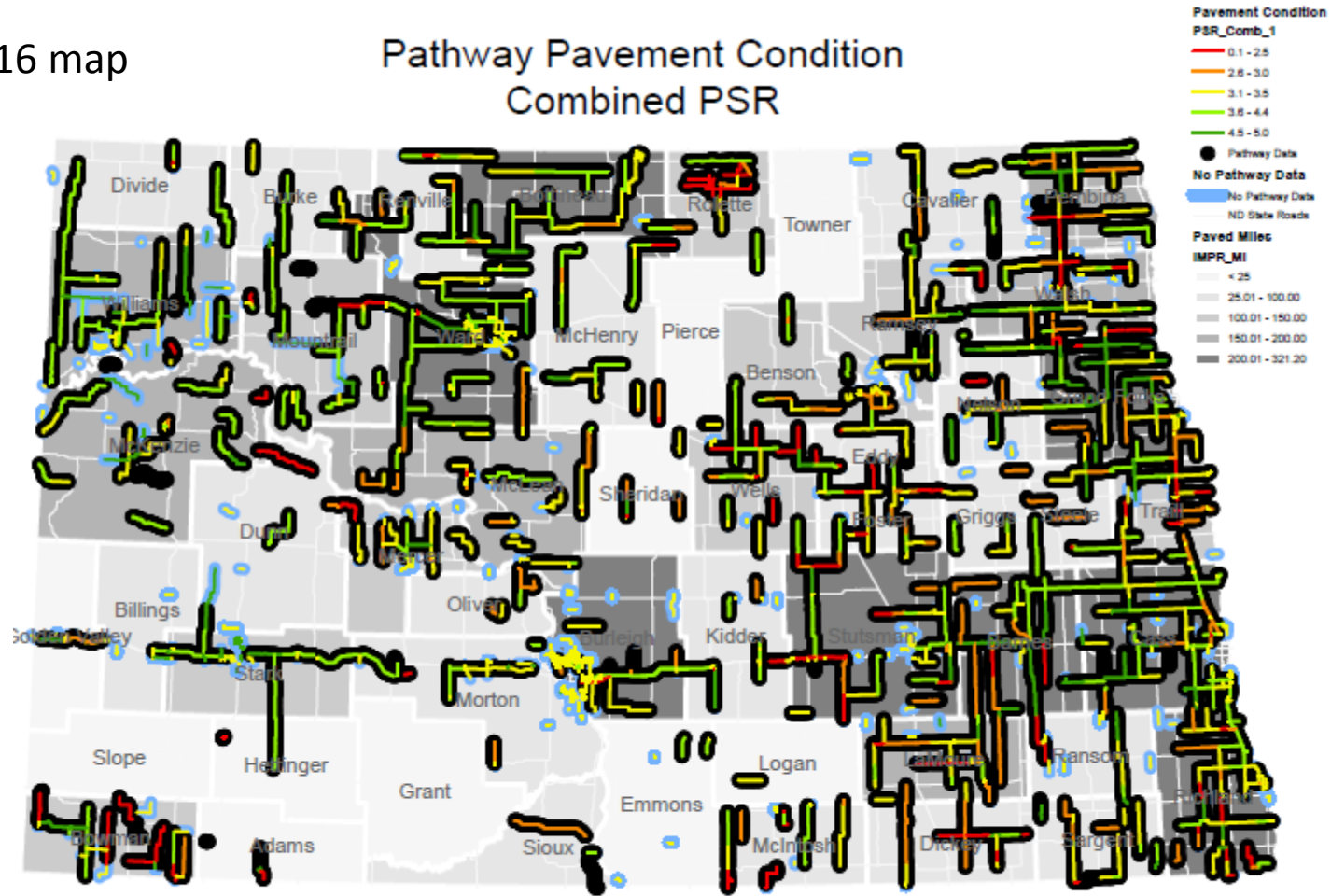
Pavement Data Collection



- Condition data collection
 - Collected data with NDDOT Pathway van and operator
 - Approx. 4500 miles of paved county roads tested
 - Supplemented 1000 miles with GRIT data (age base PCR)
 - Collection completed August 2015
 - UGPTI provided driver

2016 map

Pathway Pavement Condition Combined PSR



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6/29/16

Data Collection (Cont.)

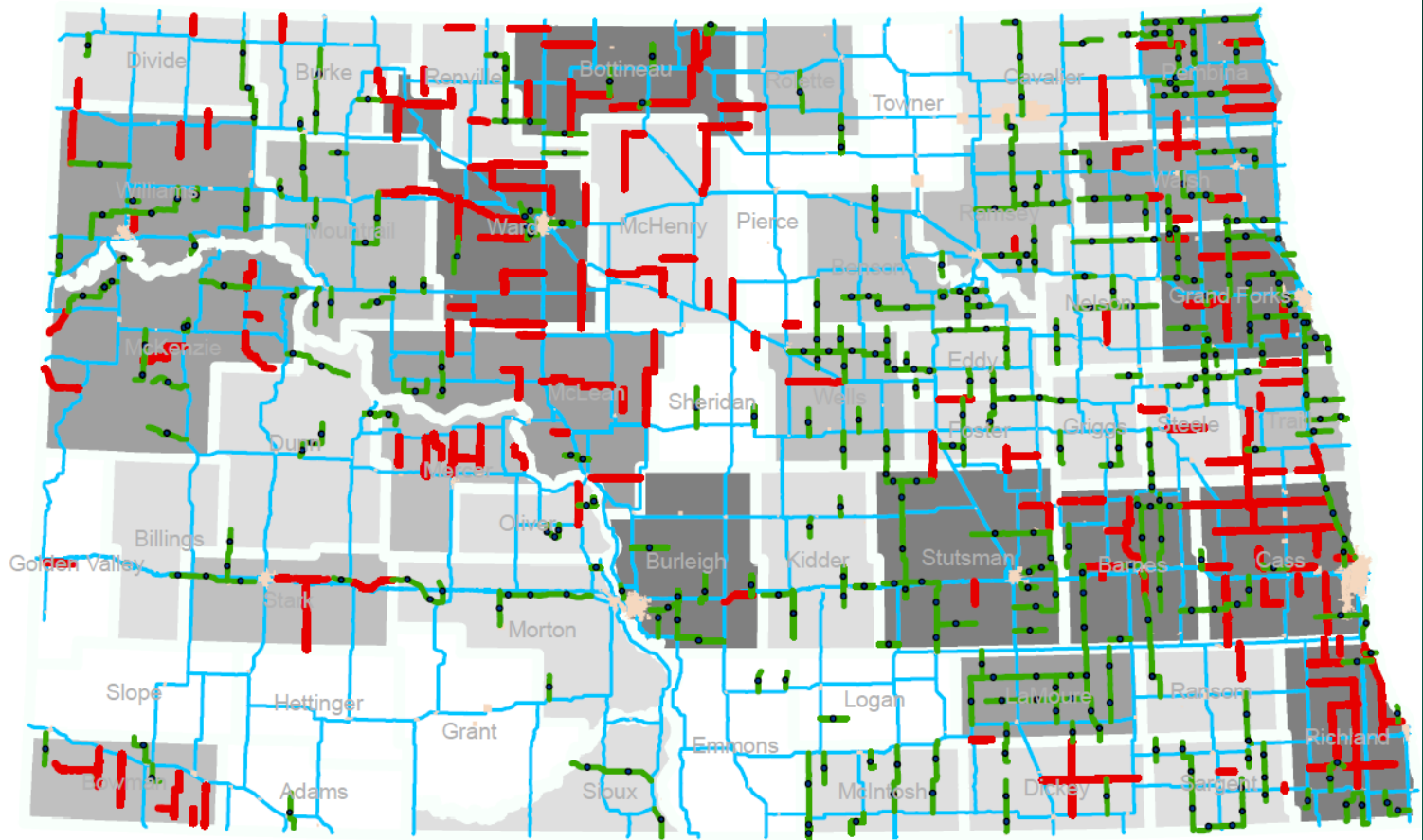
- Pavement/subgrade strength and depth surveys
 - Falling Weight Deflectometer and Ground Penetrating Radar
 - Sampling on all county paved segments > 2 miles in length
 - Completed October 28, 2015



