Upper Great Plains Transportation Institute Advisory Council Meeting Program Updates and Activities

October 6, 2022

Agenda

- Advanced Traffic Analysis Center (ATAC) and NDDOT Support Center (DOTSC) – Brad
- Transportation Learning Network (TLN) – Chris
- Small Urban and Rural Center on Mobility (SURCOM) – Jill
- Rural Transportation Safety and Security Center (RTSSC) – Kim
- ND Local Technical Assistance Program (NDLTAP) – Dale
- Western ND Transportation Liaison program – Dale
- Township Transportation Funding Program – Dale
- Assessment of County, Township and Tribal Roads and Bridges Infrastructure Needs - Al
- Center for Surface Mobility Applications and Real-time Simulation environments (SMARTSe) – Raj
- Infrastructure Management and Safety Research – Pan
- Commercial Vehicle Safety Center (CVSC) – Brenda

Advanced Traffic Analysis Center
NDDOT Support Center

Bradley Wentz, P.E. – Program Director

- Hire students to gain real world transportation experience providing the industry high tech services and potential future employees
  - Primarily funded by NDDOT - SPR
  - Also MPO's and MN LRRB and Counties
  - Continue to look for other sources

Advanced Traffic Analysis Center

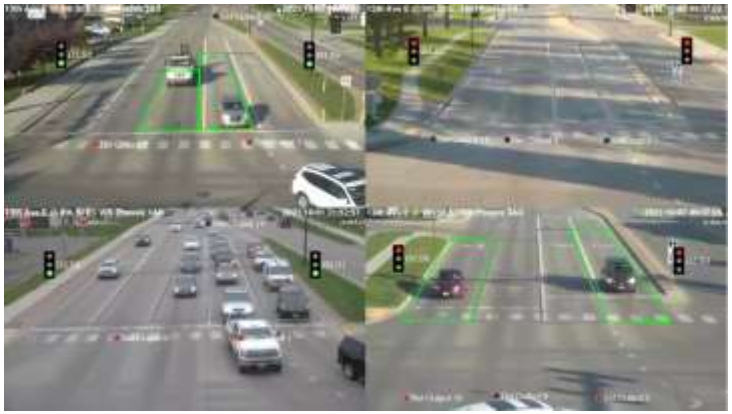
- Focus Areas and Staff
  - Traffic Operations and Data Collection
    - Kshitij Sharma, M.S., EIT
  - Travel Demand Modeling
    - Diomo Motuba, Ph.D
  - Intelligent Transportation Systems
    - Sharijad Hasan, Ph.D, EIT
  - 3 to 6 students

Traffic Operations

- Automated Traffic Signal Perf. Measures
  - NDDOT - 17 signals now (+5)
  - Fargo - 32 signals
  - Proactive Maint.
  - Optimization
  - Plans to expand
    - Bismarck
    - West Fargo

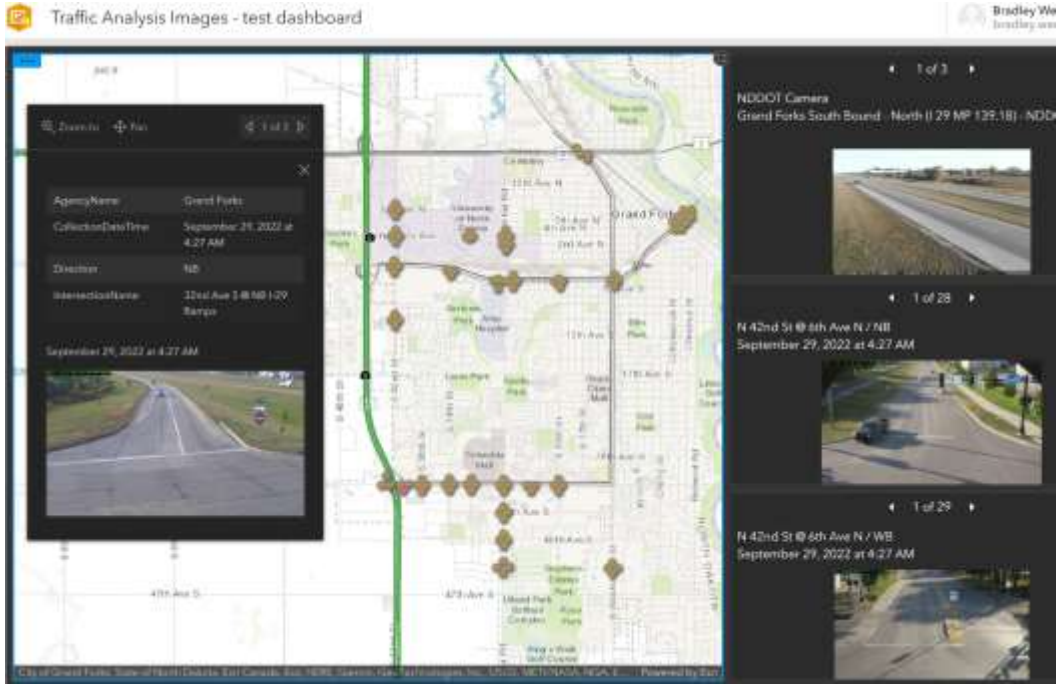
Traffic Data Collection

- 100 signals now!
- 50 more soon!
  - Fargo West Fargo
  - Bismarck
  - Moorhead
- Video & Loop
- Needs Study – data collection
  - Researching AI/video collection



Intersection Image Snapshots

- 117 GF Cameras so far
- TMC
- AI/ML



Travel Demand Modeling

Models updates for all 3 MPOs are in progress

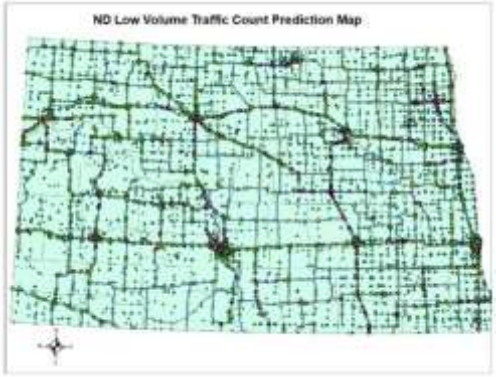
- Data collection process

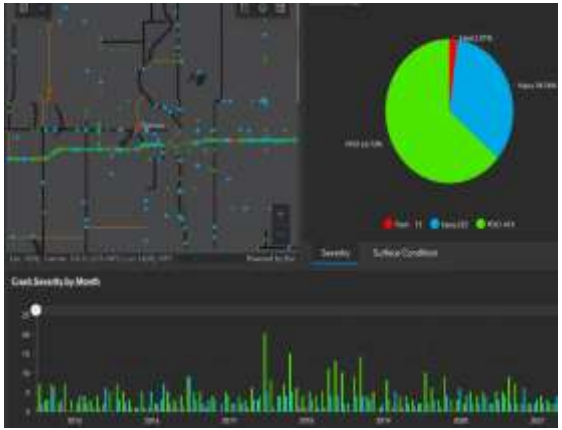
Improvements to models

- Dynamic traffic assignment model for FM Metro COG – will be expanded to other MPOs
- Being used for Transportation Improvement Program (TIP) Staging
- Freight modeling as part of models
- Transit mode added to all models
- COVID and AV impacts on transportation systems

Travel Demand Modeling

- Forecasting ADTs - NDDOT
  - Developed model that improves capability of predicting 20yr traffic volumes
- Developing on-line tools
  - Webmap/dashboard
  - GRIT tool to add traffic data
    - UGPTI, Counties, MPO's Cites…
  - Import tool for population and jobs information



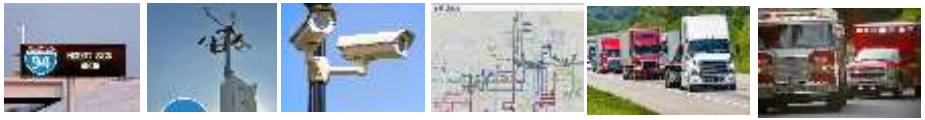


Intelligent Transportation Systems

- Regional ITS Architecture
  - National ITS Architecture versions 9.0
  - Finishing FMCOG Architecture
- Attenuator Truck Performance Measures
  - ATMA deployment and Report due January

Intelligent Transportation Systems

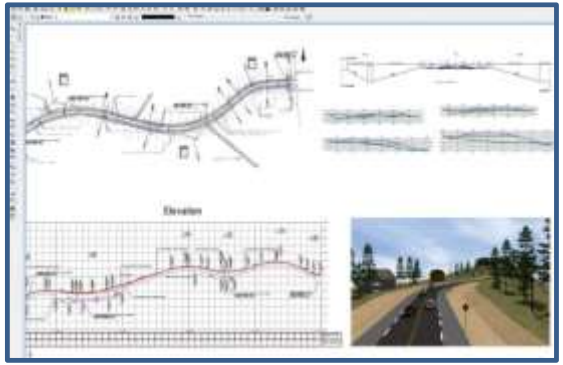
- Transportation Management Center (TMC)
  - Traveler Information System
  - Roadway and Weather Management
  - Traffic Control and Incident Management
- Transportation Data Analytics Center
  - Data critical to all aspects of Transportation
  - Develop and implement the AI tools to collect



DOT Support Center
DOTSC

- Focus Areas and Staff
  - Design Section
    - Aaron Murra, P.E. NDDOT – Moving on – Fargo DE!
    - Brady Haussler, P.E. NDDOT
    - 10 – 12 Engineering students
  - IT Section
    - Sowmya Gudise, M.S.
    - 3 to 6 Computer Science students
  - Engineering Support
    - Special projects with engineers in UGPTI

