

Infrastructure Needs: North Dakota's County, Township, & Tribal Roads & Bridges 2022-2041

Western Dakota Energy Association
Annual Meeting

Upper Great Plains Transportation Institute
North Dakota State University
Alan Dybing

Outline of Today's Presentation

- Quick History of Studies
- Primary Study Components
 - Traffic Forecasting
 - Unpaved (Gravel) Analysis
 - Paved Analysis
 - Bridge Analysis
- Results

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 oil scenario analysis
- 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
- 2022 study: Updated bridge analysis methods and classification counts
 - Inflationary impacts

Primary Components of Study

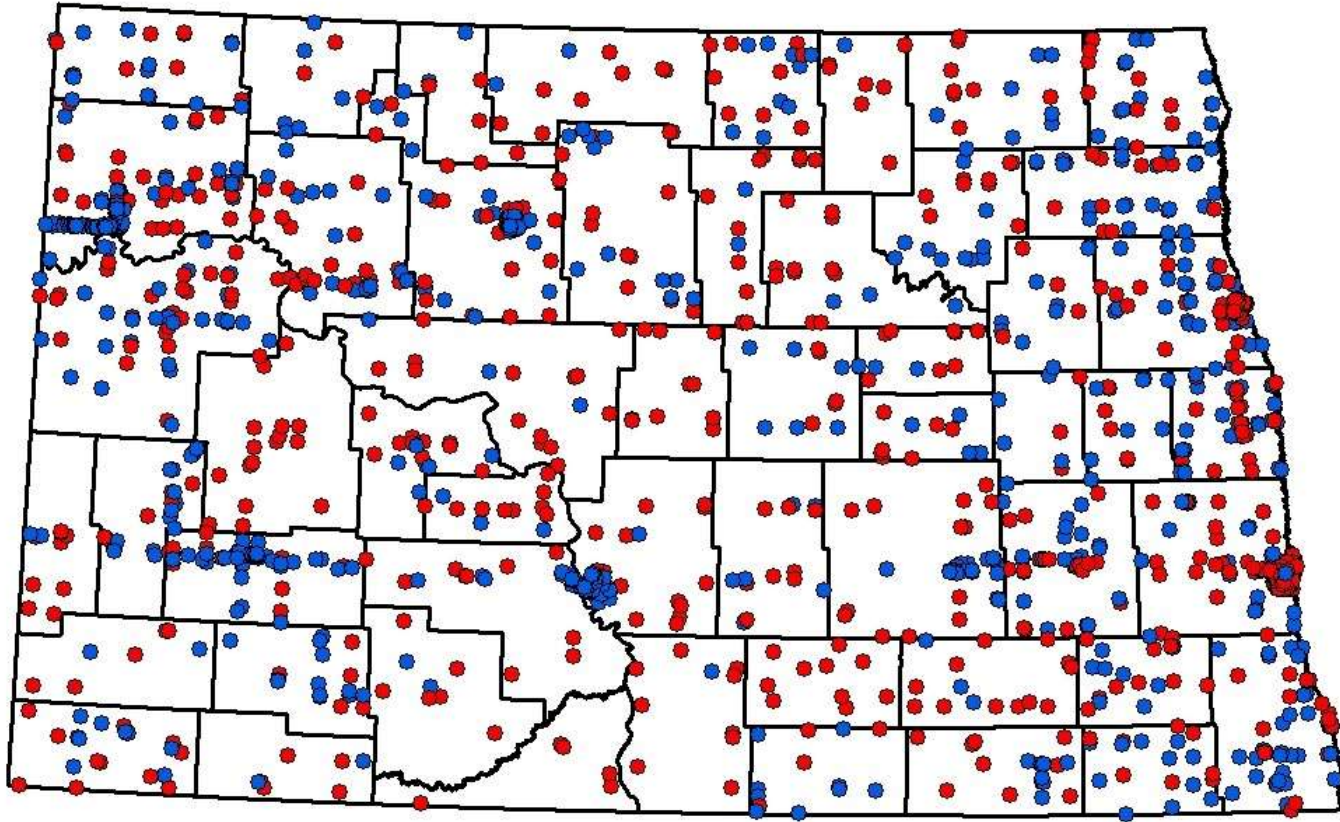
- Traffic Model
 - Traffic is key to modeling pavement and gravel needs
- Unpaved Costing Process
 - Based upon updated survey and traffic volumes
 - Gravel is 60% of the total needs in past studies
- Pavement Model and Cost Projection
 - Dependent on good data from GRIT
- Bridge Model and Cost Projection
 - Looking at the 3 major components of bridges
 - Superstructure, substructure and deck

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

Traffic Counts

- Volume Only
- Truck Classification



Unpaved Analysis

- Assigning maintenance costs based on traffic level forecasts
- Survey of costs and practices
 - Steering committee
 - Counties asked how roads are maintained differently based on traffic levels
 - Key data items
 - Unit costs (aggregate/blading/hauling)
 - Practices (blading frequency, overlay thickness and frequency, stabilization, and dust suppressant)
 - By traffic level (low, medium, and high – county specified)

Unpaved Analysis

- Survey results are used to calculate an average annual cost per mile by traffic level
- Survey results account for regional variations in gravel costs and maintenance practices
- Group miles by traffic levels
 - Very high, high, medium, low, very low
- Apply annualized costs to each traffic level and add up mileages across each jurisdiction

Aggregate Cost/Cu.Yd.