Non-Destructive Testing Sites – FWD & GPR

2013

2015



Data Collection – Gravel Road Cost Surveys

- Gravel costs & production techniques
- Placement costs
- Transportation & placement costs
- Dust suppressant costs
- Intermediate practices
 - Stabilization armor coat
 - Double chip seal/armor coat
 - Others
- Questionnaire responses:
 - 2014 - 52 Counties; 2016 - 53 Counties

Data Collection – Unpaved Costs

- Basic Cost Categories for Unpaved Roads
 - Gravel/unpaved costs & production techniques
 - Placement costs
 - Transportation & placement costs
 - Dust suppressant costs

Unpaved (Gravel Roads Survey)

- Survey Released to Counties 8-14-15
- Survey Released to TWP's 9-1-15
 - Supplemental letter to County Comm/Auditors
- Instructional Webinar Hosted and Recorded
 - September 23, 2015
- Reminder letters throughout year
- Status July 1
 - 53 Counties Submitted
 - 738 TWPs Submitted



County Road Needs Study

County: _____

Contact: _____
Name Phone Email

Preparer: _____ Date Prepared: _____

Aggregate Description

To determine the type and quality of aggregate used in your county, please check all boxes that apply. For example, if your county uses crushed, spec gravel – select crushed material and specifications.

Gravel
Scoria
Pit Run
Crushed Material
Specifications
Tested
Other _____

Placement Practices

When aggregate overlays are placed in your county, please select the typical practice that is used to apply an aggregate overlay.

Truck Drop and Blade
Windrow/Equalize
Water/Rolling/Compaction
Other _____

Operational Tasks

In this section, please provide a percentage of tasks that are done using county resources versus the percentage of work done by a contractor. For example, if your county owns the pit and does all of the crushing using county labor, 100% would be entered into the first column, and 0% in the second column.

Task	Performed by:	
	County	Contractor
Crushing		
Hauling		
Placement		
Blading		
Dust Control		
Base Stabilization		

Gravel Road Costs

Please report costs for gravel for county roads in the table below. The table asks for unit costs for graveling, maintaining, and operating gravel roads. If you are quoting contractor prices, please circle "yes" in the right hand column.

<i>Gravel/Scoria Cost</i>			
- Average Gravel/Scoria Cost (crushing & royalties at the pit)		Per cubic yd.	Is this Contractor Price? (yes/no)
- Trucking Cost from Gravel Origin		Per loaded mile/Cu. Yard	Is this Contractor Price? (yes/no)
- Average trucking distance for aggregate		Miles	
- Placement Costs		Per mile	Is this Contractor Price? (yes/no)
- Blading Cost		Per mile	Is this Contractor Price? (yes/no)
- Dust Suppressant Costs		Per mile	Is this Contractor Price? (yes/no)
- Base Stabilization Cost		Per mile	Is this Contractor Price? (yes/no)
- Snow Removal Cost		Per mile	Is this Contractor Price? (yes/no)

Gravel Road Practices

This section asks for information regarding gravel road practices based upon differing traffic levels. Under the “Daily Traffic” row, please enter what you would consider low, medium and high traffic levels on gravel roads within your county. In the example below, low is categorized as less than 50 vehicles, medium 50-150 vehicles and high 150-350. This is expected to vary significantly from county to county, so please use your own estimates of traffic levels. Following the traffic entry, please enter the regravelling thickness, blading frequency, regravelling frequency, and whether dust suppressant or base stabilization are used at each of these traffic categories.

EXAMPLE	Traffic Levels		
	<i>Low</i>	<i>Medium</i>	<i>High</i>
<i>Daily Traffic</i>	<i>>50</i>	<i>50-150</i>	<i>150-350</i>
<i>Average Regraveling Thickness</i>	<i>3 in</i>	<i>4 in</i>	<i>5 in</i>
<i>Blading Frequency (# per year)</i>	<i>8</i>	<i>12</i>	<i>16</i>
<i>Regraveling Frequency (years between regravelling)</i>	<i>7</i>	<i>5</i>	<i>3</i>
<i>Dust Suppressant (yes/no)</i>	<i>no</i>	<i>no</i>	<i>Yes</i>
<i>Base Stabilization (yes/no)</i>	<i>no</i>	<i>no</i>	<i>Yes</i>

County Entry	Traffic Levels		
	Low	Medium	High
Daily Traffic			
Average Regraveling Thickness			
Blading Frequency (# per month)			
Regraveling Frequency (years between regravelling)			
Dust Suppressant (yes/no)			
Base Stabilization (yes/no)			

County Jurisdictional Data

- Surveyed 53 counties through NDLTAP in 2013
- Updated NDDOT GIS Data
- Please Review in GRIT
- Provided layer in GRIT for County updates
 - Most Counties have not updated this layer yet
 - Paved County roads have been updated
- Essential for unpaved/gravel cost projection splits between county and townships

Data Collection – Bridges

- Used 2015 NBI bridge inventory & GIS data
- 2,423 open county, township and local bridges
- Removed 406 bridges
 - Bridges on trails – GIS Hub
 - Bridges on unimproved roads – GIS Hub
 - Bridges on graded/drainage – GIS Hub
 - Bridges on roads with grass on road – Google Earth
 - Recently closed bridges – county memos to LG
 - Bridges recently replaced with culverts

Structural Number (SN)

Note: Data collection performed Summer of 2015 and 2013.

