

Infrastructure Needs:
North Dakota's County, Township, & Tribal Roads &
Bridges
2021-2040
Draft Report

Western Dakota Energy Association Annual Meeting
October 9, 2020
Zoom Meeting

Upper Great Plains Transportation Institute
North Dakota State University
Presenters: Alan Dybing, Tim Horner

Outline of Today's Presentation

- Introductory Remarks and Purpose of the Study
- Quick History of Studies
- Traffic Forecasting
- Unpaved (Gravel) Analysis
- Data Analysis Processes/Issues
- Paved Analysis
- Bridge Analysis
- Results
- Comment Process

Purpose of The Study

- Directed by 2019 Legislative Session
- Outcomes to be used for distribution of HB 1066 (Operation Prairie Dog) county funding

Study Team

- Denver Tolliver
- Alan Dybing
- Brad Wentz
- Kelly Bengtson
- Pan Lu
- Dale Heglund
- Tim Horner
- Satpal Wadhwa
- Sharijad Hasan

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

Quick History of Studies

- 2020 study: First study with a 4-year gap between studies.
 - First study where it was known that funding distribution was partially tied to results

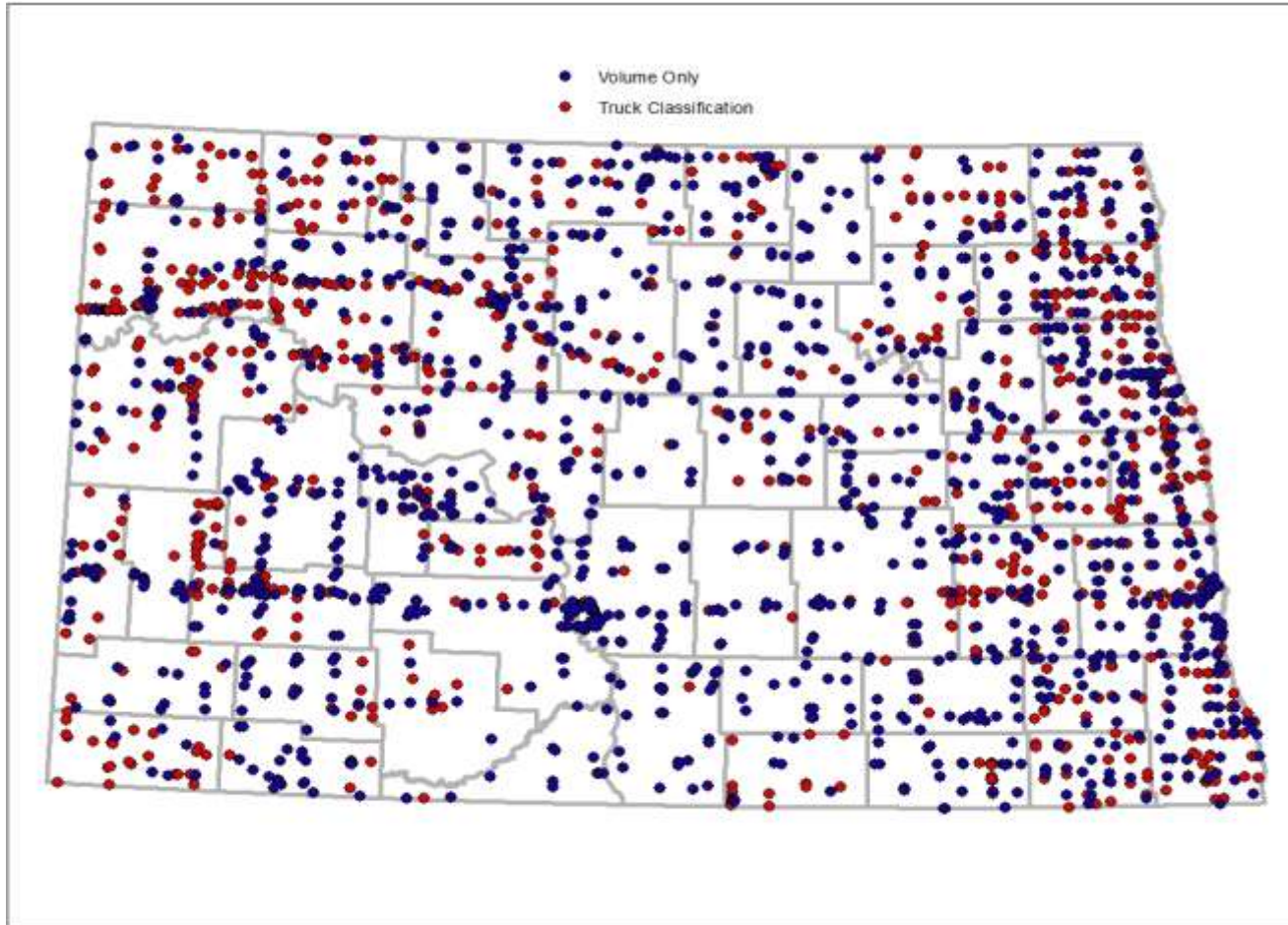
Traffic Forecasting

- Impacts to roadways are dependent on traffic levels
 - Unpaved
 - More frequent blading
 - More frequent and thicker gravel overlays
 - Dust suppressant and base stabilization
 - Paved
 - Design based upon projected ESALs
 - Pavement Thickness
 - Pavement Deterioration
- Travel Demand Model
 - Using agricultural and oil related data to forecast truck traffic over the next 20 years
 - Compared against observed traffic counts and adjusted