Paved Analysis

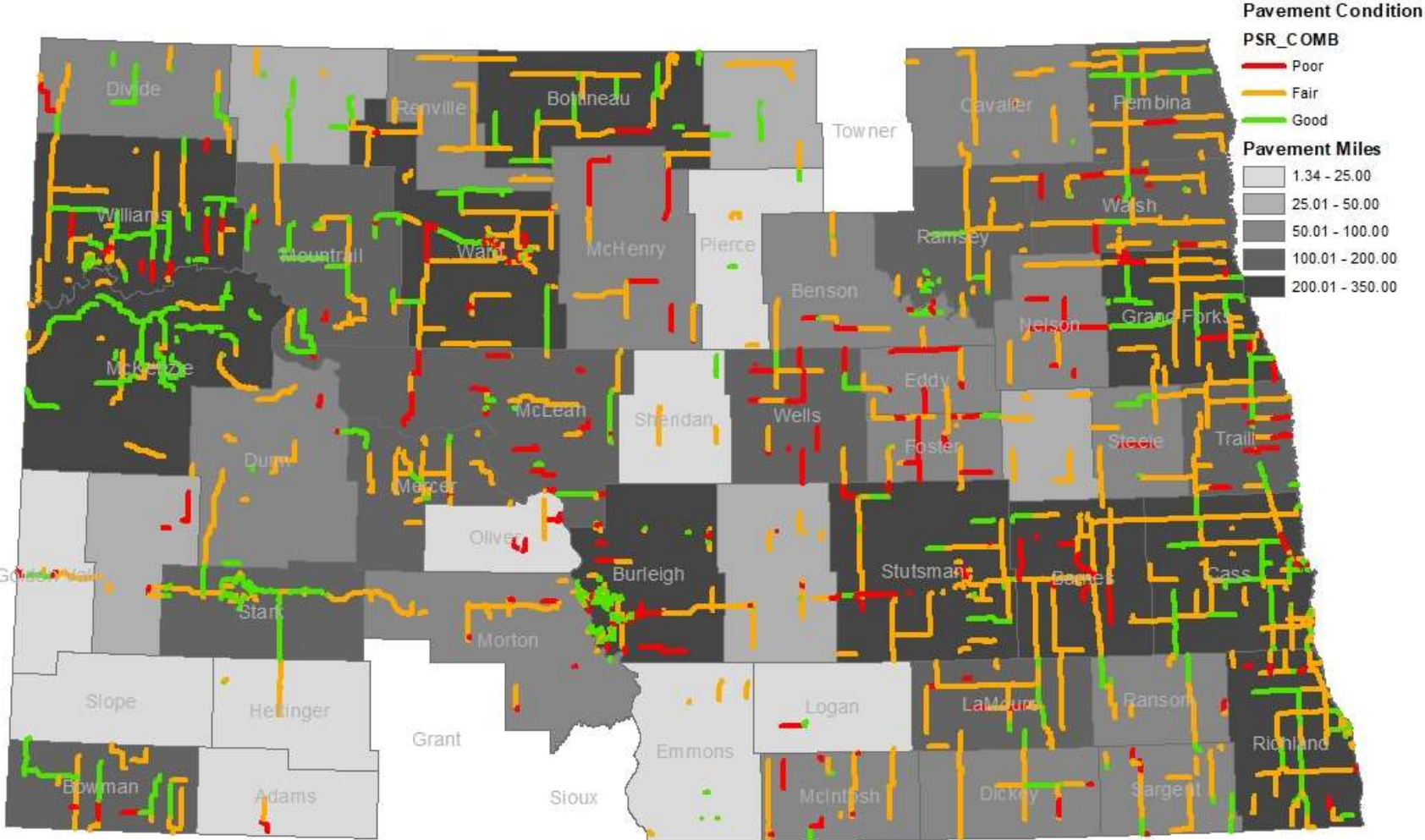
- Data Collection
 - Pavement condition
 - GRIT – County data
 - Existing Pavement and Base Information
- Data Analysis
 - AASHTO routine
 - Costs
- Pavement results

Pavement Data Collection

- 2021 Condition data collection
 - Roadbump - calibrated to Pathway
 - Collected south half of State in 2021.
 - Will collect north half in 2022.
 - Projected north from 2019 to 2021
 - Images every 500'
 - Evaluated for distress
 - Approx. 3,000 miles of ride and image data collected