DOTSC Design Section

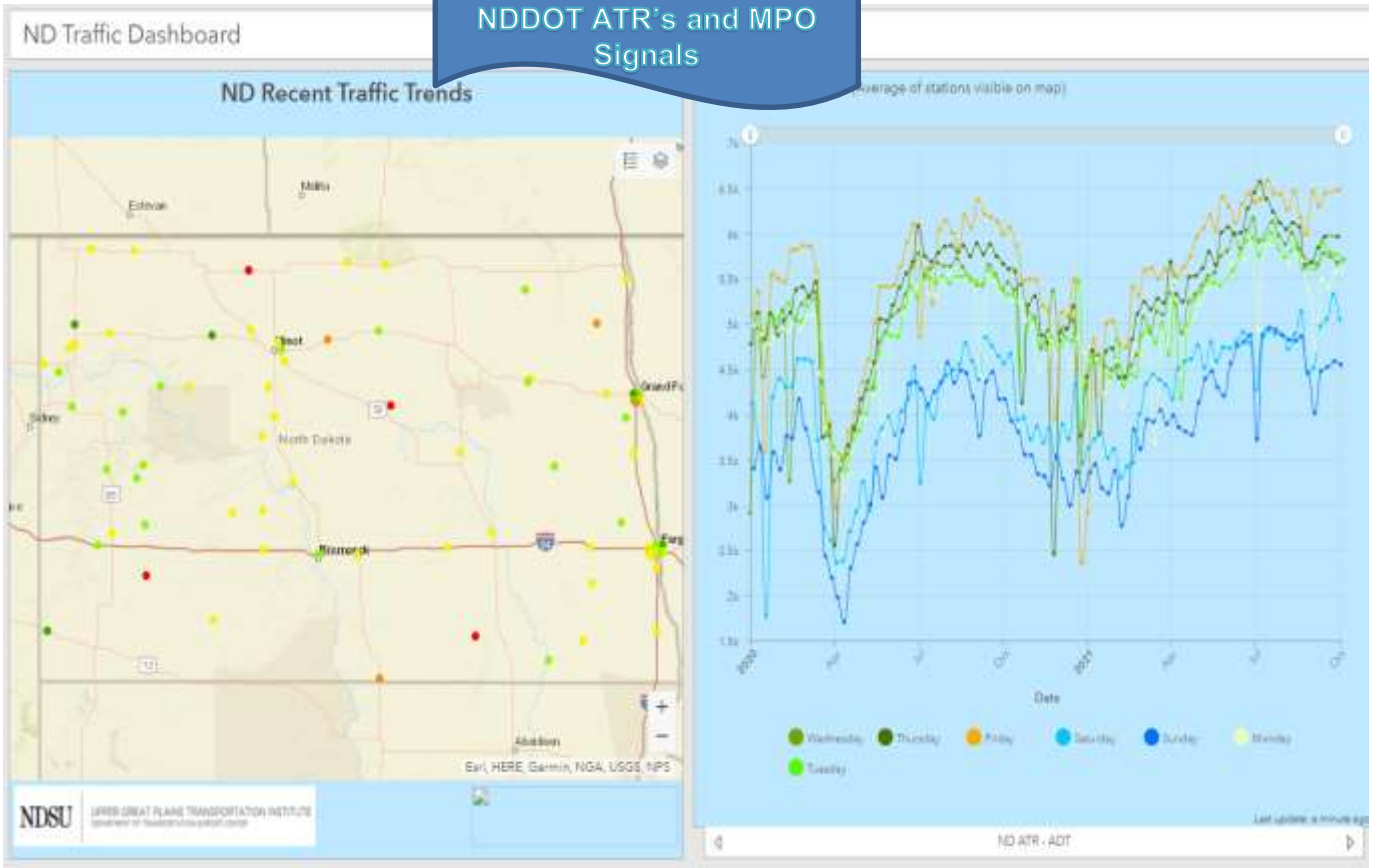


- Grading for High Mast Lights I-29 - Fargo
- ND 24 & BIA Retrofit Roundabout - Fort Yates
- I-29 Land Slide Repair – Grand Forks
- I-94 Business Loop West Land Slide Repair - Valley City
- US 2 Intersection Improvements - Williston
- Traffic Control E Bis. Expwy RR Bridge - Bismarck
- Traffic Control Memorial Bridge - Bismarck
- 13th Ave S and I-29 NE Ramp Median Mods - Fargo
- Various Technical Support Projects for Local Gov't
- 47th Ave S Interchange Alternatives - Grand Forks
- Pedestrian Path Improvements - Lidgerwood
- I-94 Business Loop East Land Slide Repair - Valley City
- Auxiliary Lane from I-29 to 25th St Interchange - Fargo
- Concrete Overlay US 2
- I-29 & I-94 Concrete Barriers - Fargo
- 194 & 810 Concrete Barriers - Bismarck
- Various Wetland Creation Mitigation Projects

DOTSC IT Section
Application Development

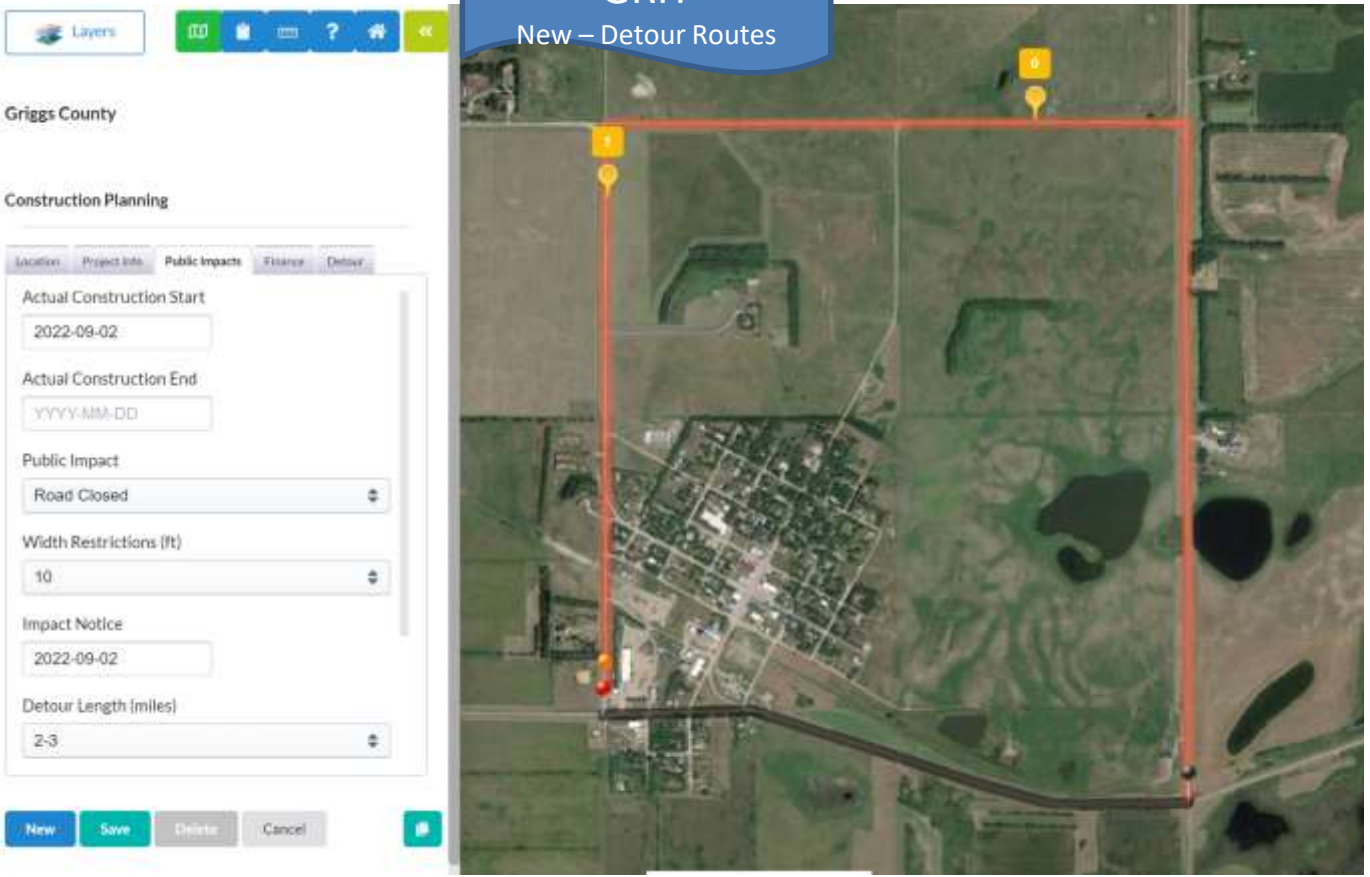
- NDDOT Certification and Materials Testing Reporting
- ★ Traffic Analysis – Added all NDDOT ATR's and Dashboard
- Maintenance Performance Measure Dashboard - NDDOT
- ★ Asset Management – GRIT
  - Pavement Performance Forecasting - Dashboards
  - Planning and detour routes
  - Sign inventory
- Surface Selection Tool – Proposal to integrate with GRIT
- Truck Weight Calculator – Updates to 129,900
- Safety Applications – Crash reporting
- ★ Artificial Intelligence and Machine Learning

Traffic Dashboard
NDDOT ATR's and MPO Signals



GRIT

New – Detour Routes



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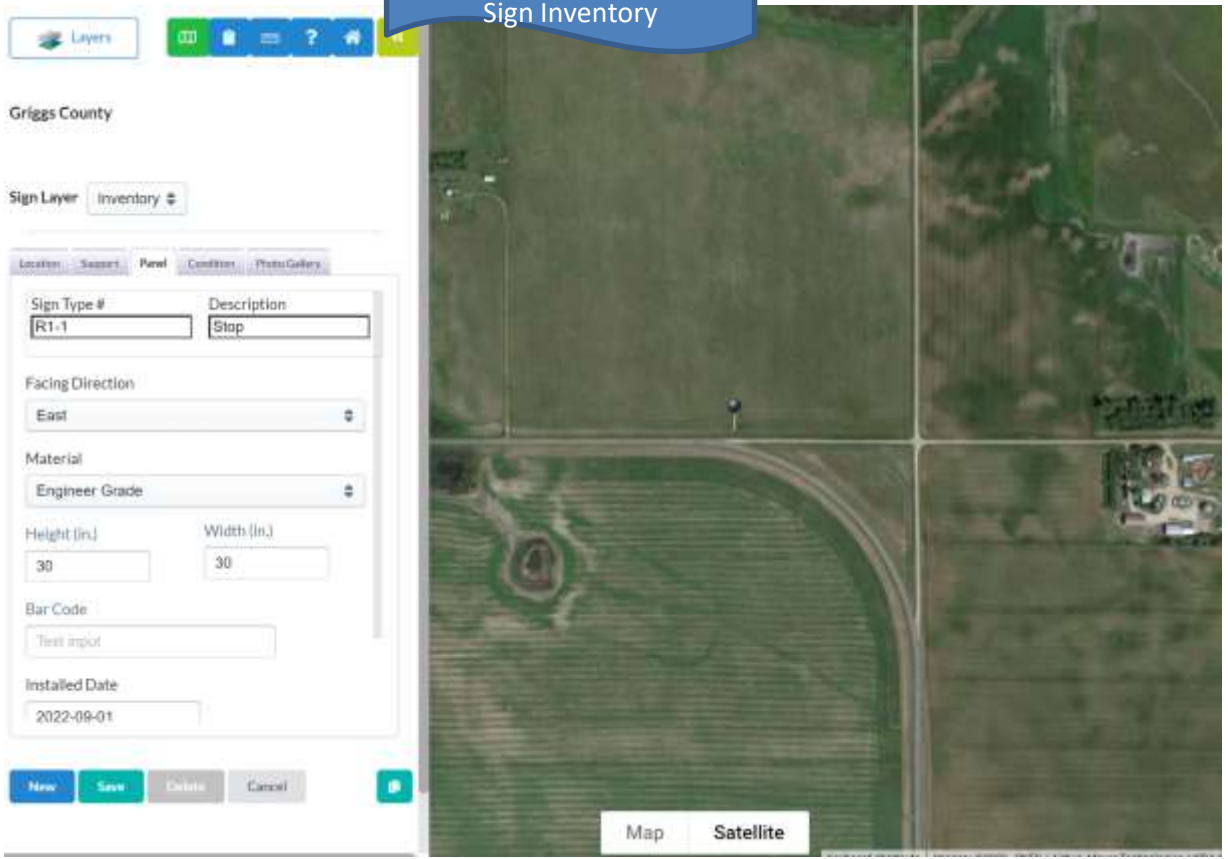
GRIT
Sign Inventory