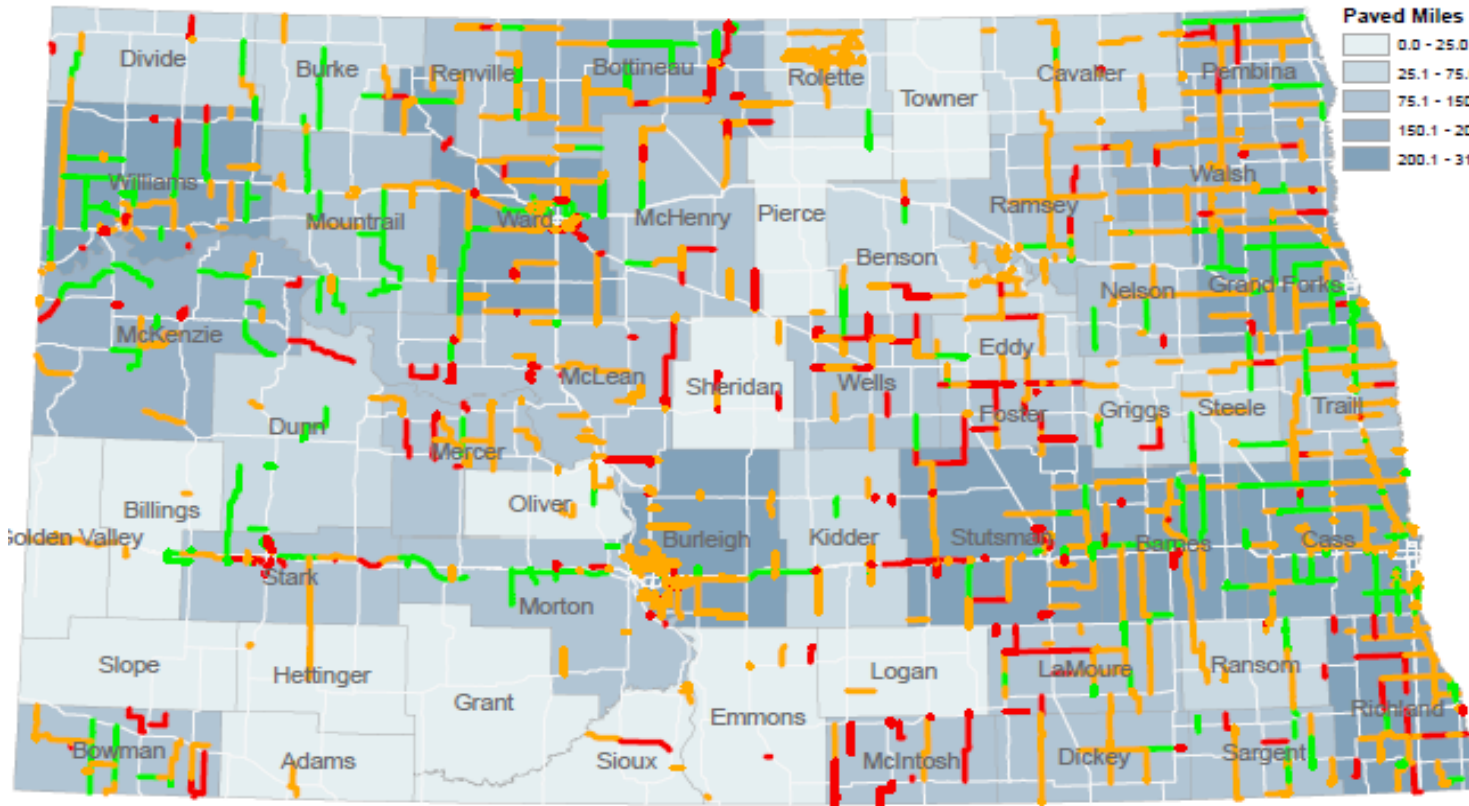
Structural Number

- 0.3 - 2.0
- 2.1 - 4.0
- 4.1 - 10.0

ND State Roads

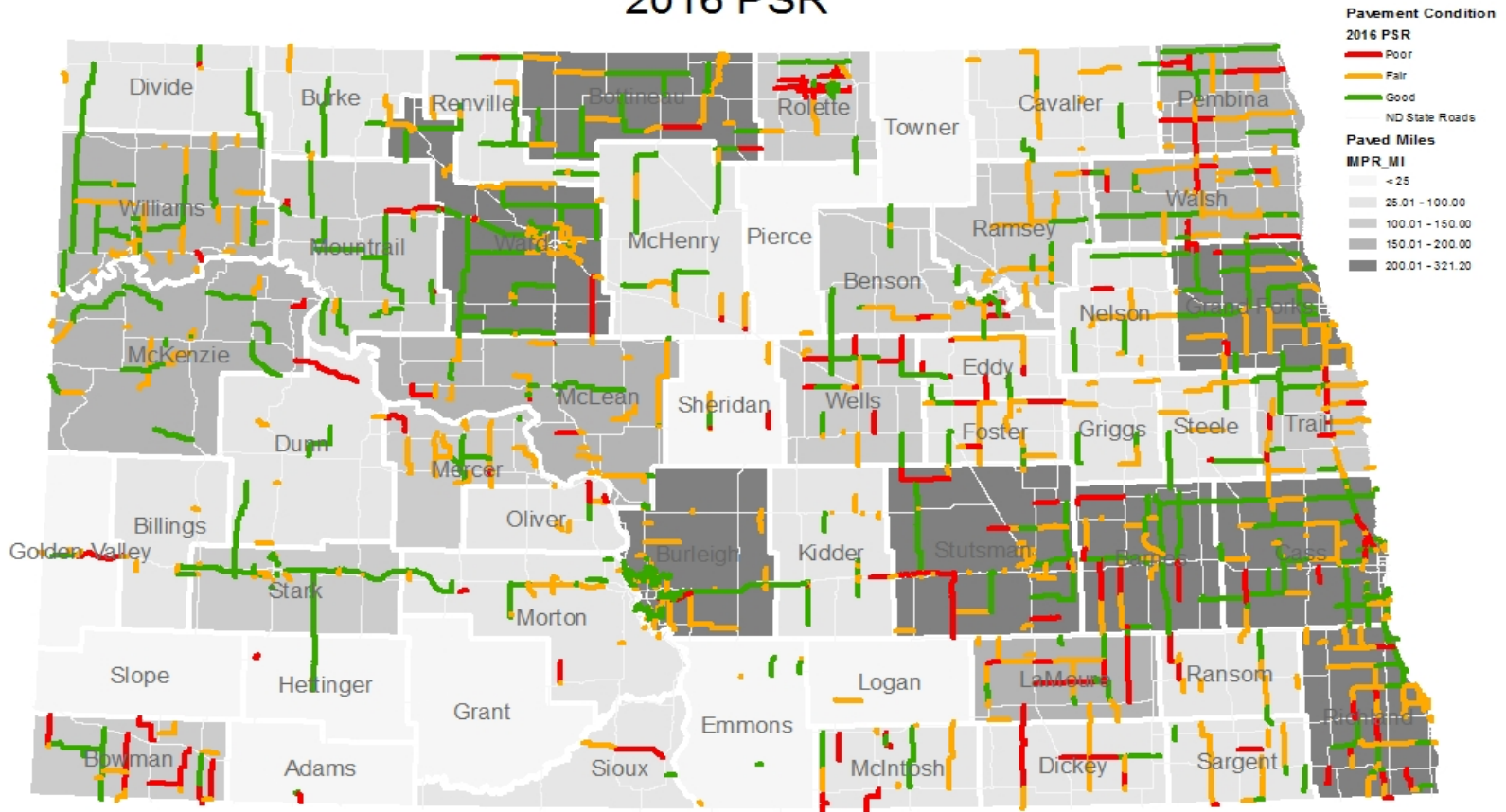
Paved Miles

- 0.0 - 25.0
- 25.1 - 75.0
- 75.1 - 150.0
- 150.1 - 200.0
- 200.1 - 317.7



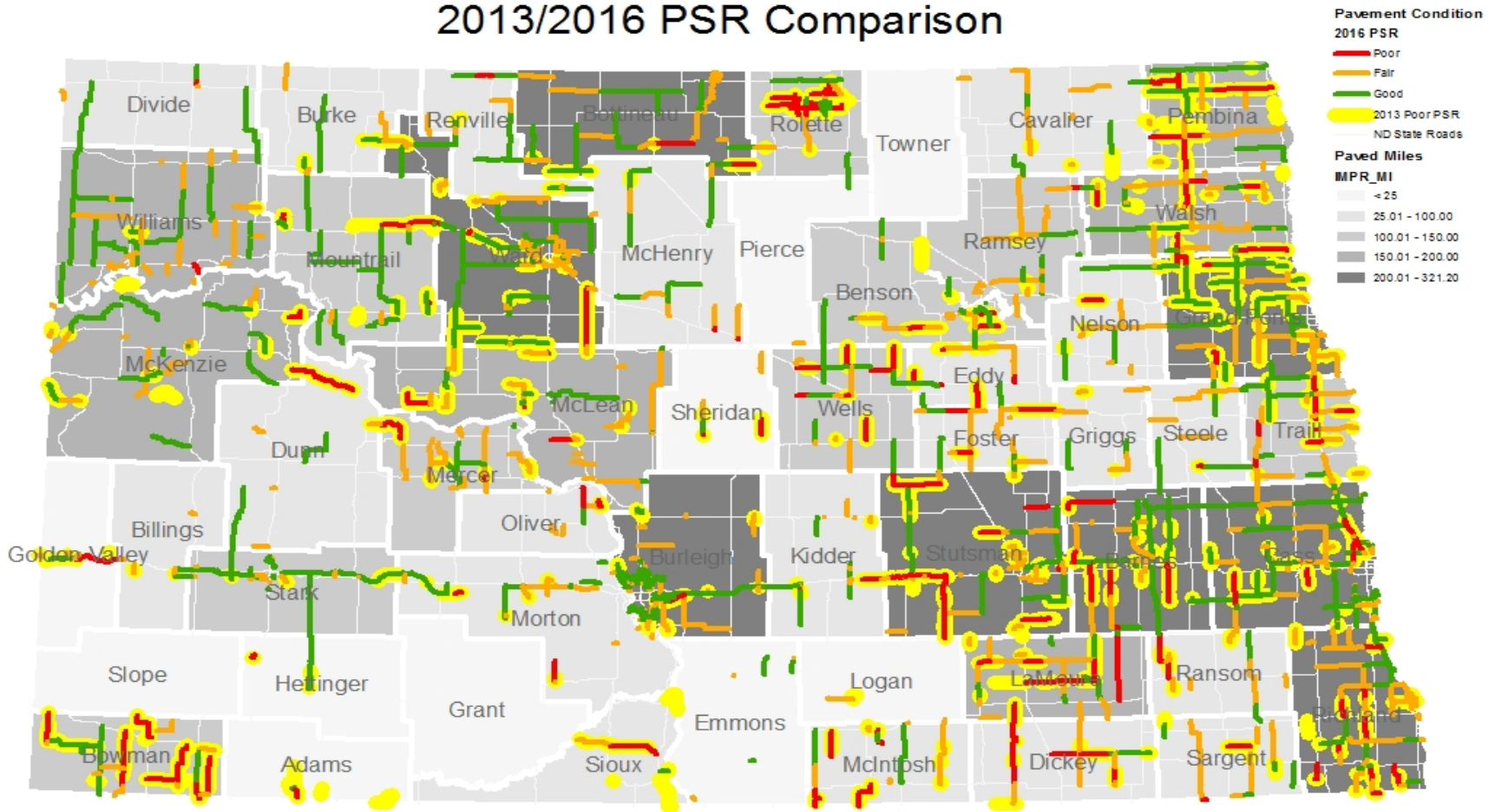
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Pavement Condition 2016 PSR



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6/29/16

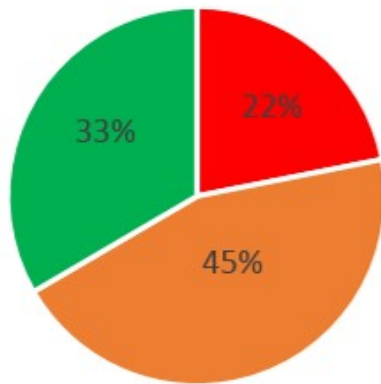
Pavement Condition 2013/2016 PSR Comparison



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6/29/16

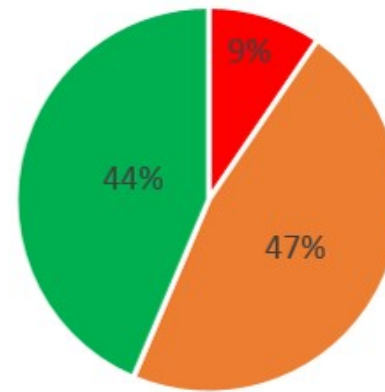
Change in Pavement Condition 2013 to 2016