County Pavement Condition 2021 Combined ride and condition



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UGPTI - DOTSC
6/8/2022

County Pavement Condition 2021 Combined ride and condition

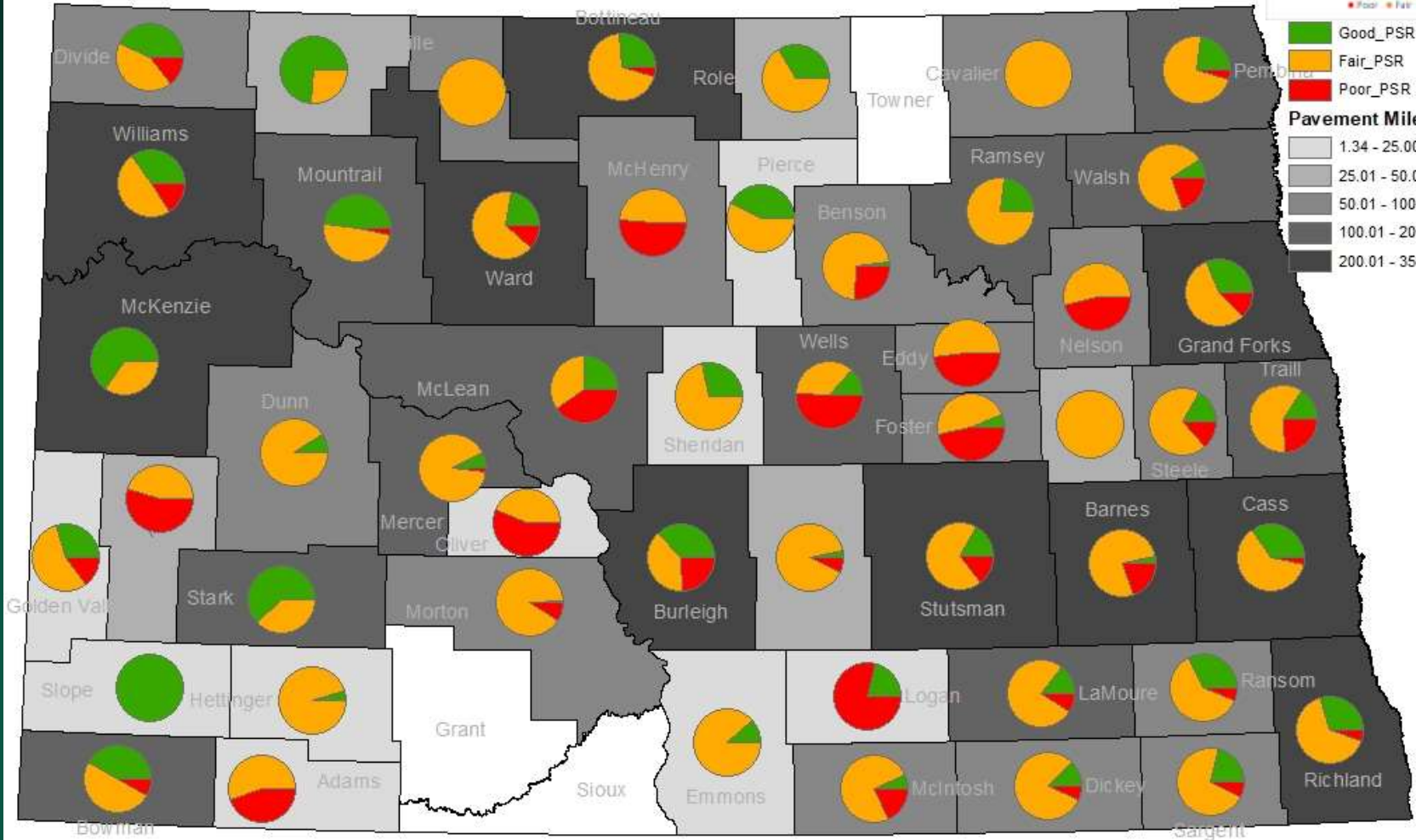
2022 Pavement Condition
% of Total Mileage



- Good_PSR
- Fair_PSR
- Poor_PSR

Pavement Miles

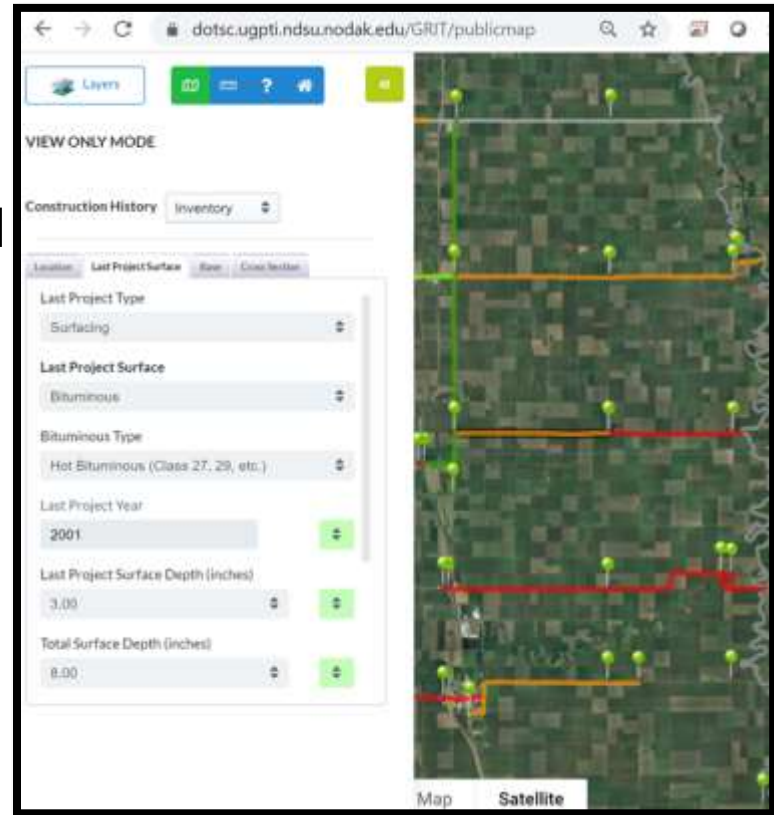
- 1.34 - 25.00
- 25.01 - 50.00
- 50.01 - 100.00
- 100.01 - 200.00
- 200.01 - 350.00