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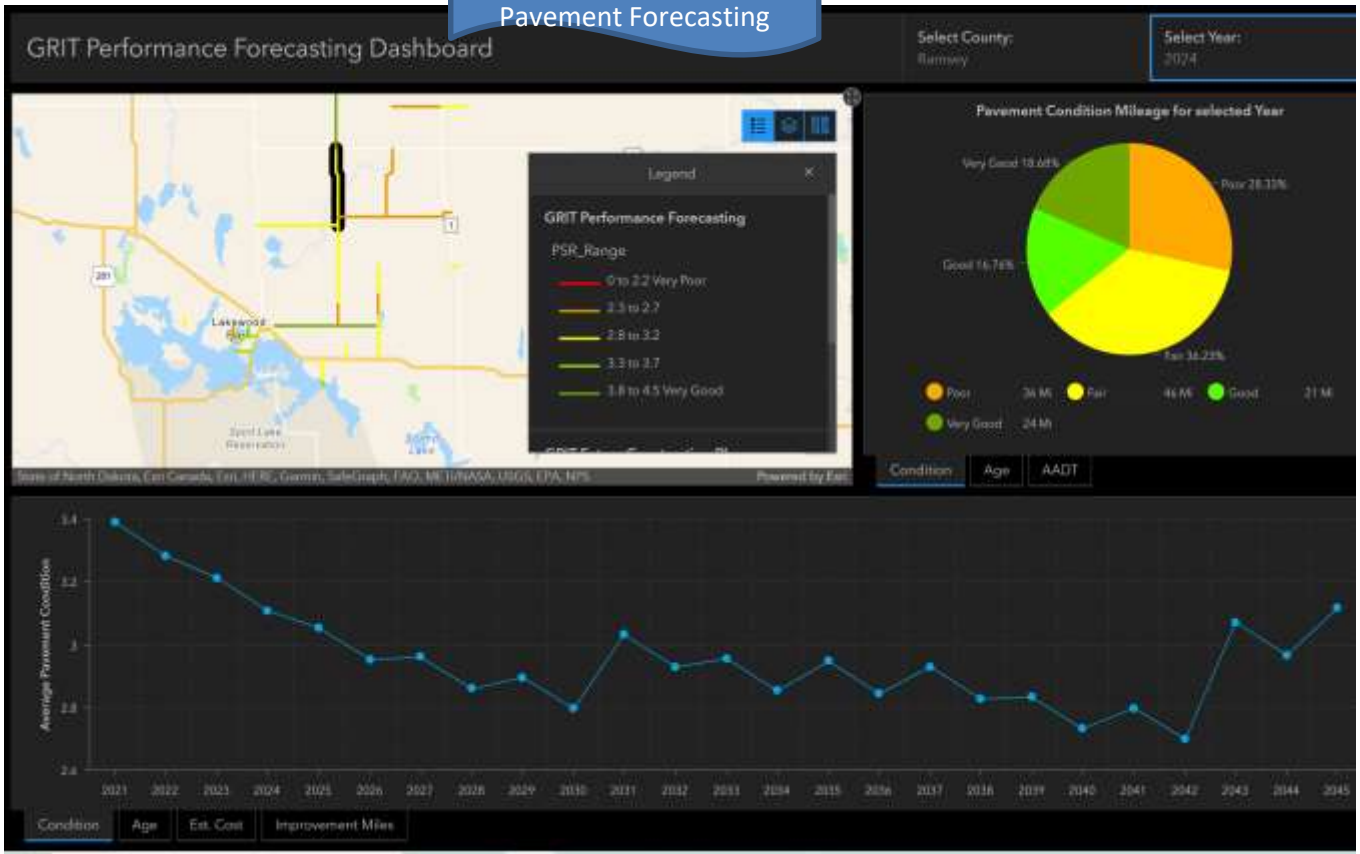
Dashboards

Pavement Forecasting



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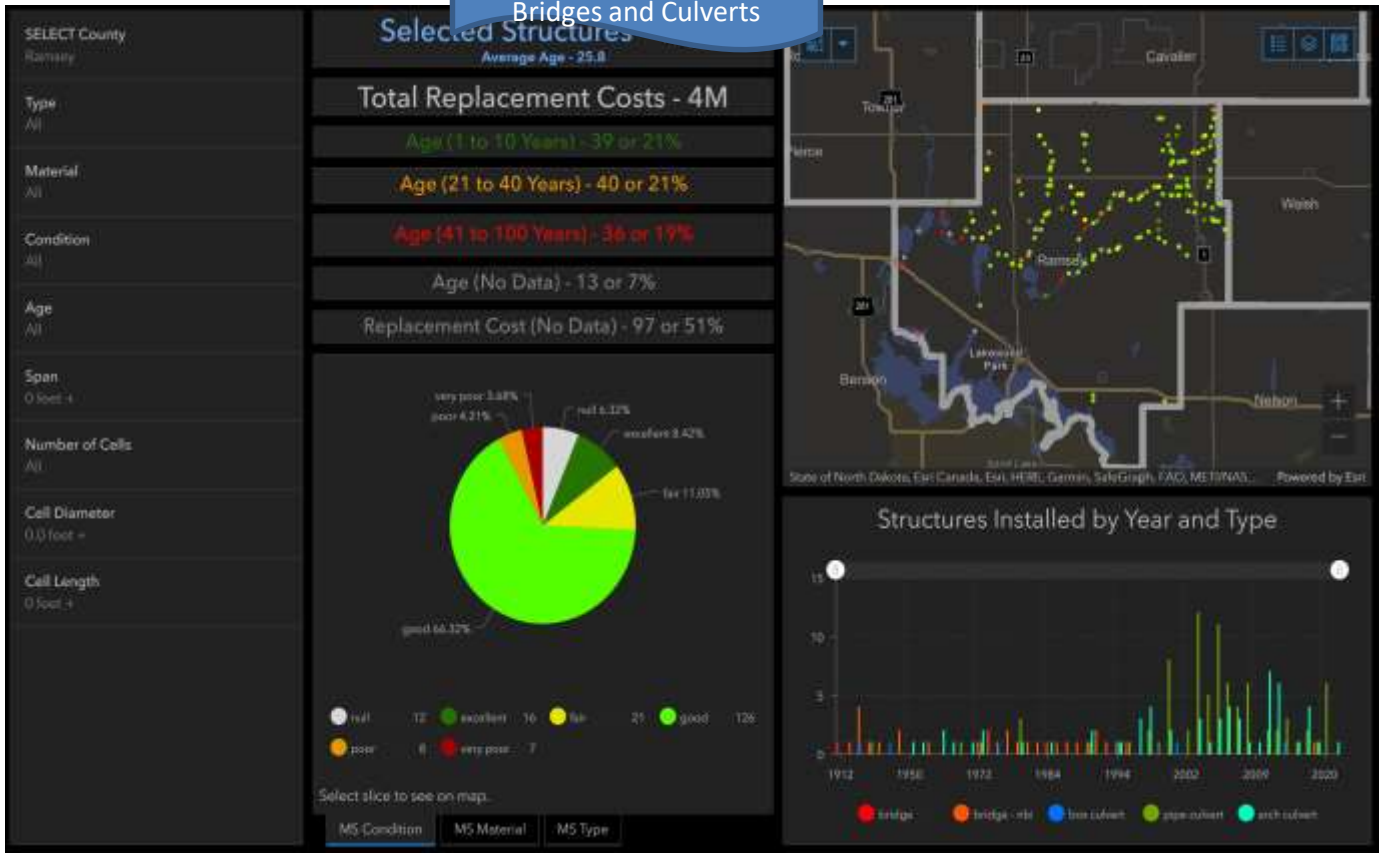
Dashboards

Bridges and Culverts



Artificial Intelligence / Machine Learning

- Major advancements in all industries
- Many low cost sensors for Transportation
- AI/ML will allow continuous monitoring and information extraction in real-time
  - Volume, classification and Speed
  - Crashes and stopped veh
  - Road condition
  - Construction/maint
  - Pedestrians
- Training AI models
- Apps to run on cams

TRANSPORTATION LEARNING NETWORK

A DYNAMIC LEARNING PARTNERSHIP

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TLN

MOUNTAIN PLAINS CONSORTIUM

TRANSPORTATION CURRICULUM COORDINATION COUNCIL

nhi national highway institute 50TH ANNIVERSARY

Commercial Vehicle Safety Center

ATSSA SAFER ROADS SAVE LIVES

ARTBA American Road & Transportation Builders Association

ASCE AMERICAN SOCIETY® OF CIVIL ENGINEERS

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NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