Model Groups

- Agriculture
 - Corn
 - Wheat
 - Soybeans
 - Barley
 - Canola
 - Sunflowers
 - Dry Edible Beans
 - Sugarbeets
 - Potatoes
- Oil
 - Fresh Water
 - Rigs
 - Equipment
 - Fuel
 - Mud
 - Pipe
 - Produced Water
 - Outbound Oil

Traffic Counts

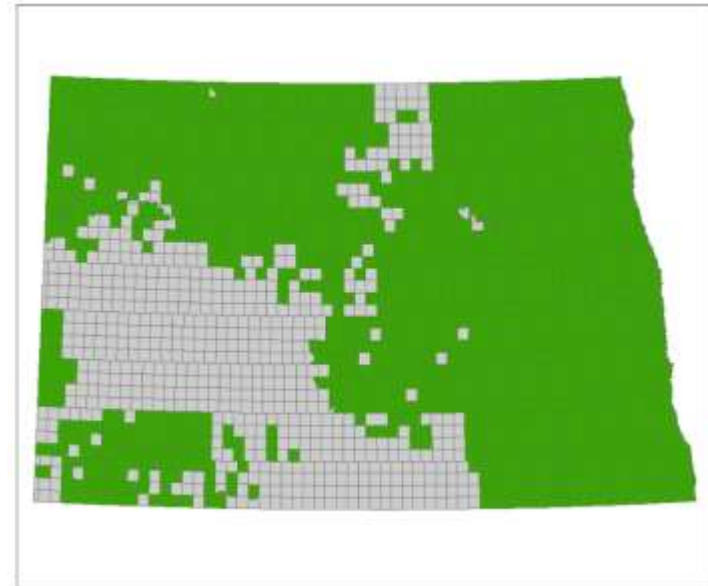


Unpaved Analysis

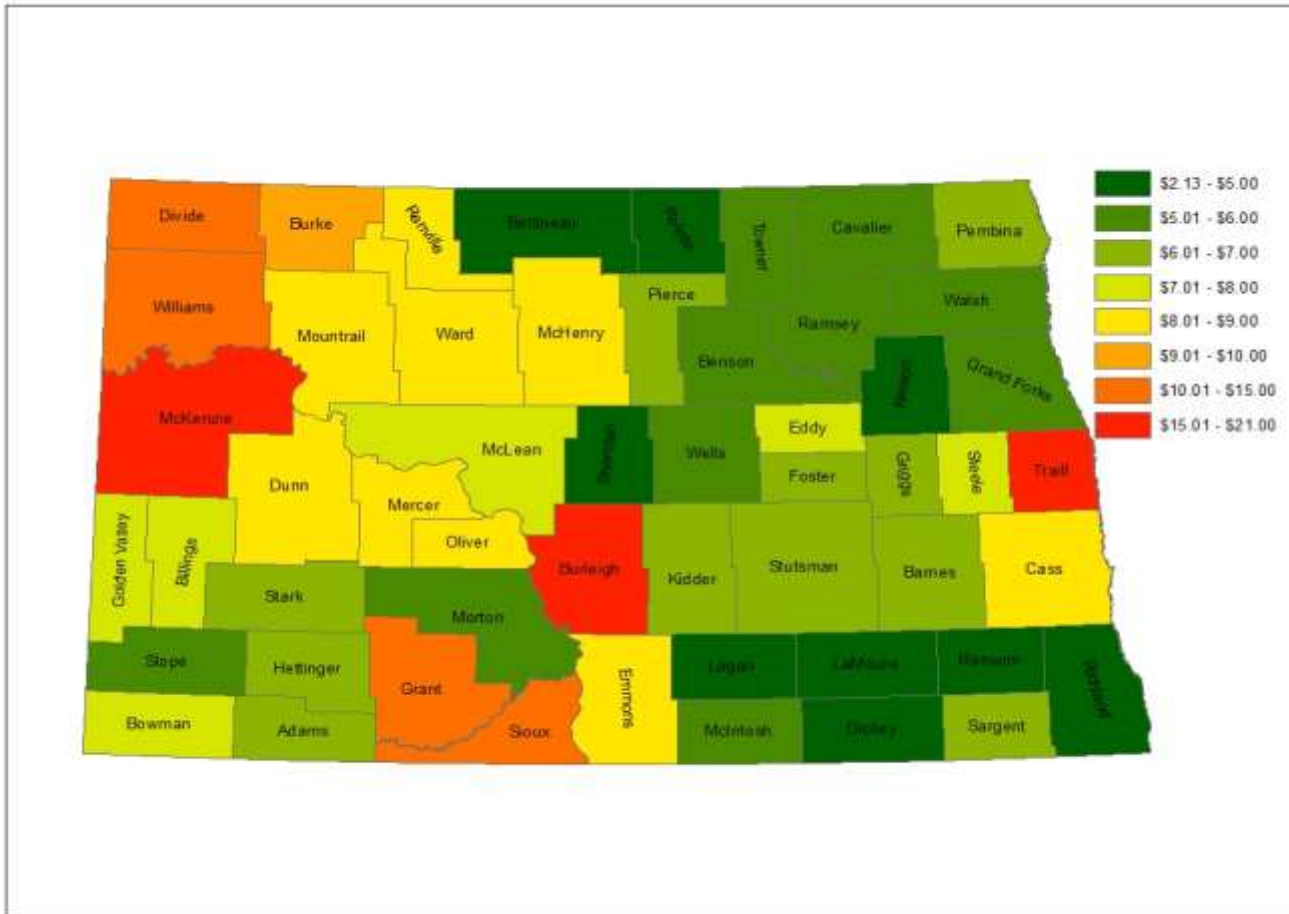
- Assigning maintenance costs based upon traffic level forecasts
- Survey of costs and practices
- Group miles by traffic levels
- Apply annualized costs to each traffic level and add up mileages across each jurisdiction