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Pavement Data Collection

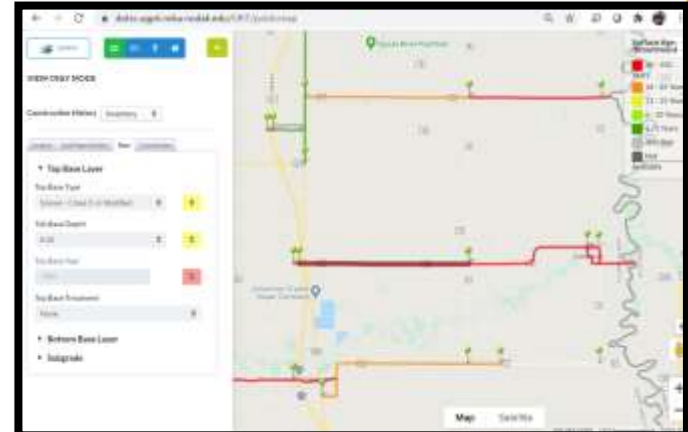
- **Geographic Roadway Inventory Tool (GRIT)**
 - Easy to use web-map based inventory tool
 - Available and in use by all ND Counties
 - Four Layers of Information
 - Construction History
 - Construction Planning
 - Minor Structures
 - Load Restrictions