PARTNERS

TEAM

TLN PLANNING COMMITTEE

TLN EXECUTIVE COMMITTEE

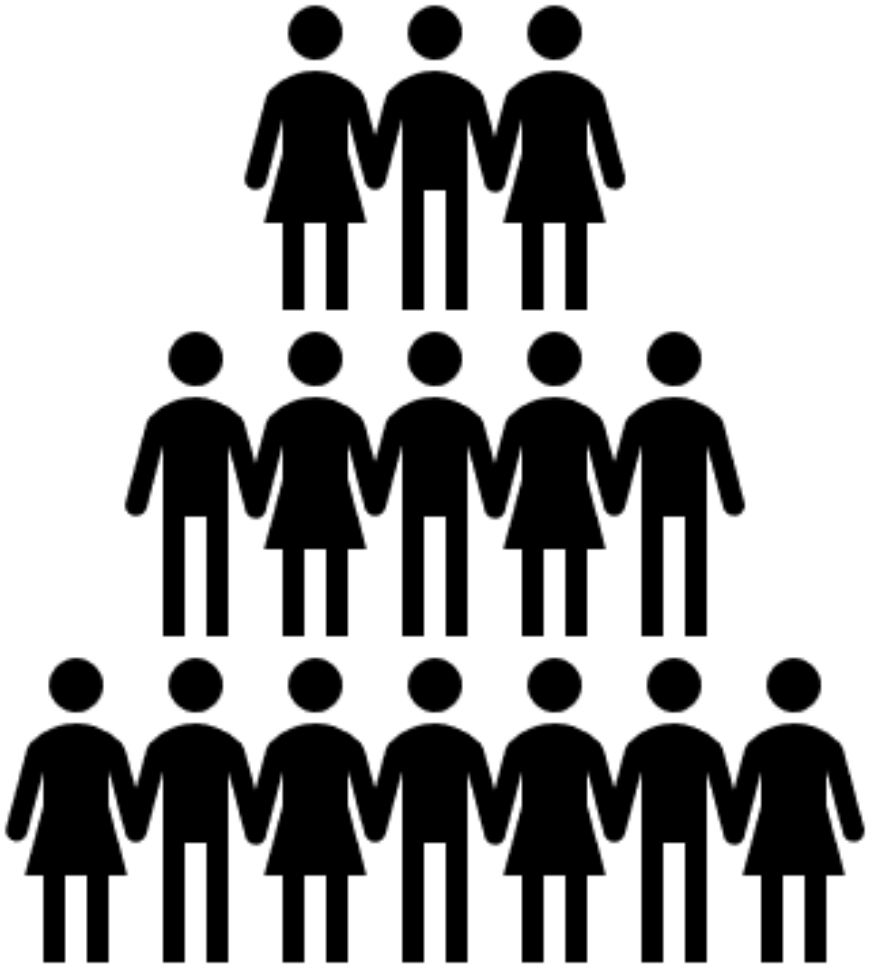
DISTANCE BASED LEARNING


TRAINING SEASON

42

EVENTS

37



3700

PARTICIPANTS

LMS


EXPERIENCE
25
YEARS
EXPERIENCE


DO SOMETHING GREAT

DON'T FORGET TO BE AWESOME!

Small Urban and Rural Center on Mobility (SURCOM)

UGPTI Advisory Council Meeting - October 6, 2022

Jill Hough, Program Director

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Vision: To be an internationally distinguished center for providing research and education for improving mobility in small urban and rural communities.

Mission: To be an innovative research, education, and outreach center providing mobility solutions to small urban and rural communities.

Team Members

Jill Hough, Ph.D. – Program Director
Hamad Al Qublan, Ph.D. – Post Doc Research Specialist
Ranjit Godavarthy, Ph.D. – Associate Professor
Jeremy Mattson, Ph.D. - Assistant Professor
Dilip Mistry, Ph.D. - Data Scientist
Del Peterson - Associate Research Fellow
Zhila Dehdari – Graduate Research Assistant
Antonio Molina - Graduate Research Assistant
Mohsen Momenitabar - Graduate Research Assistant
Bright Quayson - Graduate Research Assistant

Current Partners

UTC – Small Urban, Rural Tribal Center on Mobility (SURTCOM) in partnership with Montana State University (lead) and Eastern Washington University
North Dakota Department of Transportation
Minnesota Department of Transportation
National Rural Transit Assistance Program (NRTAP) – in-kind match
Community Transportation Association of America (CTAA) – in-kind match
KFH for NCHRP Project
Various State Transit Associations and DOTs

Recently Completed Reports

- An Analysis of NHTS Travel Behavior Data for Transportation-Disadvantaged and Rural Populations
- Veteran Mobility and COVID-19
- Rural Transit Fact Book 2022
- Food Access and Food Delivery Service an Exploratory Study for the Role of Public Transportation During the COVID-19 Pandemic in 2020-2021
- Book Chapter - Public Transportation Ridership Patterns: Past, Present, and Possible Future Trends
- Pedestrian User Experience at Roundabouts

Draft Reports

- Understanding How Bicycle Facility Characteristics and the Built Environment Influence Bicycle Use in a Small Urban Areas: Case Study of Fargo-Moorhead
- Interest of Shared Mobility and Emerging Vehicle Technologies in Rural America

Current Tribal Related Projects

- Improving Public Transportation in Rural Areas and Tribal Communities (NCHRP)
- Impact of Transportation Service on Food Access for Native American Tribes in North Dakota (MPC)
- Shared Use Mobility for Tribal Areas (UTC - SURTCOM)

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Current Research Projects

Comparing Public Transportation Service for Rural States (NDDOT)

Impacts of Transit on Health in Rural & Small Urban Areas

Utilizing Public Transportation to End Food Insecurity in the Rural and Small Urban Area by Providing Better Access: A Case Study of Rural Counties in North Dakota

Designing an Electric Transit Bus Network

Workforce Development & Succession Planning

eTool and Web App

Rural Transit eTool

Purpose of this eTool is to serve as a national resource for statistics and information on rural transit in America. This Transit eTool can be used by agency managers, local decision makers, state directors, the FTA, and lawmakers to assist in policy making, planning, managing operations, and evaluating performance.

https://www.ugpti.org/surcom/resources/transit-etool.php

State of Good Repair

This application will determine the current conditions of the revenue vehicles, predict when they need to be replaced, and determine the funding needed to replace them in a future year to maintain the state of good repair.

https://www.ugpti.org/surcom/resources/sgr.php

Outreach

- Reports are posted on the Website www.ugpti.org/surcom and include
  - Executive Summary
  - Final Report
  - YouTube video
  - Blog post
  - Social Media

Training

Advanced Transit Professional Certificate

- Transit I – The Foundations
- Transit II – The Pillars

In 2020 we moved to more eLearning

10 courses hosted at elearning.nationalrtap.org

- ✓ *Performance Appraisals*
- ✓ *Onboarding*
- ✓ *Employee Recognition*
- ✓ *Transit Interview Questions*
- ✓ *Financial Management Basics*
- ✓ *FTA 101 – An Introduction to the Federal Transit Administration*
- ✓ *Strategic Planning*
- ✓ *Crisis Management*
- ✓ *Grant Writing*
- ✓ *Customer Service*

Questions?

Thank you!!!!

Contact: jill.hough@ndsu.edu

Rural Transportation Safety and Security Center (RTSSC)

Highlights

Kimberly Vachal

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RTSSC Scope

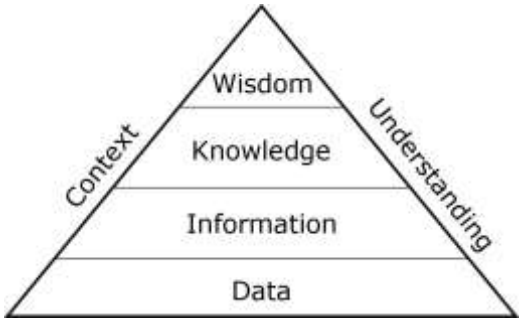
- Research and Outreach
  - Program evaluation
  - Data quantity/quality and decision-maker support
  - Exploratory analysis, POC/pilot, risk modeling
- Human behavior with engineering/environmental factors
- Evidence-based and innovative strategies
- Leverage support/funding to conduct research

RTSSC Emphasis Areas

- Lane Departure
- Intersections
- Alcohol and/or Drug Related
- Unbelted Vehicle Occupants
- Speeding/Aggressive Driving
- Young/Aging Drivers

VISION ZERO
Zero fatalities. Zero excuses.

…Local Roads!



RTSSC Team & Projects

- *Team: Seguy, Jaclyn, Judge John, Satpal, Kelly, GRAs*
- Assessment
  - Observed & Self-Reported Surveys
  - Impaired Driving Investigations
  - High-Risk Driver Groups
- Research
  - Novice Drivers, Recidivism Risk, Lane Departure
  - Local/Rural Road Safety
  - Large Truck Safety
- Education/Outreach

Photo Facebook, Traffic Safety

Questions/Comments

NDLTAP - Dale

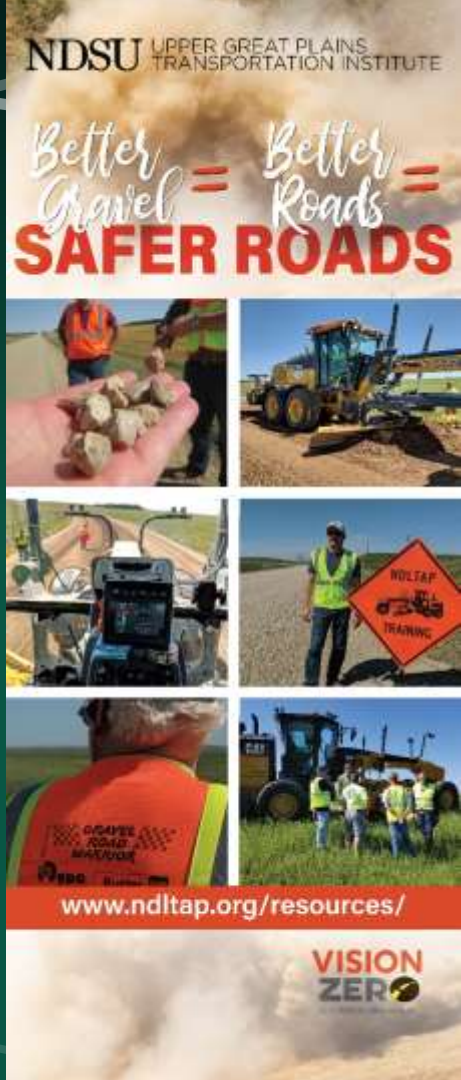
- ND Local Technical Assistance Program (NDLTAP)
- Western ND Transportation Liaison program
- Township Transportation Funding Program

North Dakota Local Technical Assistance Program (NDLTAP)

NDLTAP Update

UGPTI Advisory Council Meeting
October 6, 2022

Dale C. Heglund, North Dakota LTAP Director
701-318-6893 – dale.heglund@ndsu.edu



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53 counties
1,360 organized townships
355 communities

WESTERN DAKOTA ENERGY ASSOCIATION

THE ASSOCIATED GENERAL CONTRACTORS North Dakota

NORTH Dakota | Transportation
Be Legendary.