Gravel Survey

- Mailed to all 53 counties and roughly 1,300 organized townships
- Response rate:
 - Counties: 100%
 - Townships: 75%
- Costs and Practices



Aggregate Cost/Cu.Yd.



Average Trucking Distance



Gravel Testing and Specifications



- Specifying and testing gravel insures that we are getting quality material.
- Wash boarding, rutting, dust, and loose rock/sand are all gravel quality issues.
- Gravel quality affects safety risks and maintenance costs
- Motor grader operators set the roadway shape, with a target 4% slope. Flat roads pothole.

Gravel Specs (blue)



Gravel Testing (blue)



Paved Analysis

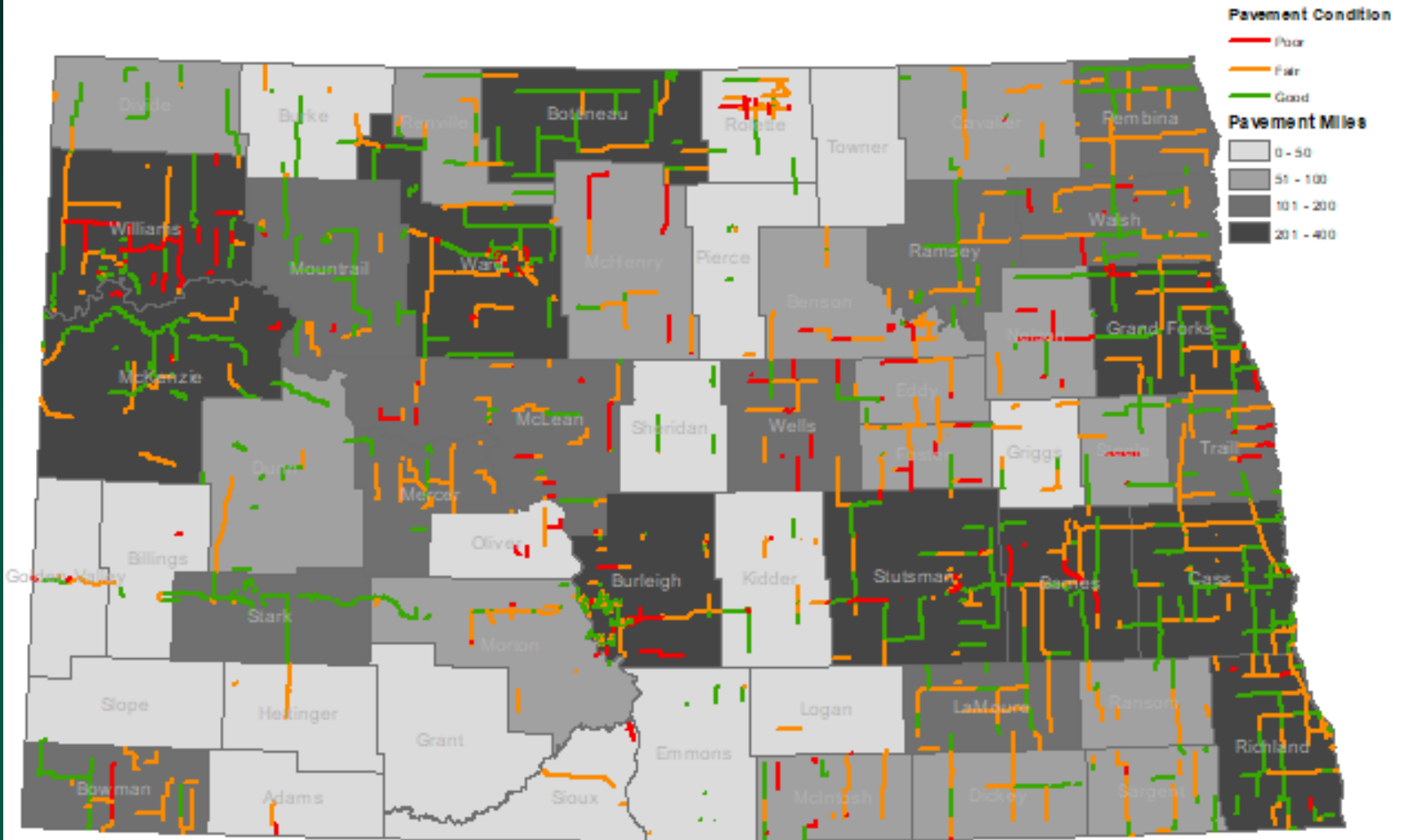
- Data Collection
 - Pavement surface and ride condition
 - GRIT – County data
 - Existing Pavement and Base Information
- Data Analysis
 - AASHTO routine
 - Costs based on recent bids
- Pavement results