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

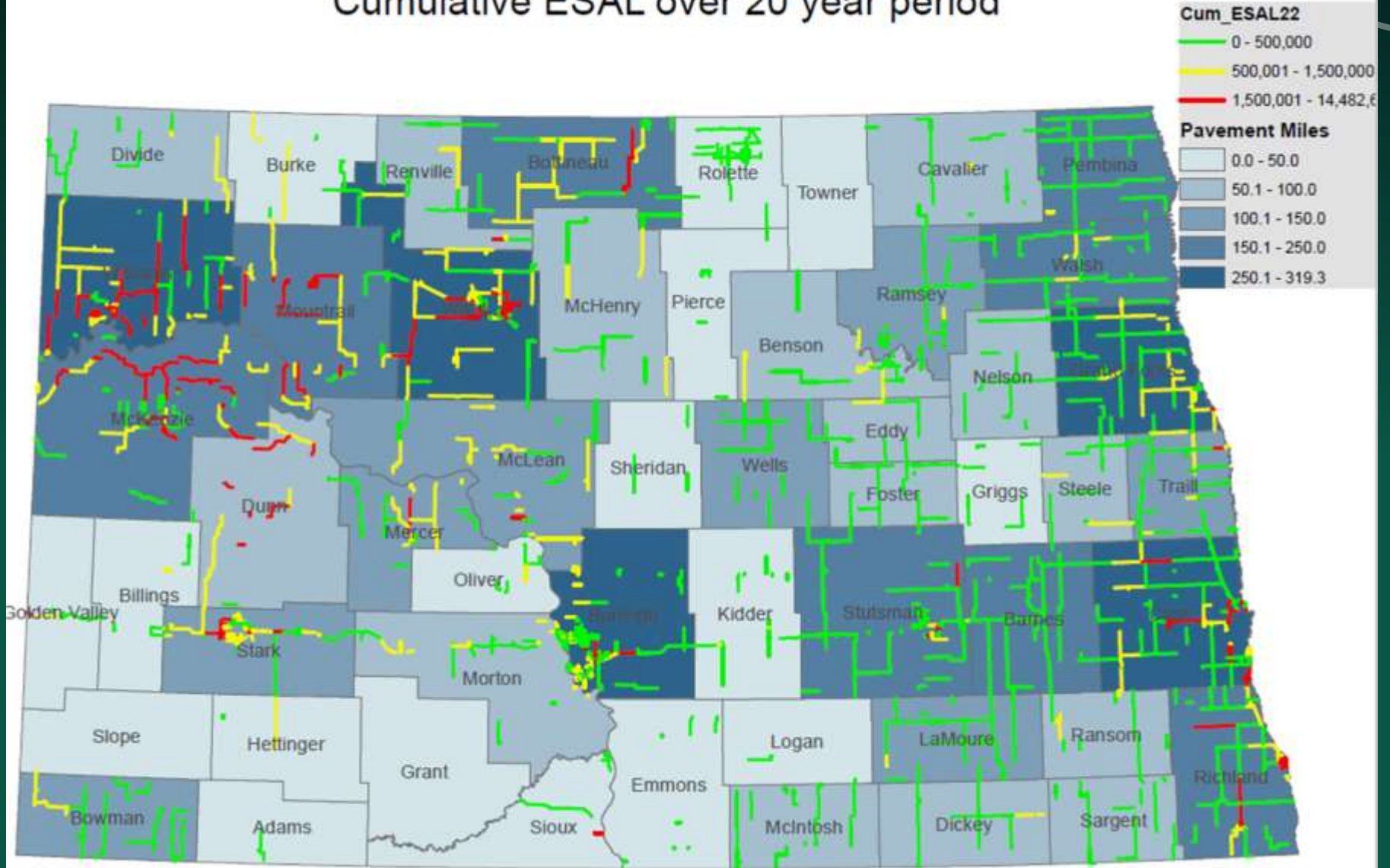
Pavement Data Collection

- **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/>

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



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Paved Data Analysis

- AASHTO pavement design model
 - Design Inputs
 - PSR – initial pavement condition
 - Cumulative ESAL's – truck traffic
 - Structural Number SN – roadway strength
 - Subgrade strength – Resilient Modulus
- Other Inputs
 - Shoulder width