2013 Pavement Condition
% of Total Mileage



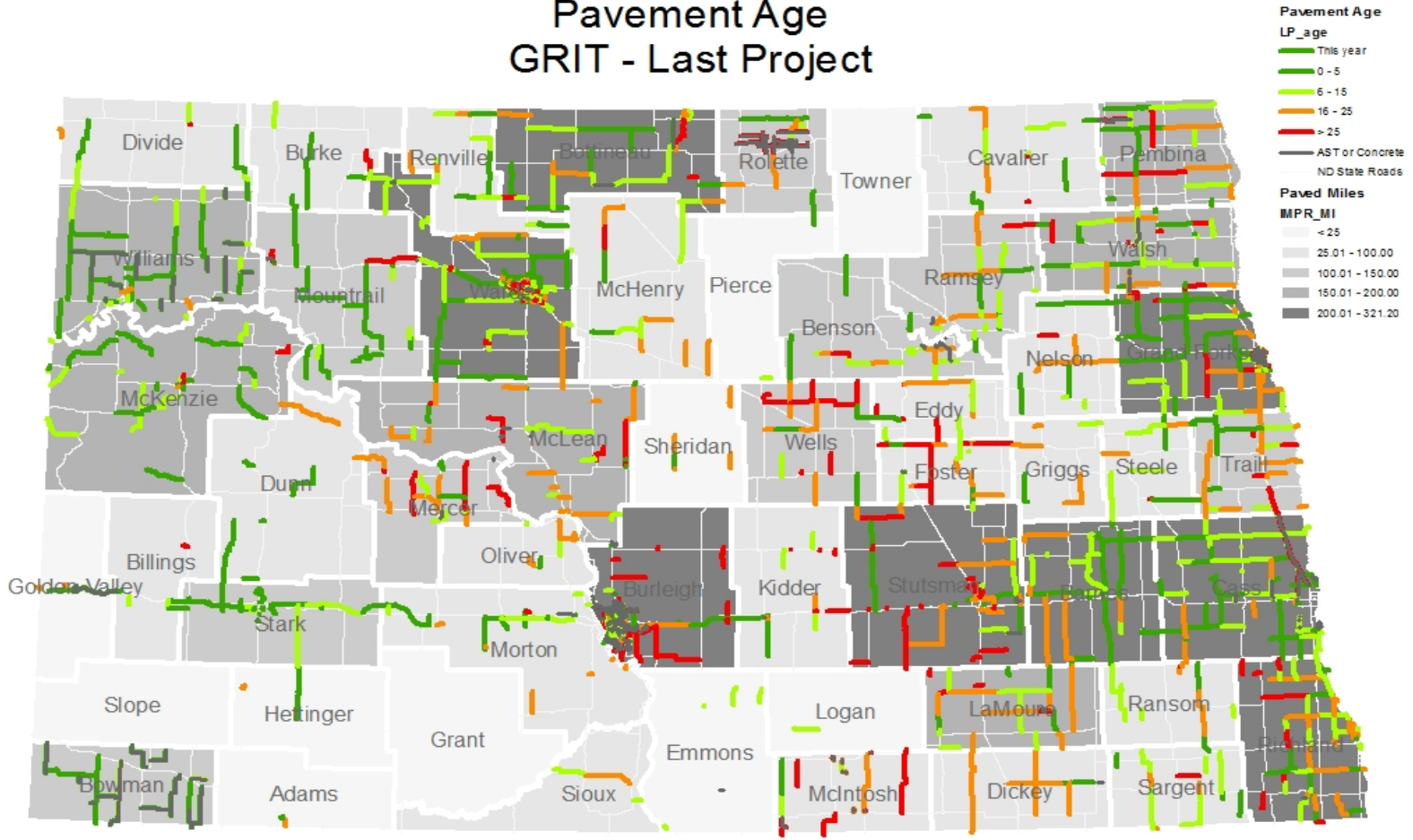
■ Poor ■ Fair ■ Good

2016 Pavement Condition
% of Total Mileage



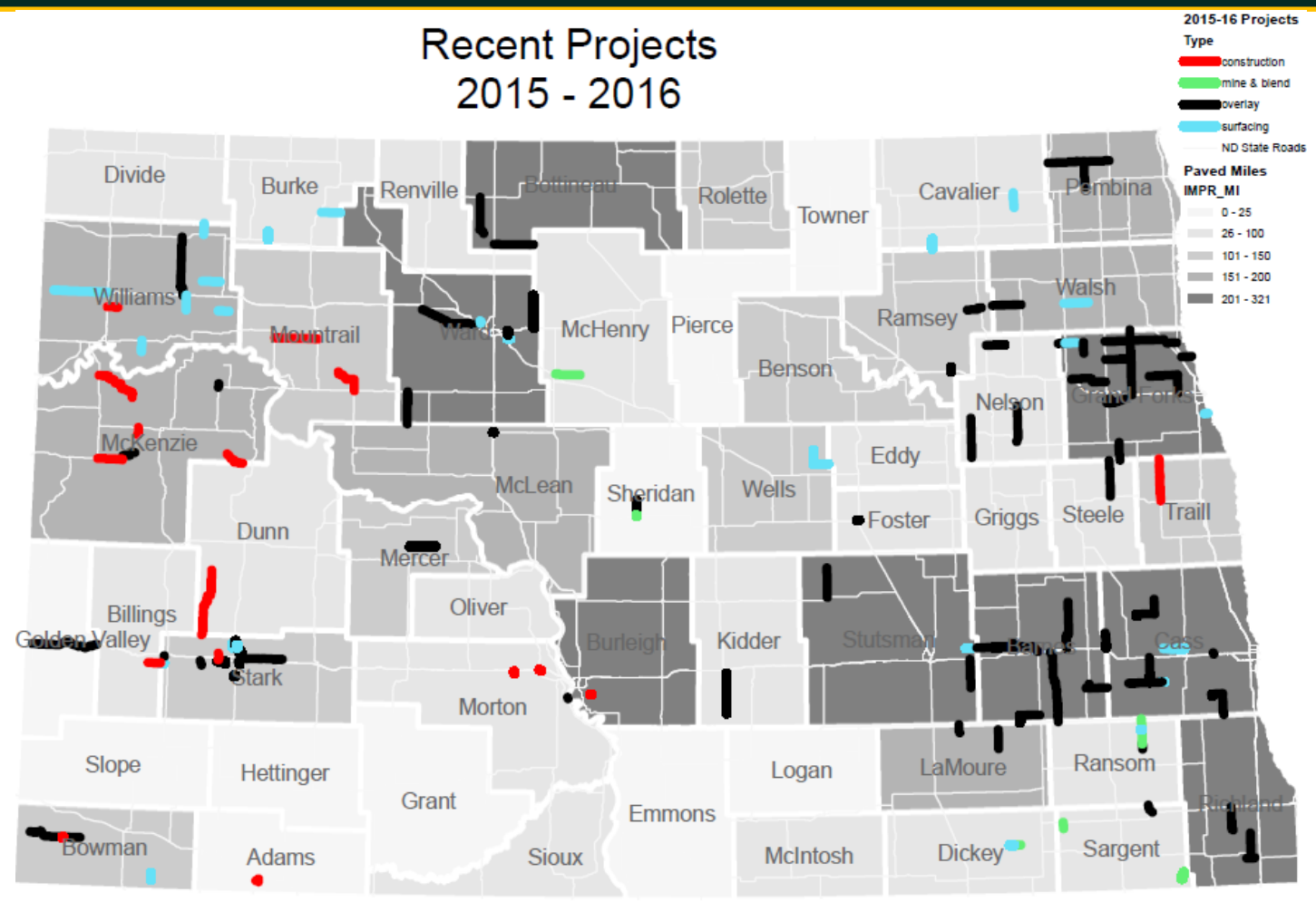
■ Poor ■ Fair ■ Good

Pavement Age GRIT - Last Project



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Recent Projects 2015 - 2016



**Data based on County data entry through GRIT and project information from NDDOT Local Government Division.

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Data Analysis Steps & Review

Oil Analysis

- Each of the major truck traffic categories were analyzed due to potential differences in travel behavior and trip length distribution.
- A total of 9 sub models were estimated for the overall oil sub model.
- Individual estimates were aggregated to the segment level for overall traffic estimates.
- **Three rig count scenarios were estimated: 30, 60 and 90 rigs**
- Rig productivity was updated following updates at the WBPC

Agricultural Analysis

- **A total of 9 commodities were modeled.** In addition, fertilizer and transshipment movements were modeled individually for a total of 11 ag sub models.
- Individual models were aggregated to the segment level to develop estimates of agricultural traffic estimates statewide.

Unpaved Road Analysis

- Grouped unpaved road miles by traffic volume categories.
- Established “normal” practices for each county based upon traffic observations and reported maintenance practices.
- For traffic volumes above normal levels responses for oil impacted roads were used to establish upper categories of maintenance.

Analysis Steps & Review – Paved Roads

- AASHTO 1993 Design Guide
- Predict year & type of improvement
- Improvement threshold: $PSR < 2.5$
- Year of improvement based on:
 - Existing structural capacity
 - Forecasted ESALs

Analysis Steps & Reviews - Bridges

- Unit cost model
 - Based on 2011-2016 NDDOT bid reports
 - Discussed with Local Roads Div. & counties
 - Includes approach roadway, engineering, & incidentals
- Replacement cost projections:
 - Bridges: \$250/sf. deck area
 - Culverts: \$400,000-\$600,000 /project

Analysis Steps & Reviews - Bridges

- Rehabilitation:
 - Deck widening 50% replacement cost
 - Deck replacement 45% replacement cost
- Preventive maintenance:
 - \$0.25/sf./year