Pavement Data Collection

- Condition data collection
 - Previous study - NDDOT Pathway van
 - Smartphone Application
 - Approx. 5300 miles of ride and image data collected



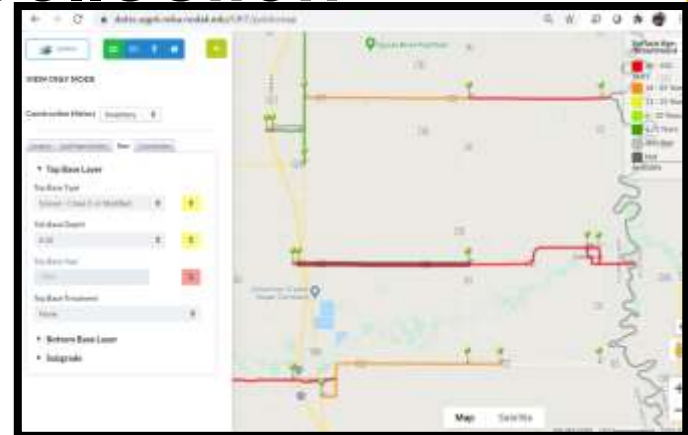
Pavement Condition 2019 Combined ride and condition



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Pavement Data Collection

- **Geographic Roadway Inventory Tool (GRIT)**
 - Construction History – SN
 - Pavement thickness and type
 - Base thickness and type
 - Subgrade strength
 - Pavement Age
 - Shoulder type and width