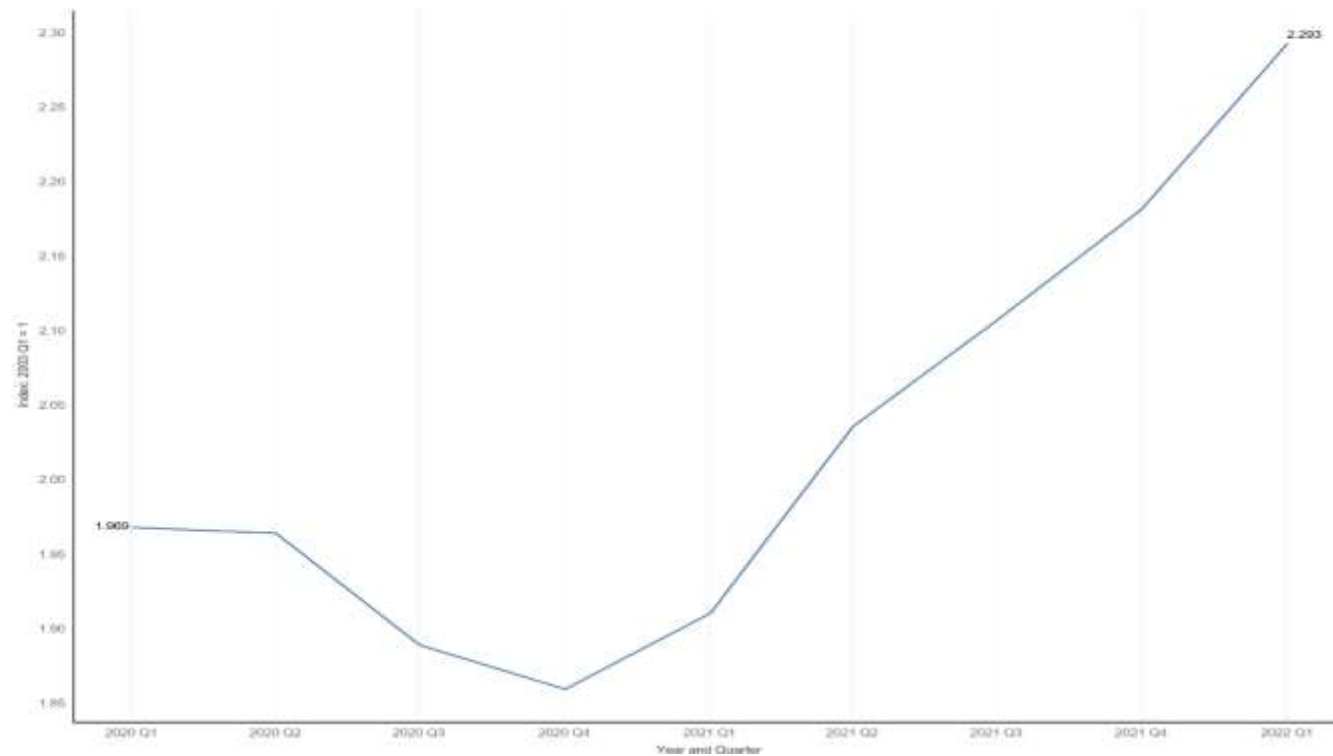
Since Last Study NHCCI is up 16%



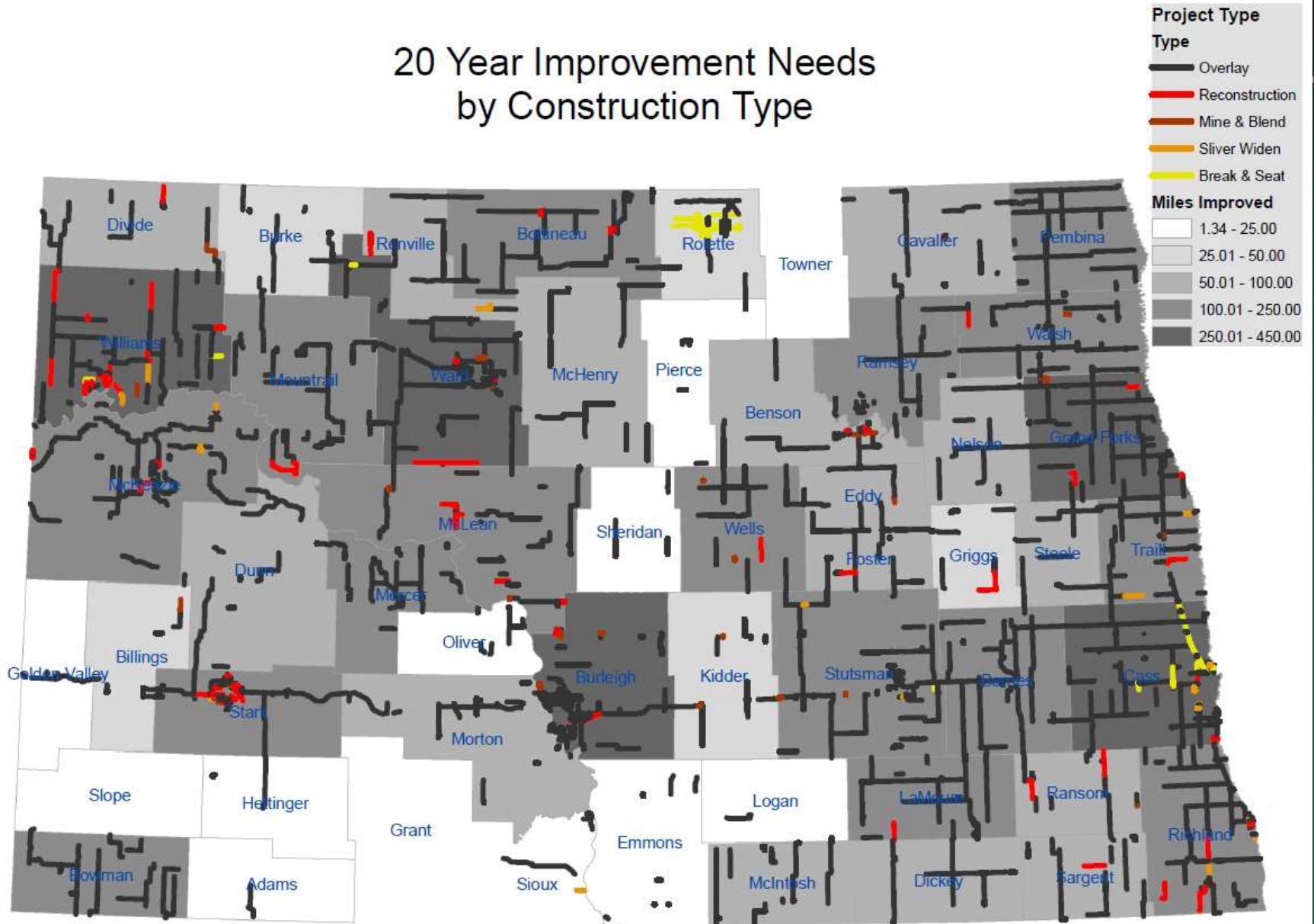
U.S. Department of Transportation
Federal Highway Administration

National Highway Construction Cost Index (NHCCI)

Select Year and Quarter:
2019 Q4 to 2022 Q1
and Null values



20 Year Improvement Needs by Construction Type



Project Type

- Overlay
- Reconstruction
- Mine & Blend
- Sliver Widen
- Break & Seat

Miles Improved

- 1.34 - 25.00
- 25.01 - 50.00
- 50.01 - 100.00
- 100.01 - 250.00
- 250.01 - 450.00