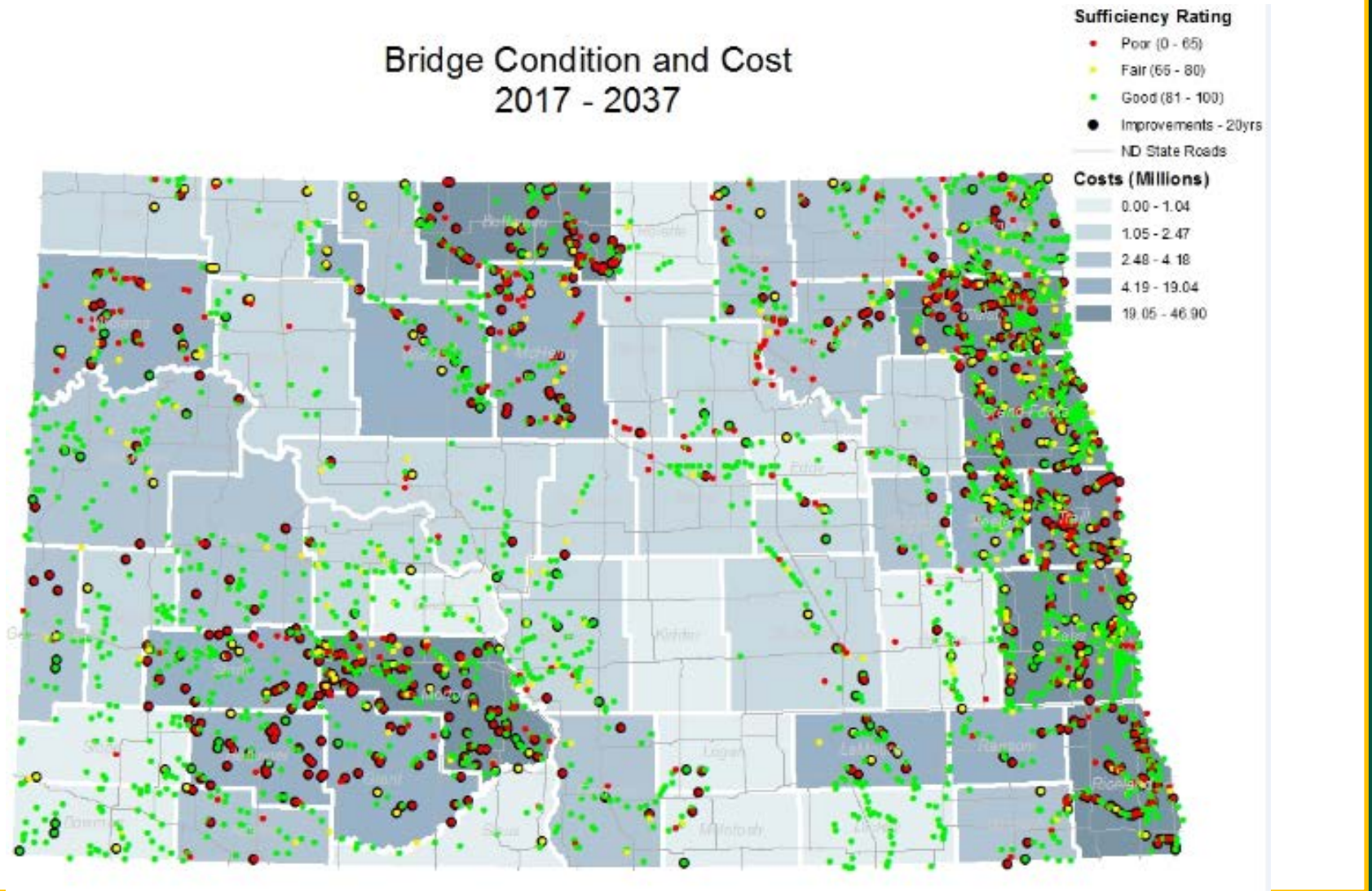
Summation of Needs Part of Presentation

Initial Results of Bridge Analysis

Period	Statewide	Oil Patch	Rest of State
2017-18	\$88	\$21	\$67
2019-20	\$88	\$21	\$67
2021-22	\$88	\$21	\$67
2023-24	\$88	\$21	\$67
2025-26	\$88	\$21	\$67
2027-36	\$12	\$3	\$9
2017-36	\$449	\$106	\$343

Grand Totals by County – All Improvements

Bridge Condition and Cost 2017 - 2037



Draft Summation of Unpaved Road Needs

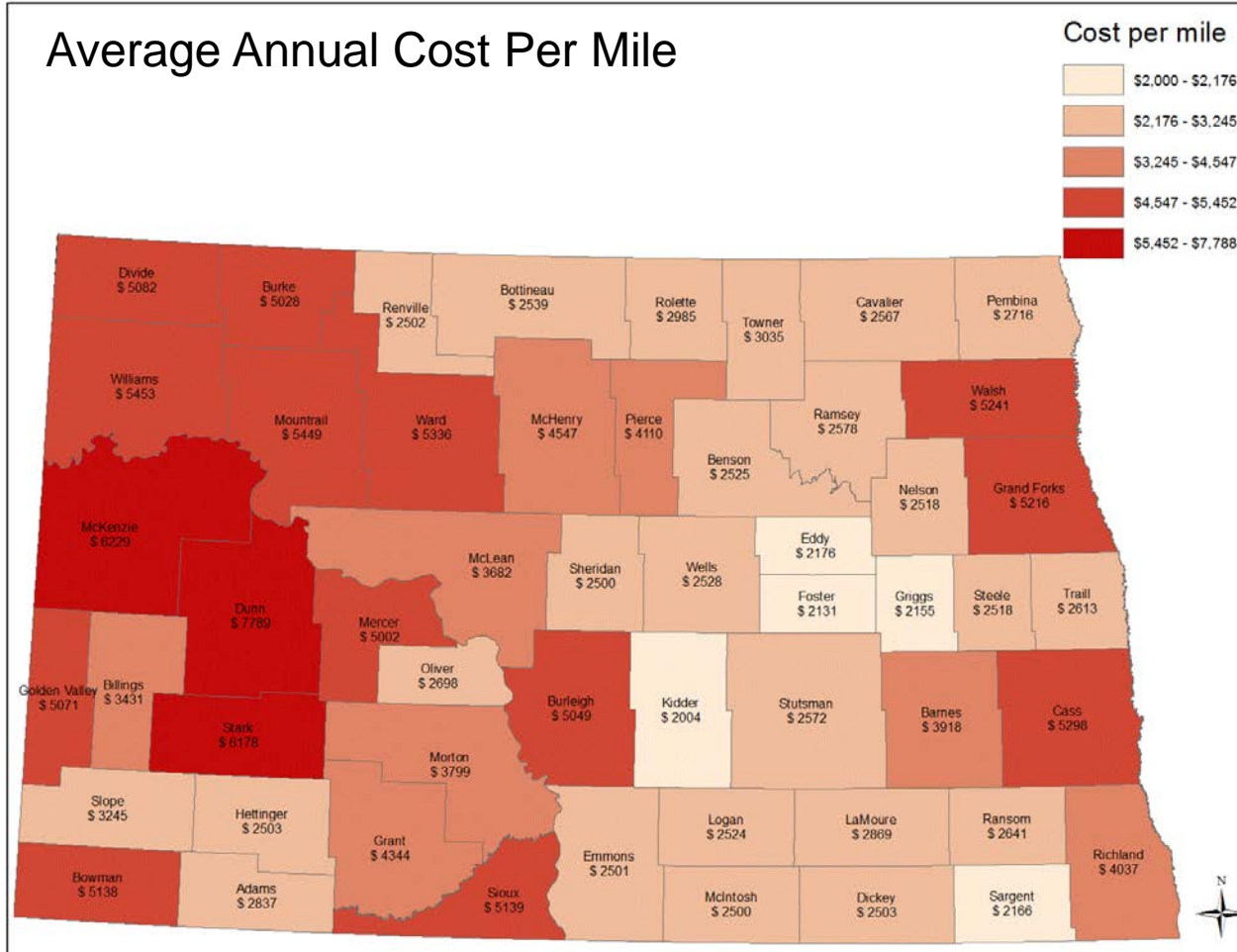
Table of Results – Unpaved Roads

(millions of dollars)

	2012 Study	2014 Study	Current Study		
			30 Rigs	60 Rigs	90 Rigs
2017-2018	\$ 470	\$ 560	\$ 600	\$ 645	\$ 672
2019-2020	\$ 470	\$ 560	\$ 590	\$ 607	\$ 627
2021-2022	\$ 486	\$ 560	\$ 602	\$ 660	\$ 668
2023-2024	\$ 501	\$ 558	\$ 598	\$ 661	\$ 659
2025-2026	\$ 501	\$ 555	\$ 583	\$ 603	\$ 620
2027-2036	\$ 2,604	\$ 2,764	\$ 2,887	\$ 2,916	\$ 2,962
2017-2036	\$ 5,034	\$ 5,558	\$ 5,860	\$ 6,091	\$ 6,206