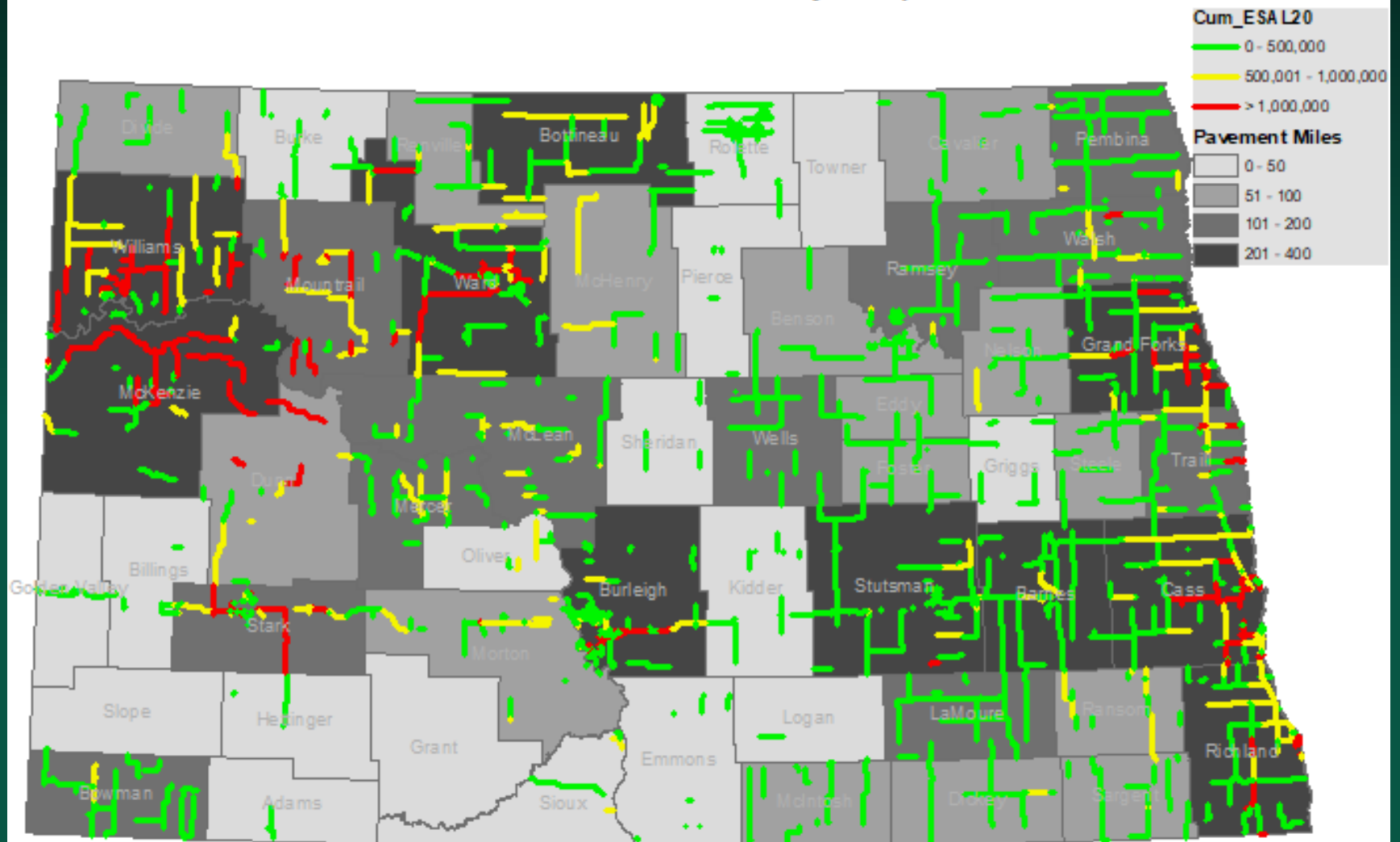


<https://www.ugpti.org/resources/asset-inventory/>

Paved Data Analysis

- AASHTO pavement design model
 - Design Inputs
 - PSR – Present Serviceability Rating - pavement condition
 - Cumulative ESAL's – truck traffic – Equivalent Single Axle Loads
 - Structural Number SN –combined roadway layer strength
 - Subgrade strength – Resilient Modulus (Stiffness)
- Other Inputs
 - Shoulder width