U.S. Department of Transportation Federal Highway Administration

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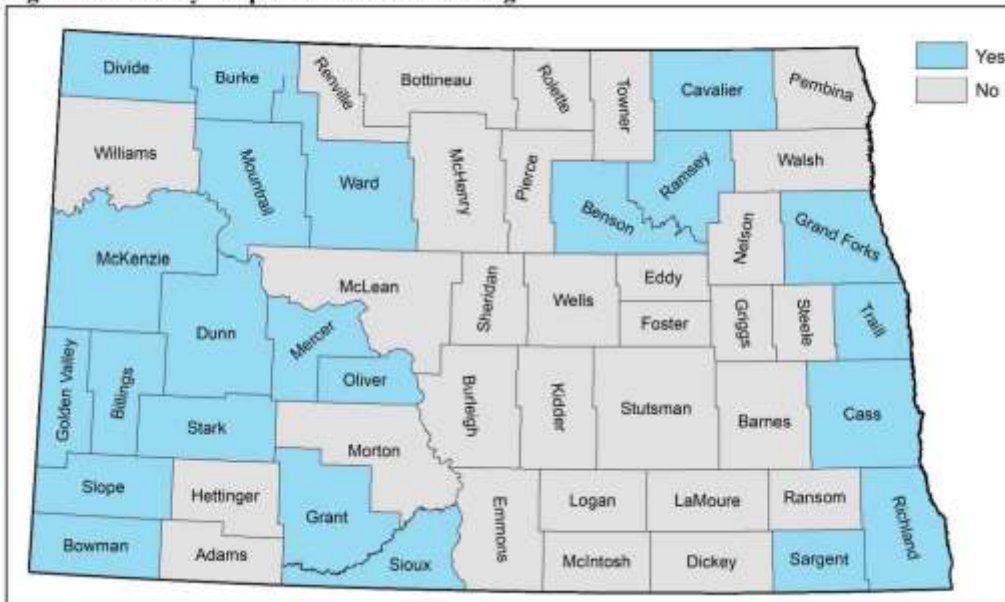
Scotty Satermo, MHA

NDLTAP Advisory Board Member

gure 19. Survey Responses to Gravel Specifications

NDLTAP
NDSU
GRAVEL ROAD WARRIOR

Figure 20. Survey Responses to Gravel Testing



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CAT

Greetings from the NDLTAP Team



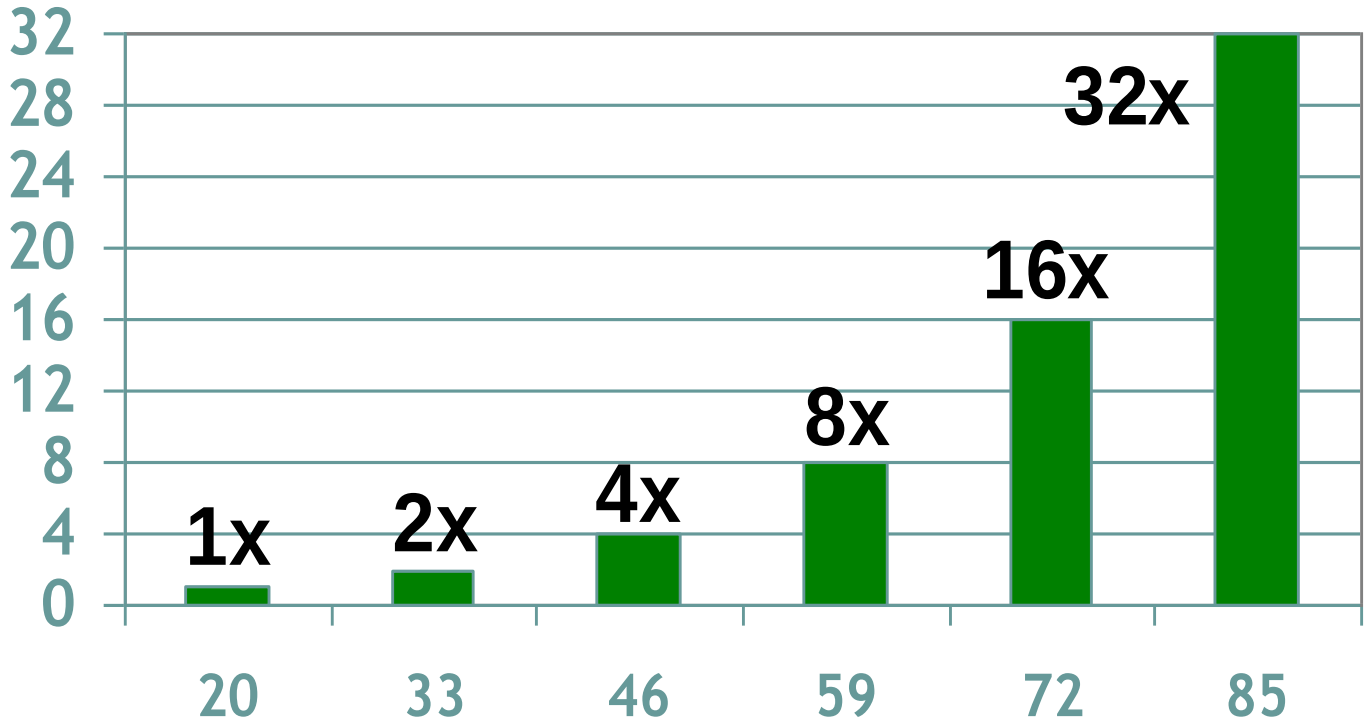





NDSU UPPER GREAT PL
TRANSPORTATIO

Learn – Implement
Calls to Action – Creating Change

Older Driver Vision



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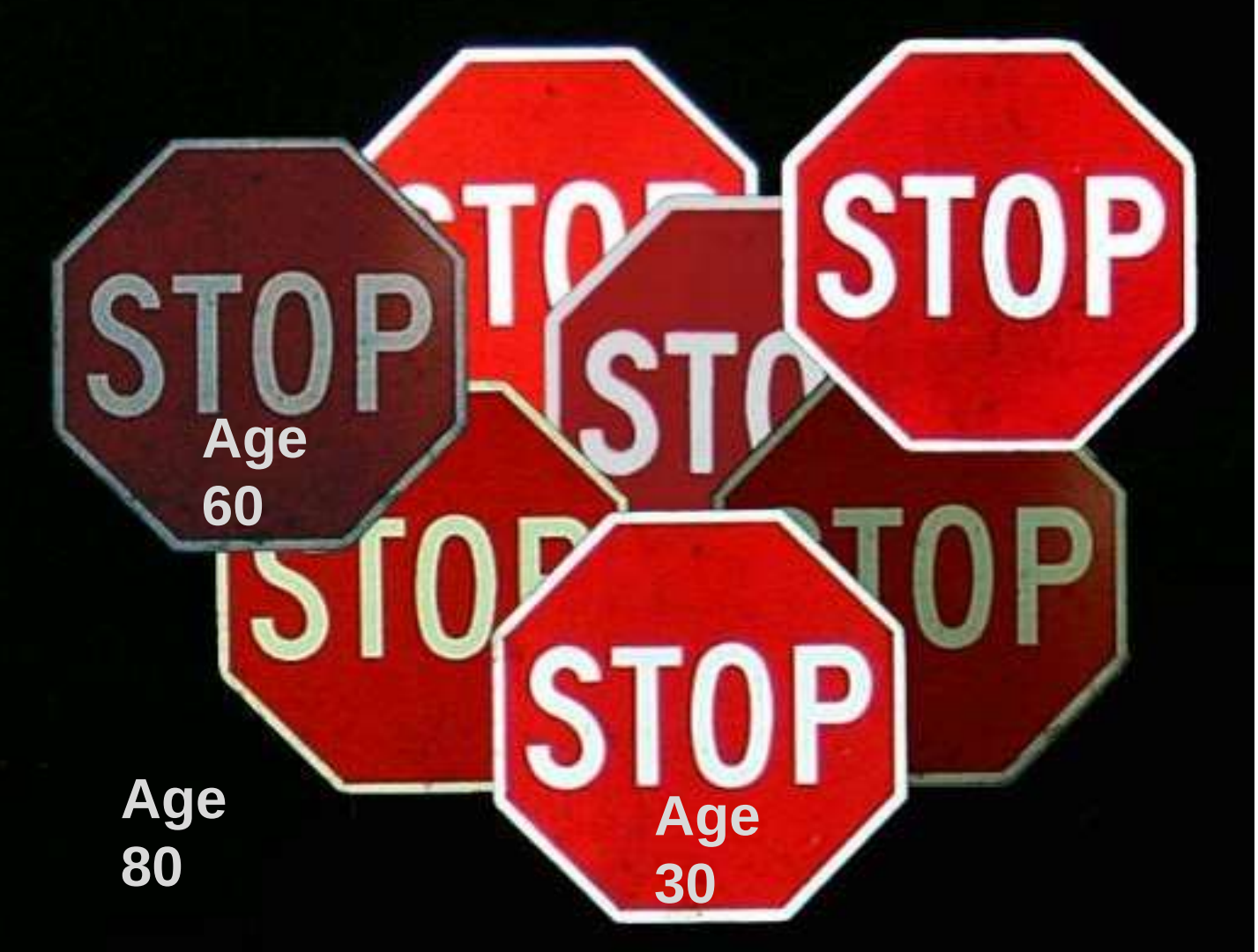
STOP
STOP
STOP
STOP
STOP
STOP
Age
60
Age
80
Age
30


BOTS
ON THE GROUND
NDSU | NDLTAP

My Favorite Quote

“Cracks need to be sealed, because where I come from water can’t jump.”

Tom Wood, Astech

NDSU


VISION
ZERO
Zero fatalities. Zero excuses.


7615
7615
7615
ANSF


R
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TRUCK
ROUTE


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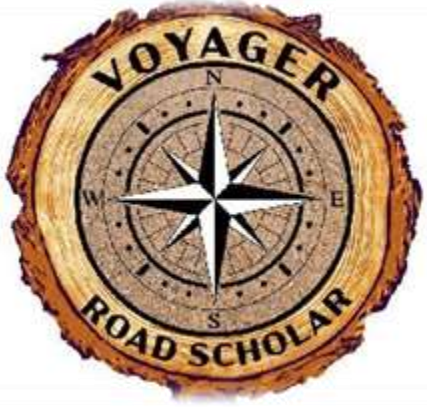
2021 CONTEST
INNOVATION
CHAMPIONS
ROAD TO
INNOVATION

Road Scholar 2023



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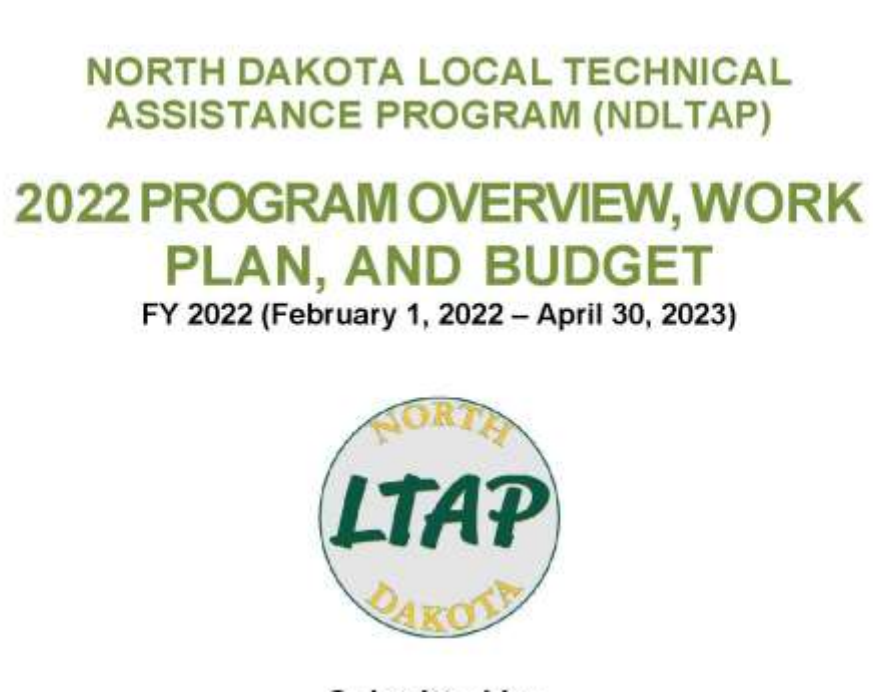
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM


NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM (NDLTAP)

2022 PROGRAM OVERVIEW, WORK PLAN, AND BUDGET

FY 2022 (February 1, 2022 – April 30, 2023)

NORTH LTAP DAKOTA

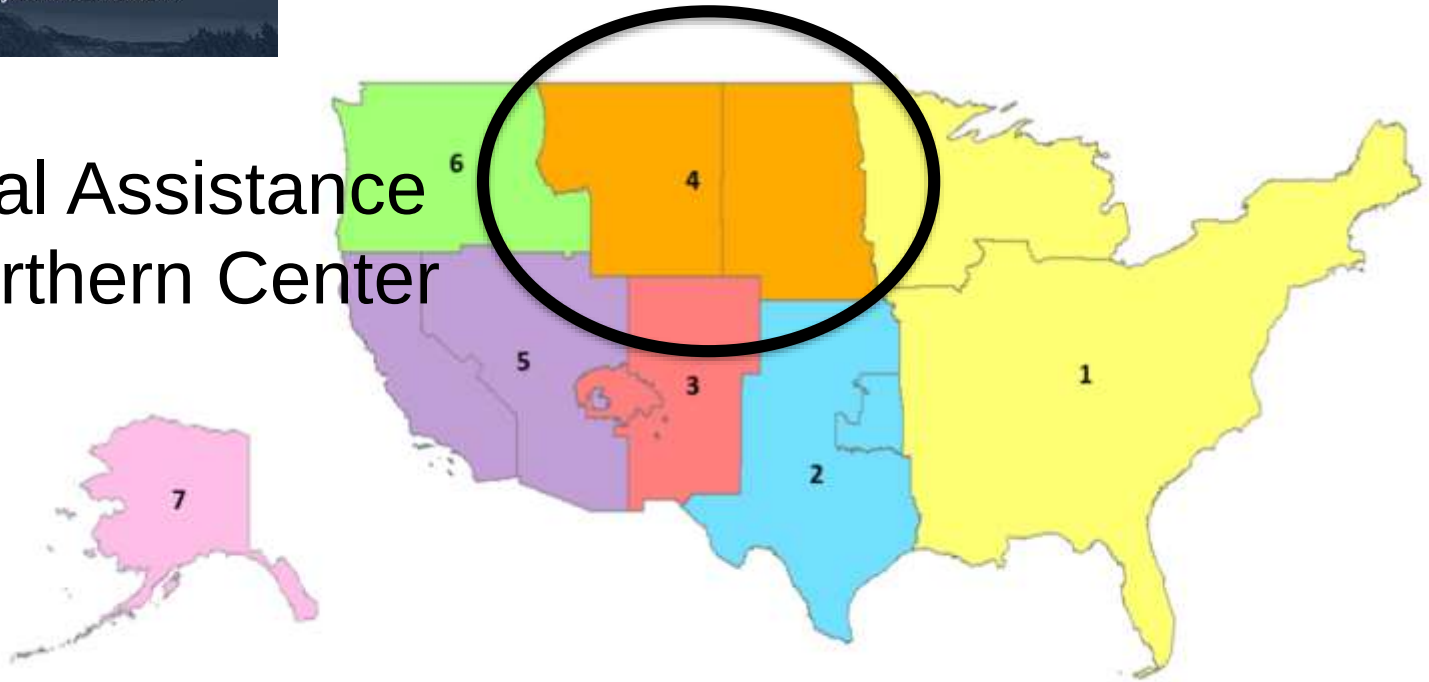
Funding Update

- FHWA $150k
- NDDOT $150k

2023 Increases!

- FHWA $210k
- NDDOT $210k

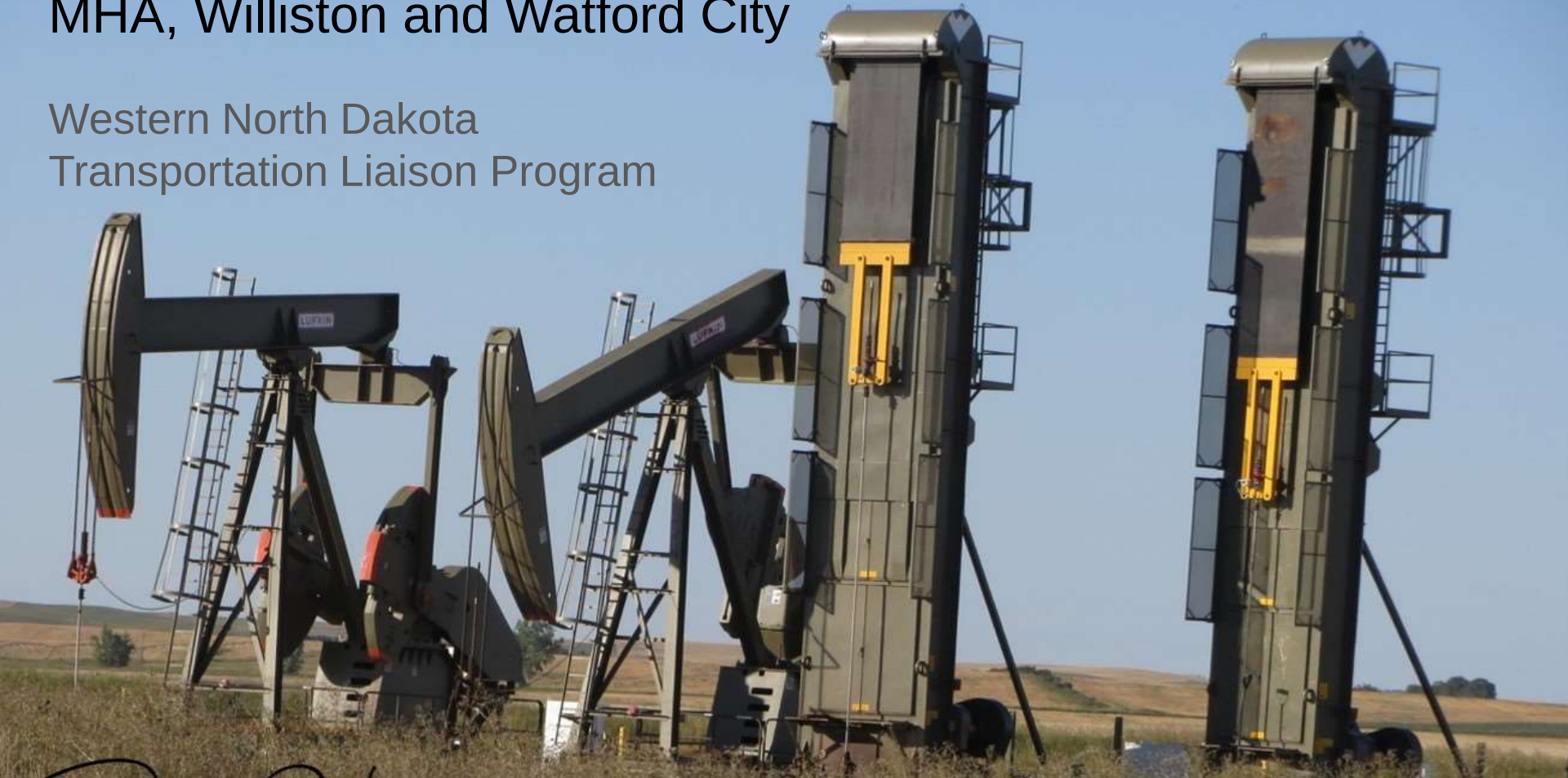
Tribal Technical Assistance Program – Northern Center



4. Northern TTAP Center	**Rocky Mountain** **Great Plains**	**5 States:** MT, NE, ND, SD, WY	***North Dakota State University (NDSU)***

Oil Country – Mountrail, Dunn, McKenzie, Williams, MHA, Williston and Watford City

Western North Dakota
Transportation Liaison Program



UGPTI Transportation Liaison Staff Added in ND Oil Patch

Posted: Sep 25, 2020

Pictured: Matthew Johnson(left), Ed Ryen(right)

Two transportation experts were recently added to the staff of NDSU's Upper Great Plains Transportation Institute to assist with local transportation planning and investments in Dunn, McKenzie, and Williams Counties and with the Mandan Hidatasa Arikara Nation. Matthew Johnson and Ed Ryen will be located in Williston and affiliated with UGPTI's ND Local Technical Assistance Program in Bismarck.

Matthew Johnson is the Western ND Transportation Liaison. He has more than 26 years of experience in the transportation industry, serving as a project engineer with Wold Engineering in Bottineau. He operated his own construction engineering firm, MJ Consulting from 2018 to 2020. Johnson will help local officials plan and enhance their regional efforts and transportation investments.

Ed Ryen is the Western Transportation Liaison. He has more than 40 years in transportation engineering, bringing valuable knowledge in construction, bridge inspections, planning, emergency operations and highway technology. In his role he will assist in further implementation of the Wise Road Weather station and the Toward 365 project. He will also assist with project and regional planning, help with the Geographic Roadway Inventory Tool (GRIT) data entry, and share best practices with local governments in the region.