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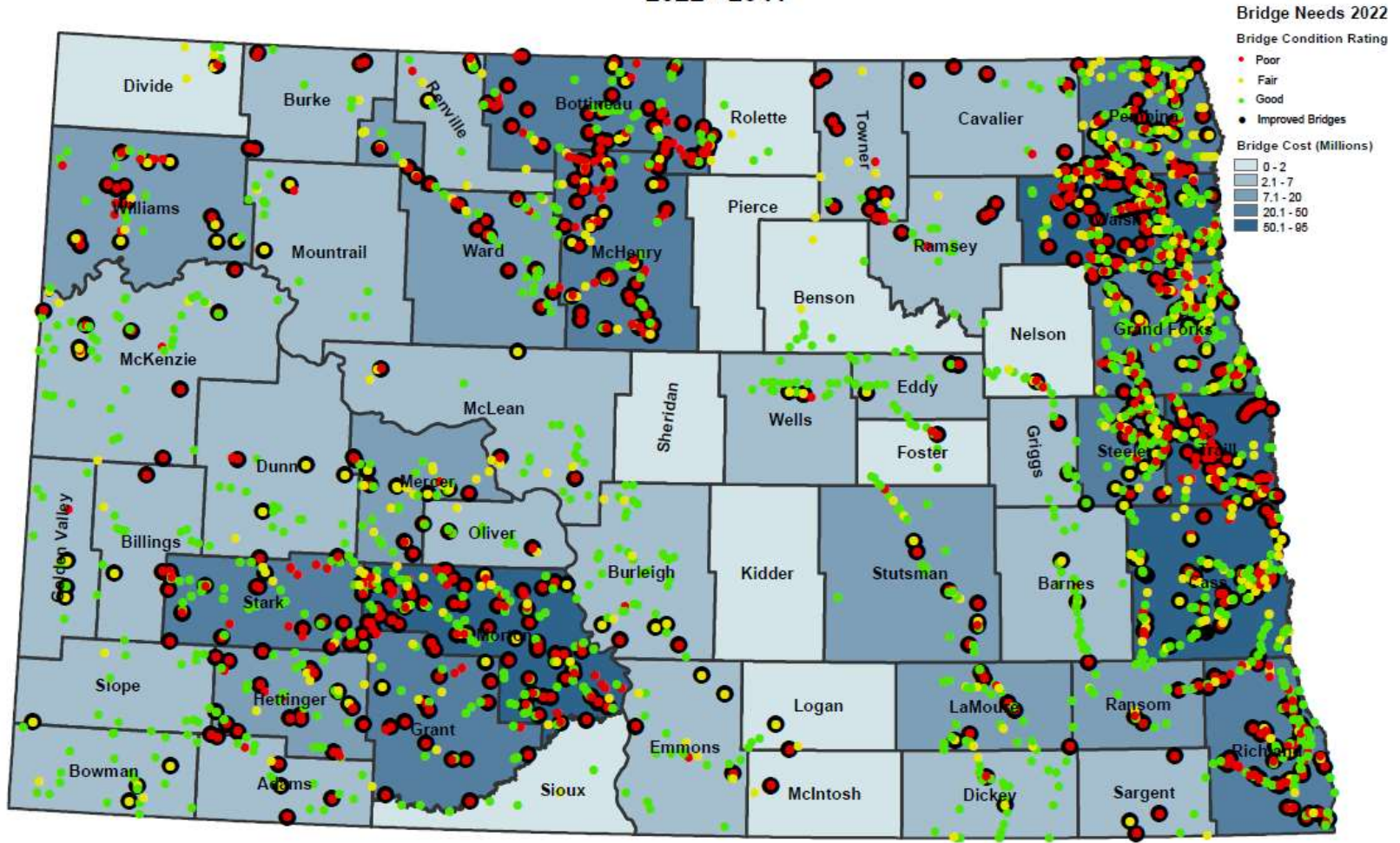
Bridge Needs Data Source

- Data sources
 - Used the FHWA 2021 National Bridge Inventory System (NBIS).
 - Contained data from 2020-2021 bridge safety inspections (started with 2996 structures)
 - Extracted the existing box culverts 479*
 - Extracted 182 minimum maintenance road-based bridges
 - This study has 53 more bridges analyzed than last study plus 17 culvert bridges*.

NBI is not tracking Sufficiency Rating

- Many States have been developing their own rating guidelines since 2016.
- UGPTI had its own SR calculator which was updated to include special reduction factors for scour critical, fracture critical, load posted and timber materials.
- This is now referred to as the Bridge Needs Target (BNT). New threshold is $BNT < 75$ vs $SR < 80$ – good correlation.

Projected Bridge Costs 2022 - 2041



Needs Estimates for County, Township and Tribal Roads and Bridges

Statewide Needs Results

Period	Unpaved (\$M)	Paved (\$M)	Bridges (\$M)	Total (\$M)
2022-2023	\$ 660.35	\$ 557.10	\$139.42	\$1,356.87
2024-2025	\$ 650.79	\$ 515.00	\$139.42	\$1,305.21
2026-2027	\$ 665.91	\$ 371.50	\$139.42	\$1,176.83
2028-2029	\$ 665.55	\$ 344.90	\$139.42	\$1,149.87
2030-2031	\$ 651.44	\$ 274.30	\$139.42	\$1,065.16
2032-2041	\$ 3,251.62	\$ 1,186.00	\$18.45	\$4,456.07
2022-2041	\$ 6,545.66	\$ 3,248.80	\$715.57	\$10,510.01

Comparison to Previous Study

Category	2020-2039 (\$M)	2022-2041 (\$M)	% Change
Unpaved	\$6,056.34	\$6,545.66	8.07%
Paved	\$2,668.49	\$3,248.80	21.75%
Bridges	\$498.81	\$715.57	43.46%
Total	\$9,223.64	\$10,510.01	13.95%