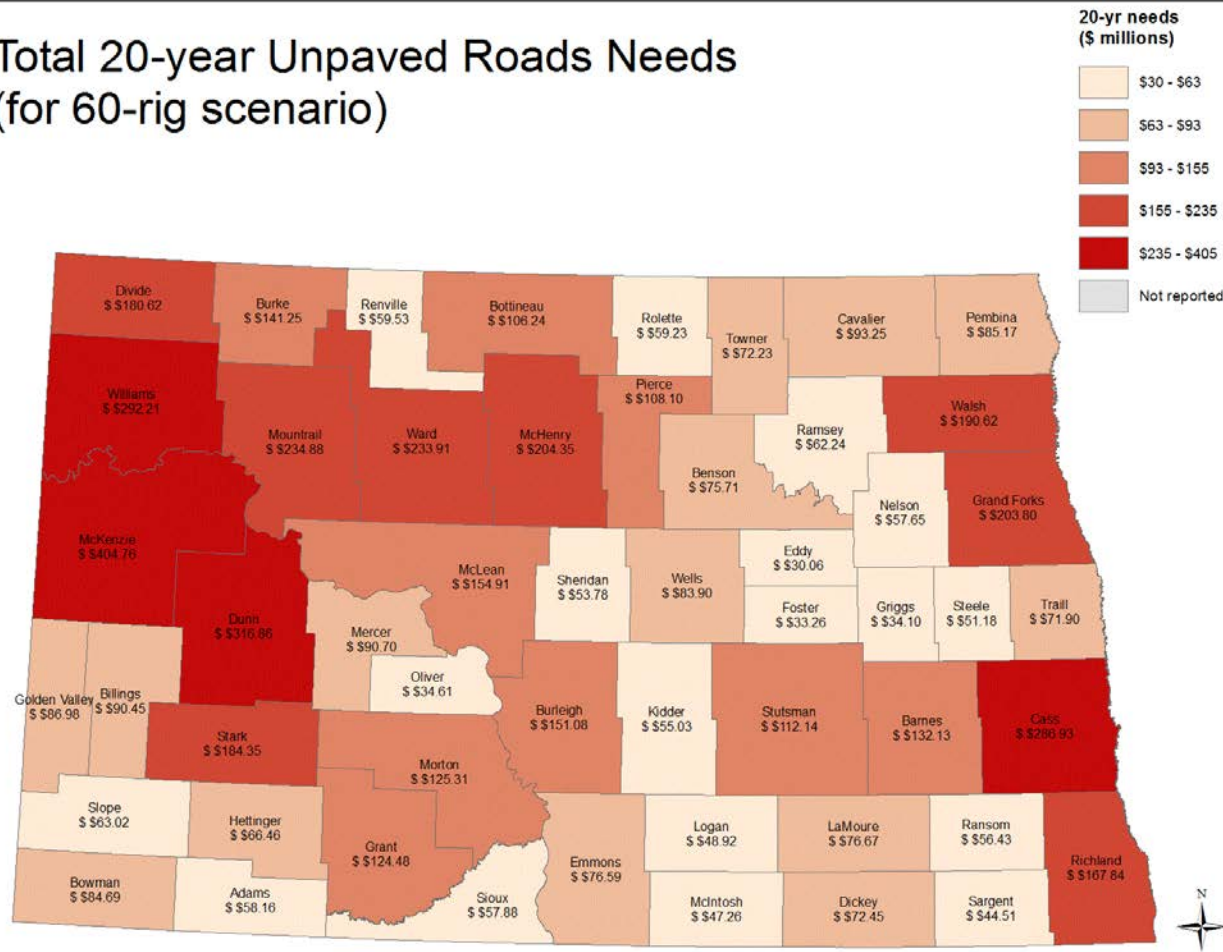
Study Findings – Unpaved Roads Costs

Average Annual Cost Per Mile



Study Findings – Unpaved Roads

Total 20-year Unpaved Roads Needs
(for 60-rig scenario)



Summation of Pavement Needs

Table of Paved Roads Results – 60 Rig

Period	Resurfacing Cost	Widening Cost	Reconstruction Cost	Mine & Blend Cost	Break & Seat Cost	Maintenance Cost	Total Cost
2017-2018	\$122.5	\$27.2	\$14.0	\$15.3	\$11.9	\$101.3	\$292.2
2019-2020	\$120.4	\$33.0	\$20.9	\$22.0	\$3.8	\$102.1	\$302.2
2021-2022	\$68.0	\$6.5	\$99.5	\$0.2	\$0.0	\$103.0	\$277.2
2023-2024	\$69.0	\$4.8	\$50.8	\$2.4	\$4.6	\$103.6	\$235.2
2025-2026	\$107.4	\$0.0	\$21.0	\$0.2	\$0.7	\$104.6	\$234.0
2027-2031	\$168.5	\$0.8	\$1.2	\$7.5	\$2.0	\$265.6	\$445.5
2032-2036	\$242.1	\$5.8	\$1.0	\$1.4	\$2.2	\$215.3	\$467.8
Total	\$898.0	\$78.0	\$208.4	\$49.0	\$25.2	\$995.5	\$2,254.1

- 30 Rig Scenario – \$2.194 Billion
- 90 Rig Scenario - \$2.268 Billion
- 2014 Study – \$2.911 Billion

First Biennium & Total Study Period Costs: Preliminary Findings & Comparison of Studies

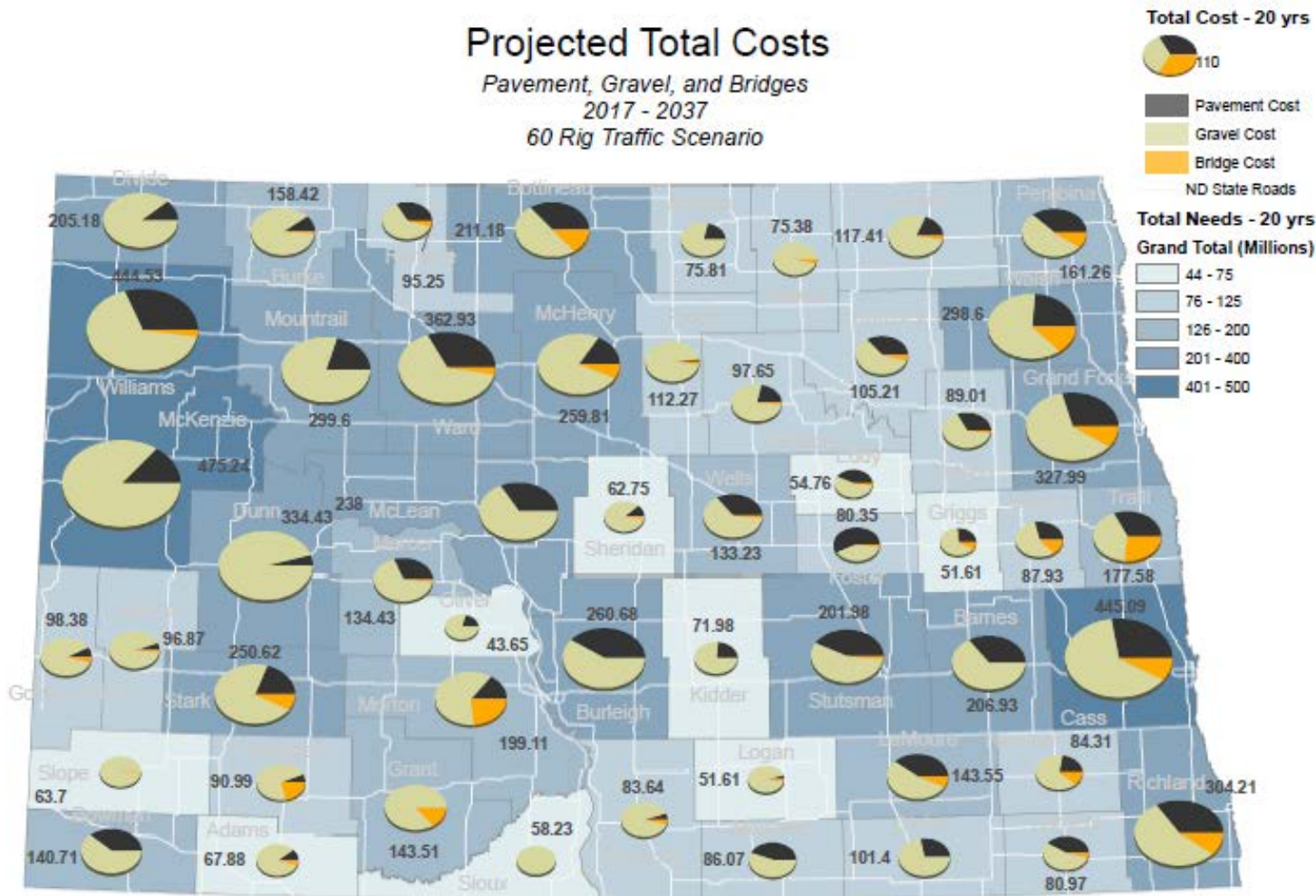
2016 Study (\$ Millions)					2014 Study
Period	Bridge	Paved	Unpaved	Total	Total
2017-2019	\$88	\$645	\$292	\$1,025	\$1172
2017-2036	\$449	2,254	6090	\$8,793	\$9086