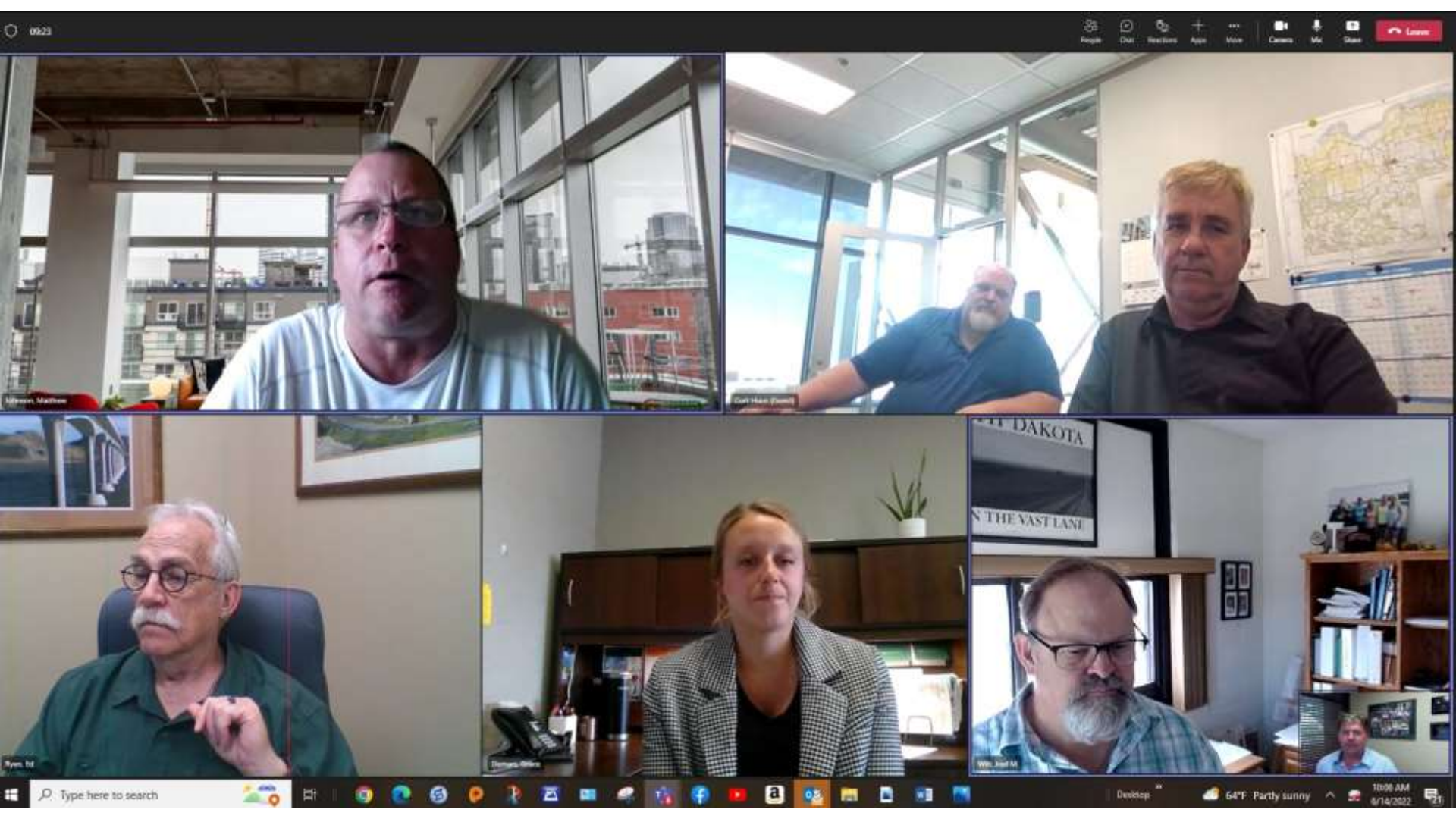
Western Objectives

- Advance Transportation Planning
- Network Connectivity
- Nurture Multi-juristictional Project Development
- Tribal Assistance
- Asset Management Development

Key Success

Enhanced collaboration between county, tribe, township, city and state

One Roadway Network


09:23
People
Chat
Reactions
Apps
More
Camera
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Share
Leave
DAKOTA
THE VAST LAND
Type here to search
Desktop
64°F Partly sunny
10:06 AM
6/14/2022


Gravel
Bituminous
Concrete
AST
Composite
Not Available
Roseglen
White Shield
FORT BERTHOLD RESERVATION
Missouri River
Lake Sakakawea
FORT LARAMIE TREATY
1851 1951
MANDAN · HIDATSA · ARIKARA · NATION

Matt Johnson, PE

Service Award

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

New Weather Stations Proactively Tackle Disruption in the Industry

NDAWN Center
North Dakota Agricultural Weather Network

This weather station was installed last fall at Antelope Creek in McKenzie County during phase two of the project.

WISE ROADS

LoadPass PERMITS

An Automated Permit and Routing System for Oversize and Overweight Vehicles/Loads traveling on ND County, Township and City Roads.

(by Leanna Emmer, NDLTAP)

LoadPass Permits (aka ND Uniform County Permit System) is an automated permit and routing program used by ND counties and cities. It is used to regulate the movement of oversize and overweight vehicles and loads traveling on ND county, township, and city roads.

*Effective 1/25/2022

Township Transportation Funding Program HB 1015

Kenneth Steiner

NORTH Dakota | Transportation
Be Legendary.™

Les Noehre

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

NDTOA North Dakota Township Officers Association

Township Transportation Funding Program

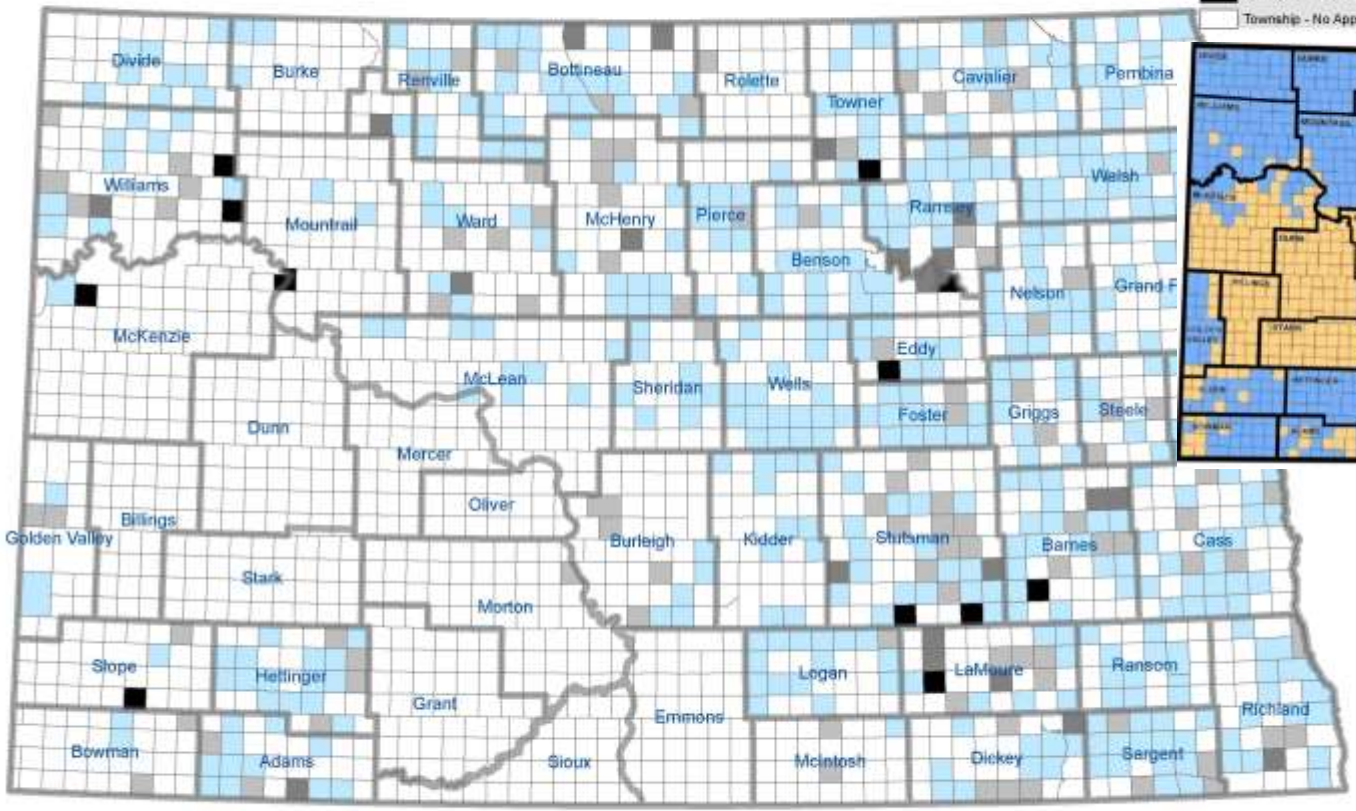
- Legislative Foundation – **HB 1015**
  - $10 million in State Funds

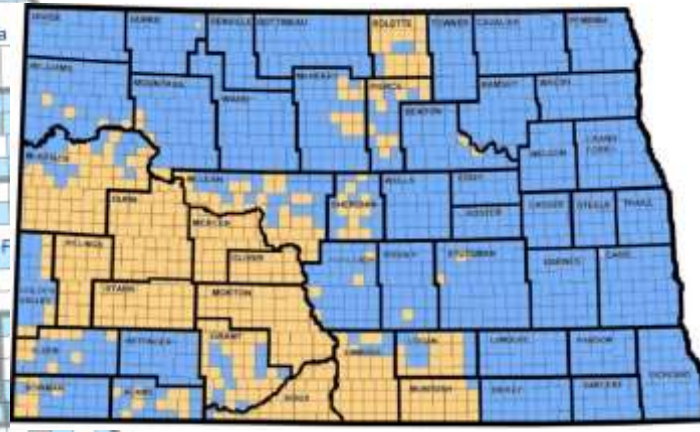
Township Transportation Funding Program

- **Preliminary Concepts/Eligible Projects**
  - Multi-township-based **corridor improvements** such as gravel improvements of structural nature
    - Need to be in excess of 3.0 inches thick with engineered and tested gravel meeting NDDOT specifications for surfacing gravel.
  - **Bundling of minor structure improvements** across a multi-township area.
  - **Roadway flood resiliency improvements** so the roadway meets the logical design “Q” of the pipes along the corridor.
  - **Signing improvement** projects for elevating safety across a multi-township region.