Projected Total Costs

Pavement, Gravel, and Bridge Needs 2022 - 2041

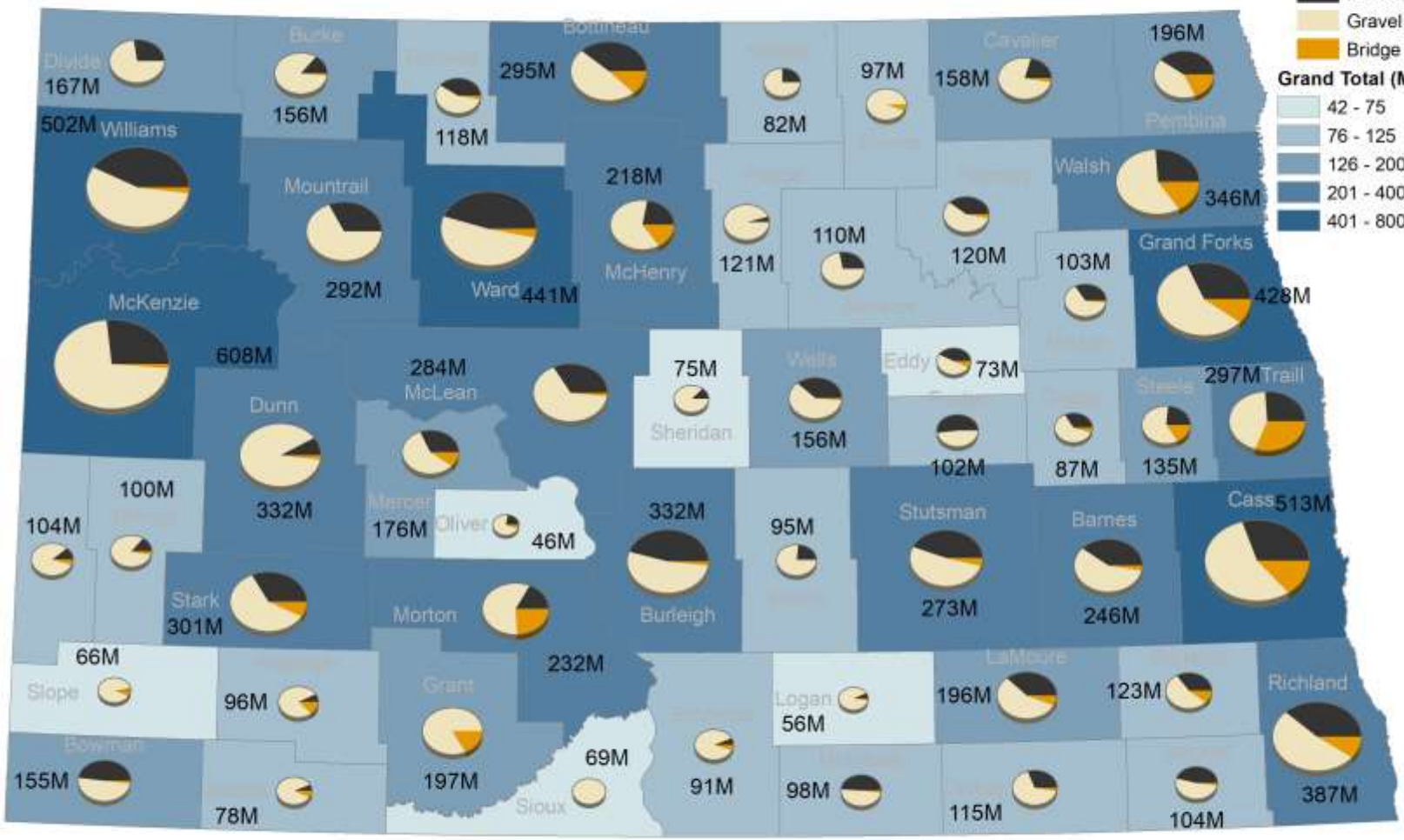
County - Needs 2022
Total Cost



Pavement Cost
 Gravel Cost
 Bridge Cost

Grand Total (Millions)

42 - 75
76 - 125
126 - 200
201 - 400
401 - 800



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7/2/2022

Study Report at ugpti.org

The screenshot shows the homepage of the NDSU Upper Great Plains Transportation Institute. At the top left is the logo "NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE". To the right is a search bar with "ENHANCED BY Google" and a "FOLLOW US" link. Below the header is a navigation menu with buttons for "browse by PROGRAMS", "ABOUT US", "TRIBAL OUTREACH", "RESOURCES", "RESEARCH", "EDUCATION", and "TRAINING & OUTREACH".

The main content area features several promotional tiles:

- Outreach:** A photo of a man and a woman in business attire looking at a laptop. Text below reads "outreach Putting research".
- North Dakota Statewide Traffic Safety Survey, 2022:** A video player showing a driver's perspective from inside a car. Text includes "New Report" and "1 of 6".
- Assessment of ND Road Needs:** A tile with a red circle around the text "County and Local Roads". Other text includes "Urban Roadways and Bridges".
- North Dakota Truck Harmonization Study:** A tile showing a truck.
- Spotlight:** A dark tile with the word "SPOTLIGHT" in yellow. Below it, text reads "Research Yields New Tools for Assessing Scour Risk to Bridges".

Study Report at ugpti.org



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NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

site map | search: ENHANCED BY Google  

PROGRAMS ABOUT US TRIBAL OUTREACH RESOURCES RESEARCH EDUCATION TRAINING & OUTREACH

Assessment of ND County and Local Road Needs

2021-2023 Legislative Study

This effort responded 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. UGPTI developed and analyzed traffic, bridge, pavement and unpaved road data in order to forecast investment needs for the next 20 years. Infrastructure needs were estimated using the most current crop and oil production forecasts, traffic estimates, and roadway condition data. Agricultural and oil related traffic was modeled in detail at sub-county level. Oil related traffic was predicted for individual spacing units, whereas agricultural production is estimated at the township level. The draft report and supplemental information and meeting presentation material is shown below.

Related Links

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

outreach
Putting research to work through relationships
UGPTI

Final Reports from Past Legislative Studies

- [2019-2021 — Study of County and Local Roadway Needs](#)
- [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](#)

Study Update

- Data Collection
 - GRIT county updates
 - Pavement condition
 - Updated gravel survey
- County Visits
 - Jurisdiction (own/maintain/funding)
 - Traffic Generators

Questions or Comments?

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