Equivalent Single Axle Loads (ESAL) Cumulative ESAL over 20 year period

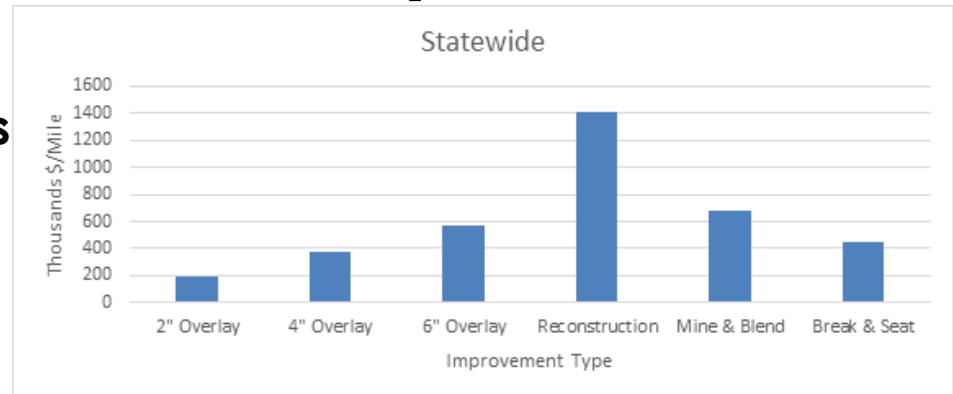


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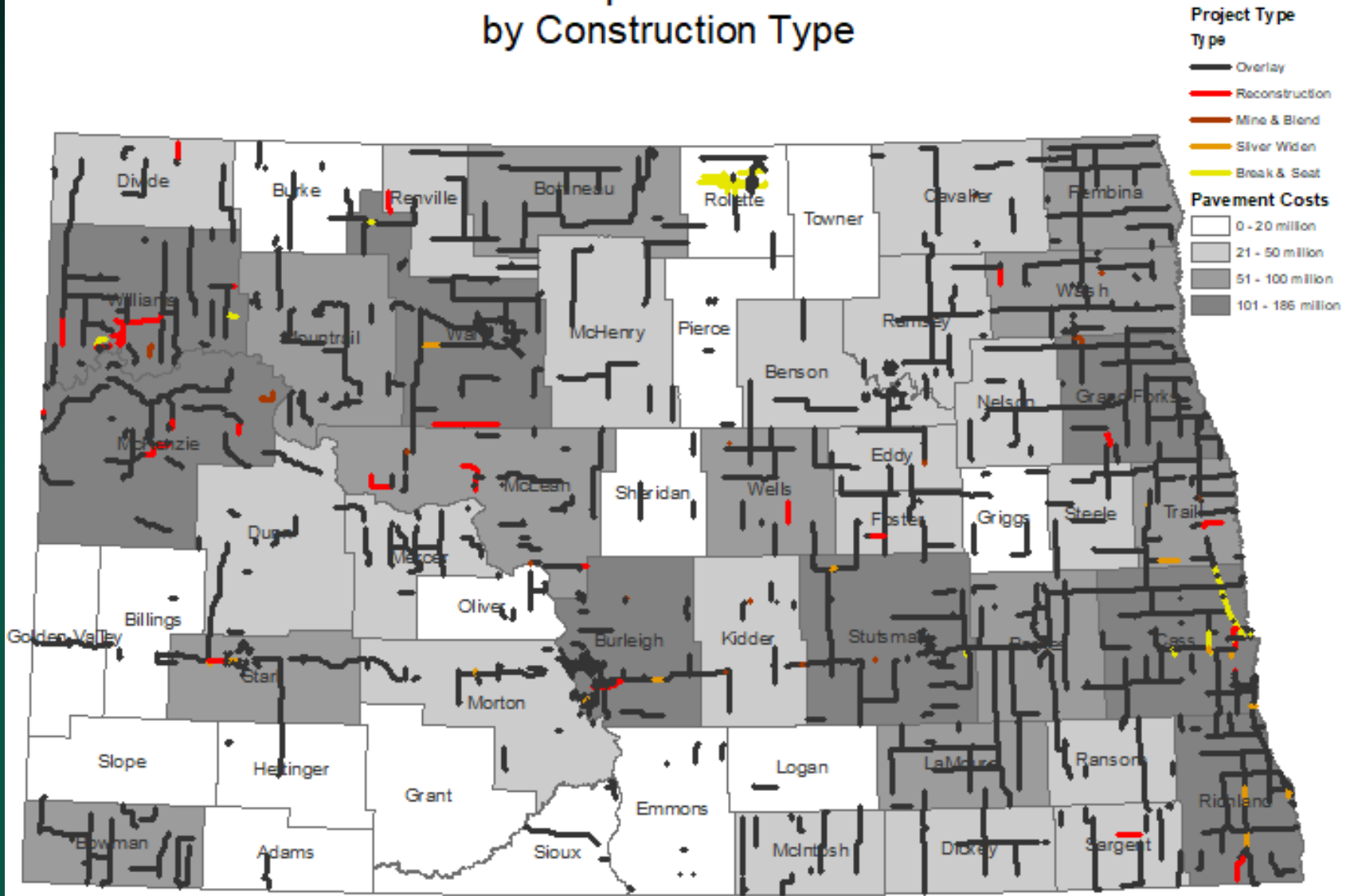
Paved Data Analysis

- **Project Selection and Costs**

- Bituminous Overlay
 - \$200,000 to \$550,000
- Total Reconstruction
 - \$1.4 Million
- Mine & Blend / Reclamation
 - \$678,000
- Widening with Overlay
 - Add \$87,000 per foot width to overlay
- Concrete Pavement Repair (CPR)
 - \$450,000