*2014 Study costs have been moved forward to allow direct comparison against 2016 study period

Grand Totals by County – All Improvements

Projected Total Costs

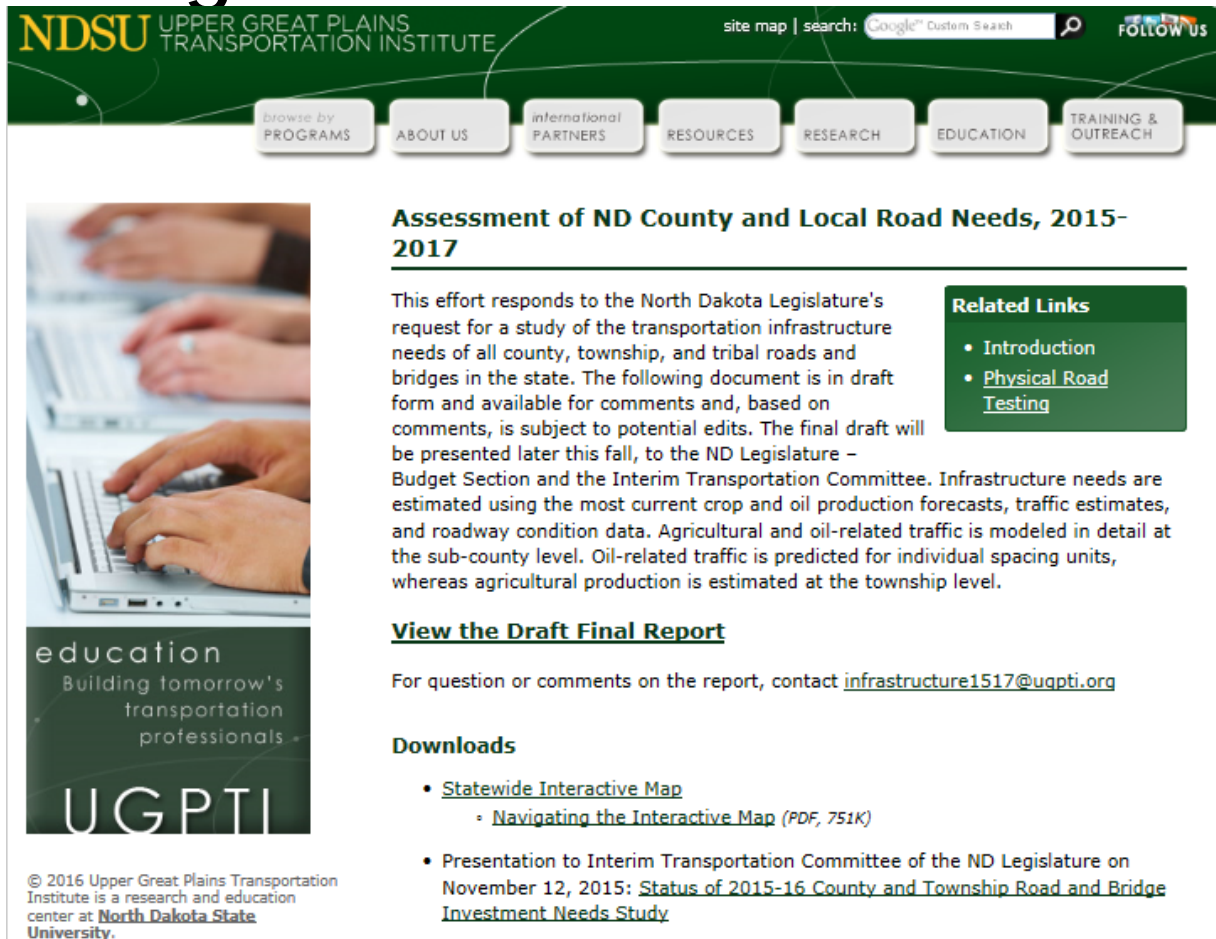
Pavement, Gravel, and Bridges
 2017 - 2037
 60 Rtg Traffic Scenario



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 UGPTI - DOTSC
 8/20/16

Outreach/Comment Process

Posting of Draft Document on Webpage



The screenshot shows the website for the Upper Great Plains Transportation Institute (UGPTI) at North Dakota State University. The header includes the NDSU logo, the text "UPPER GREAT PLAINS TRANSPORTATION INSTITUTE", a "site map" link, a search bar with "Google Custom Search", and a "FOLLOW US" button. A navigation menu contains buttons for "PROGRAMS", "ABOUT US", "INTERNATIONAL PARTNERS", "RESOURCES", "RESEARCH", "EDUCATION", and "TRAINING & OUTREACH".

The main content area features a photograph of hands typing on a laptop. To the right of the photo is the title "Assessment of ND County and Local Road Needs, 2015-2017". Below the title is a paragraph of text describing the study's purpose and findings. To the right of this text is a "Related Links" box containing two links: "Introduction" and "Physical Road Testing". Below the text is a "View the Draft Final Report" link. Further down is a "Downloads" section with two items: "Statewide Interactive Map" (with a sub-link "Navigating the Interactive Map (PDF, 751K)") and "Presentation to Interim Transportation Committee of the ND Legislature on November 12, 2015: Status of 2015-16 County and Township Road and Bridge Investment Needs Study".

At the bottom left of the page, there is a logo for "education Building tomorrow's transportation professionals UGPTI" and a copyright notice: "© 2016 Upper Great Plains Transportation Institute is a research and education center at North Dakota State University."

Posting of Draft Document on Webpage

- This effort responds to the North Dakota Legislature's request for a study of the transportation infrastructure needs of all county, township, and tribal roads and bridges in the state. The following document is in draft form and available for comments and based on comments subject to potential edits. **The final draft will be presented later this fall, to the ND Legislature – Budget Section and the Interim Transportation Committee.**

Infrastructure needs are estimated using the most current crop and oil production forecasts, traffic estimates, and roadway condition data. Agricultural and oil-related traffic is modeled in detail at the sub-county level. Oil-related traffic is predicted for individual spacing units, whereas agricultural production is estimated at the township level.

Provide Online Comment Button

- Provided on UGPTI Website
 - Tracking of Comments/Responses

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Assessment of ND County and Local Road Needs, 2015-2017

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Related Links

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- [Physical Road Testing](#)

[View the Draft Final Report](#)

For question or comments on the report, contact infrastructure1517@ugpti.org

Downloads

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Tracking of Comments/Responses

- As per 2014 Method.

Commenting Entity	UGPTI Emailed Road Authority Maps and Offered to Help(dch)	Tribal Contacts	UGPTI Visited Road Authority in Person (dch or bw)	UGPTI Contacted or Met With Road Authority's Consultant(dch)	Sent Response to UGPTI	UGPTI Emailed Response	UGPTI Phone Response
Adams County	X						
Barnes County	X		X	X	X	Mielke	X
Benson County	X		X		X		
Billings County	X		X		X	Mielke	
Bottineau County	X			X			
Bowman County	X			X			X
Burke County	X				X		
Burleigh County	X		X		X		Alan
Cass County	X		X				X
Cavalier County	X				X		
Dickey County	X		X	X	X	Mielke	
Divide County	X						
Dunn County	X		X				
Eddy County	X				X		
Emmons County	X		X	X			
Foster County	X						
Golden Valley County	X		X				
Grand Forks County	X		X		X		Alan
Grant County	X			X			
Griggs County	X						



Questions?