20 Year Improvement Needs by Construction Type

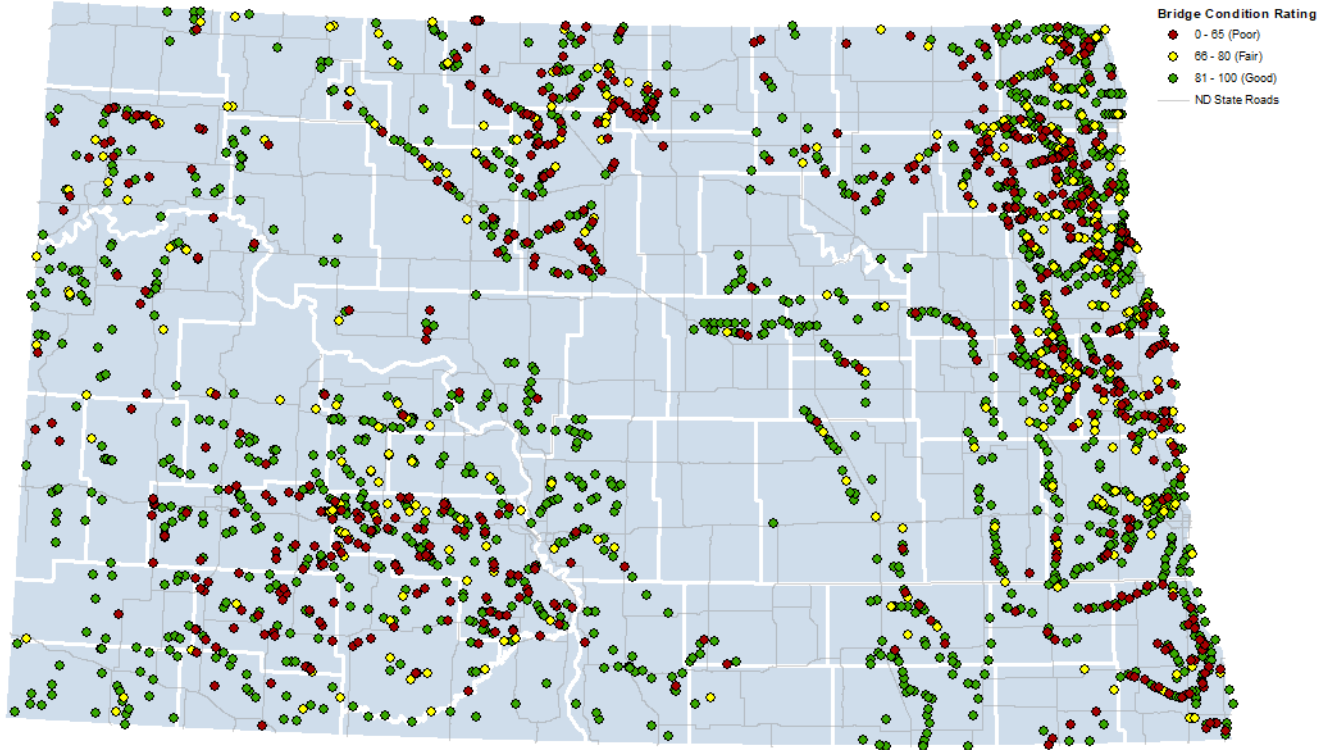


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Bridge Analysis

- Data sources
 - Used the FHWA 2019 National Bridge Inventory System (NBIS).
 - Contained data from 2018-19 bridge safety surveys
 - Extracted the existing box culverts
 - Extracted minimum maintenance road-based bridges – about 175
 - Extracted known improvements for 2019 and 2020

Bridge Condition and Location – FHWA NBIS - 2019



Bridge Analysis Methodology

- In a Nutshell – Reviewed the Following
 - Deck, Superstructure or Substructure ≤ 4
 - On-System bridges $< HS-20$
 - Structurally Deficient
 - Width < 20 ft. (off-system)
 - Low Sufficiency Rating with unknown foundation

Bridge Analysis

- Unit cost model
 - Based on 2019-20 NDDOT county bid reports
 - Examples obtained from Local Govt. Div.
 - Includes approach roadway, preliminary and construction engineering
- Replacement cost projections:
 - Bridges: \$295/sf. deck area
 - Culverts: \$450,000 per single barrel box and \$750,000 per multiple barrel box.

Bridge Analysis

- Rehabilitation:
 - Deck widening 50% replacement cost
 - Deck replacement 45% replacement cost
- Preventive maintenance:
 - \$0.25/sf./year – deck washing, deck and crack sealing and joint maintenance
 - \$0.29/sf./year if within 5 miles of city > 5000 population

Statewide Results

\$ Millions

Period	Unpaved	Paved	Bridges	Total
2021-2022	\$ 611.08	\$ 388.46	\$94	\$ 1093.54
2023-2024	\$ 602.19	\$ 406.97	\$94	\$ 1103.16
2025-2026	\$ 616.21	\$ 304.56	\$95	\$ 1015.77
2027-2028	\$ 615.89	\$ 264.53	\$95	\$ 975.42
2029-2030	\$ 602.76	\$ 222.20	\$94	\$ 918.96
2031-2040	\$ 3,087.97	\$ 1,081.77	\$26	\$ 4195.74
2021-2040	\$ 6,136.10	\$ 2,668.49	\$498	\$ 9302.59

Projected Total Costs

Pavement, Gravel, and Bridge Needs
2021 - 2040

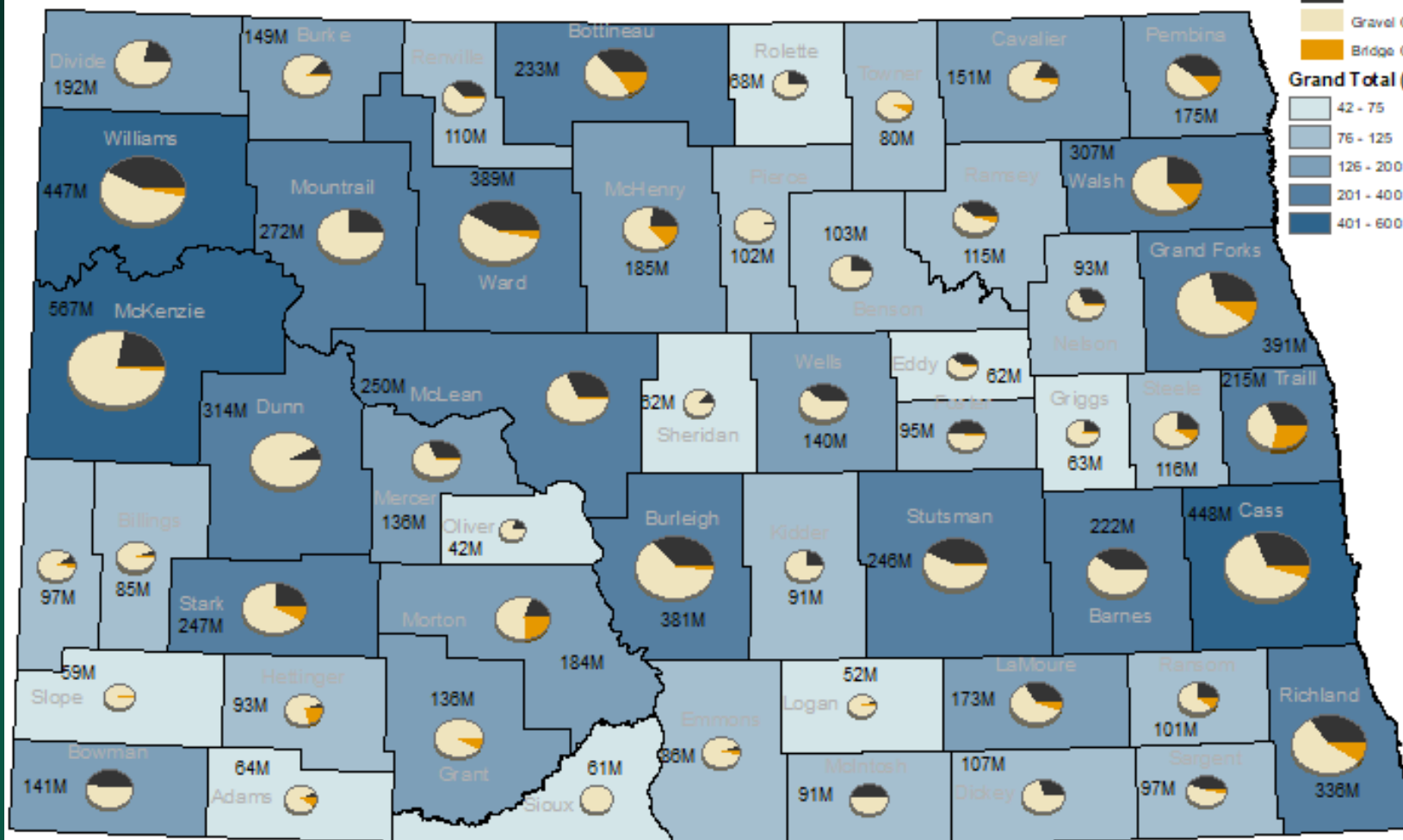
County - Needs 2020
Total Cost



- Pavement Cost
- Gravel Cost
- Bridge Cost

Grand Total (Millions)

- 42 - 75
- 76 - 125
- 126 - 200
- 201 - 400
- 401 - 600



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7/2/2020

Draft Document on Webpage – Posted 7-21-2020



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Assessment of ND County and Local Road Needs

2019-2021 Legislative Study

This effort responds to the North Dakota Legislature's request for a study of the transportation infrastructure 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 the comments is subject to potential edits. Comments will be taken until August 30, 2020 and then a final draft will be posted.

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 sub-county level. Oil related traffic is predicted for individual spacing units, whereas agricultural production is estimated at the township level.

Related Links

- [Study Overview](#)
- [Study Updates](#)
- [Geographic Roadway Inventory Tool \(GRIT\)](#)

- [View the Draft Report](#) (PDF, 6979K)
- [View the Supplemental Information](#)

For questions or comments on the report, contact ndsu.roadneeds@ndsu.edu.

Final Reports from Past Legislative Studies

- [2015-2017 — Study of County and Local Roadway Needs](#)
- [2013-2015 — Study of County and Local Roadway Needs](#)
- [2011-2013 — Study of County and Local Roadway Needs](#)

Comment Process

- Contact info – Email submittal preferred
- ndsu.roadneeds@ndsu.edu
- Responders will be Tim Horner, Dale Heglund, Brad Wentz or Alan Dybing
- Comment Period Ends October 12, 2020 (about 2.5 months to comment) (Report posted July 21, 2020)

Questions?