The Strength of the Herd
is the Bison
The Strength of the Bison
is the Herd!
Kenneth Stoner (Guest)
Fuchs, Bryson L.
Horner, Timothy

ND Township Grant Funding Applications
2022





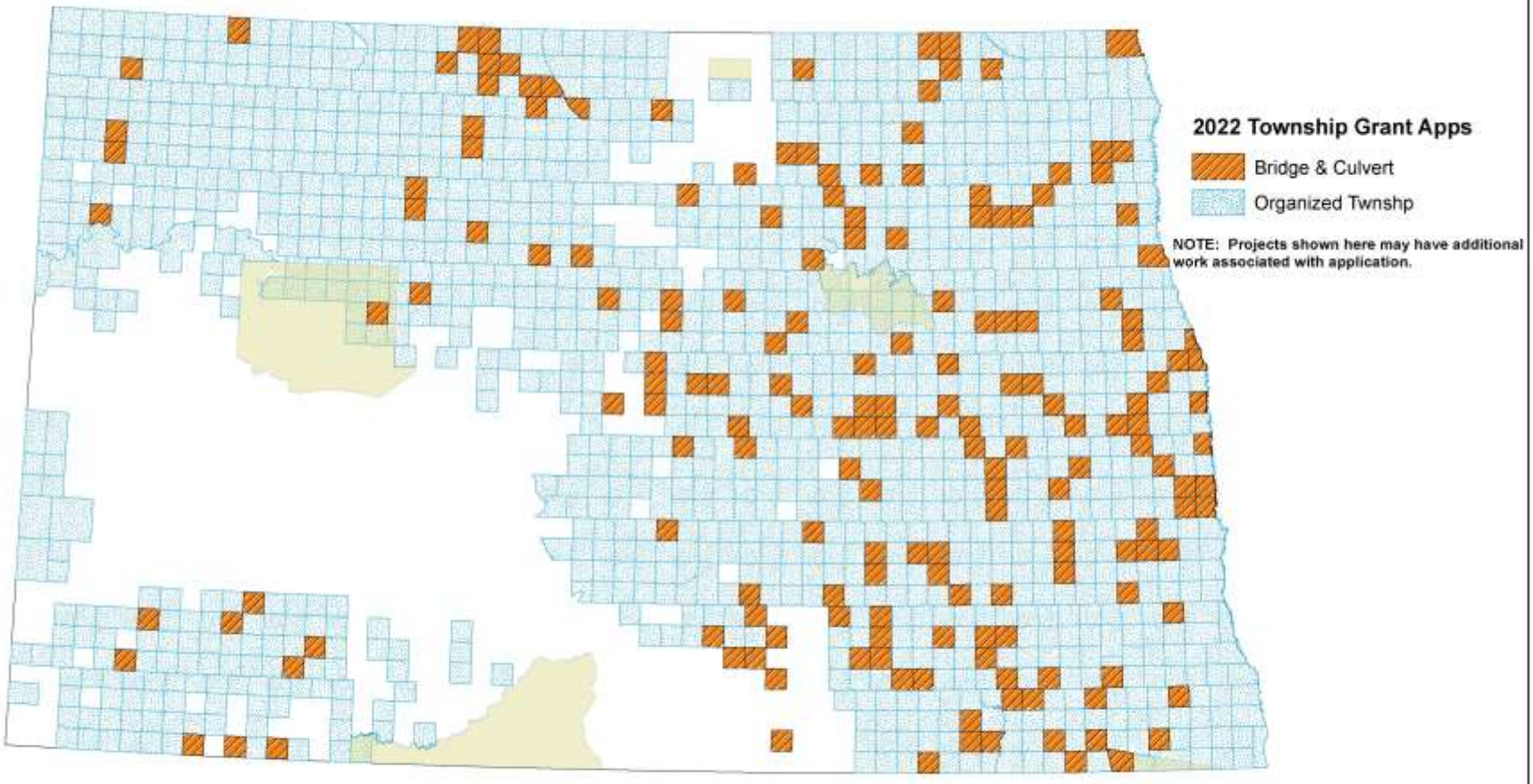
County Boundry

Township Grant Apps

Cost Estimate

- 200 - 100,000
- 100,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 12,000,000
- Township - No App

Prepared by:
UGPTI - DOTSC
6/7/2022



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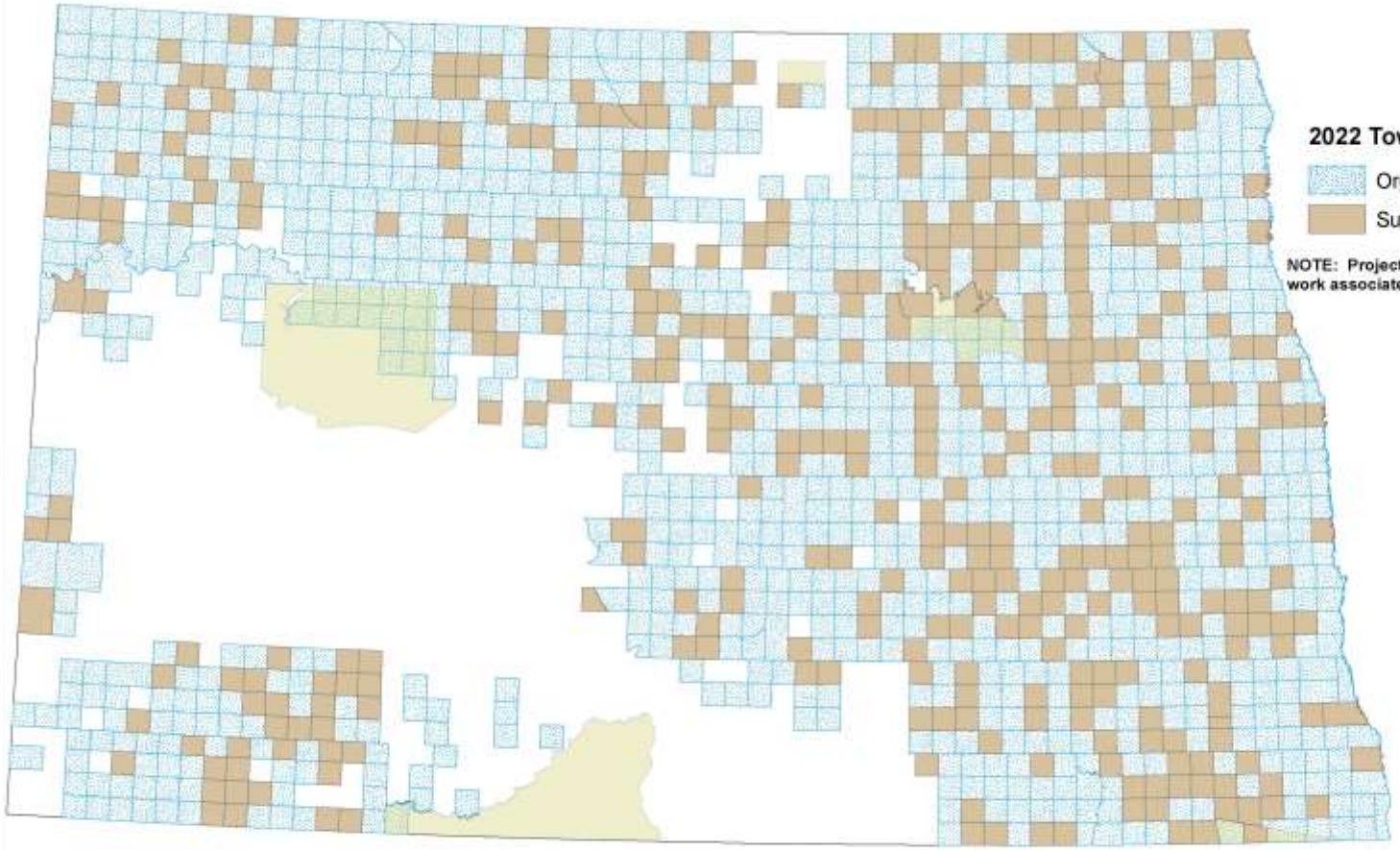
STATE NEWS

Oklahoma couple dies after trying to cross Cannonball River in truck

by: Brooke Williams
Posted: May 2, 2022 / 05:18 PM CDT
Updated: May 2, 2022 / 05:19 PM CDT



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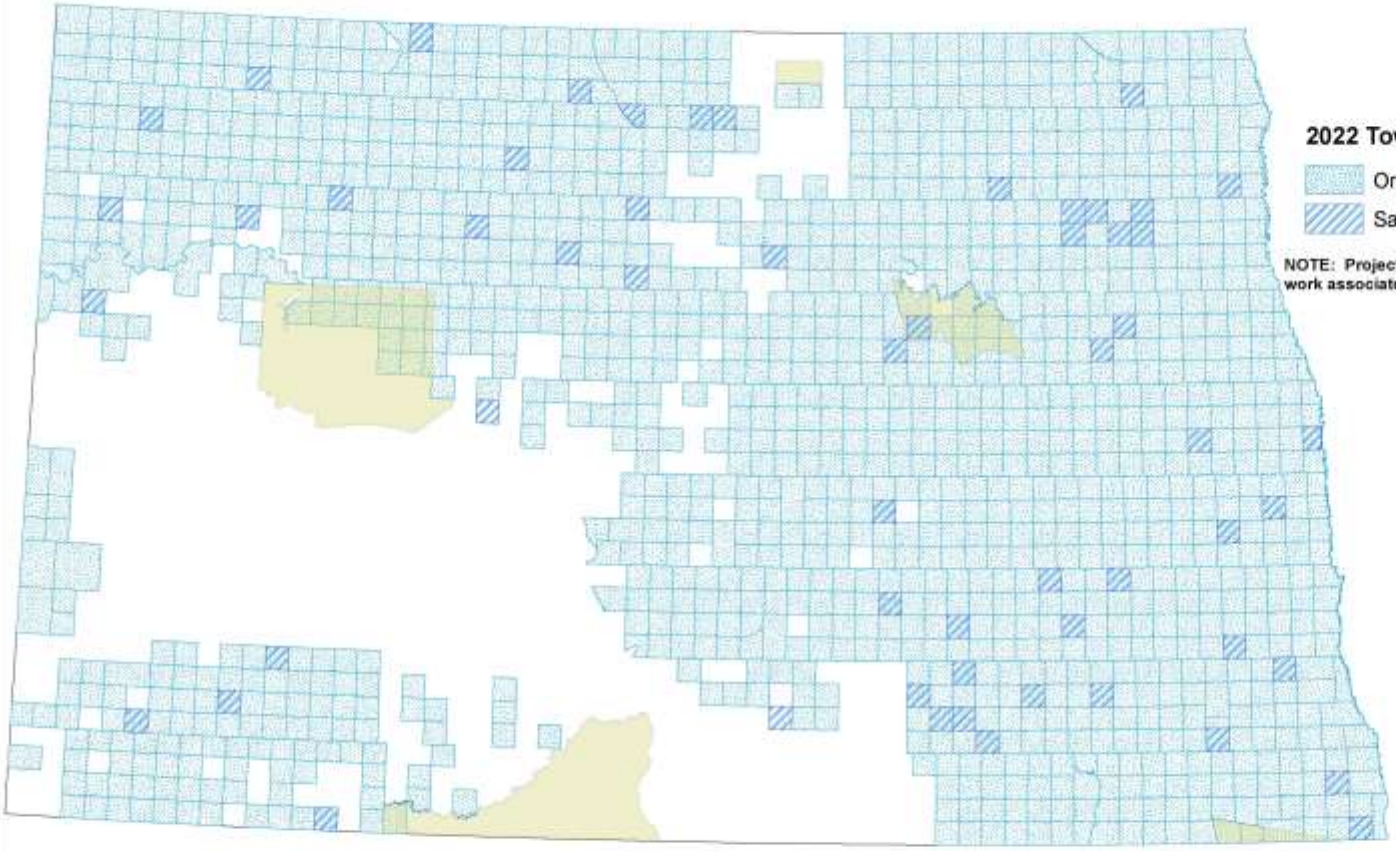
160H



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Infrastructure Needs:

County, Township and Tribal Roads and Bridges: 2022-2041

Alan Dybing

Advanced Research Fellow

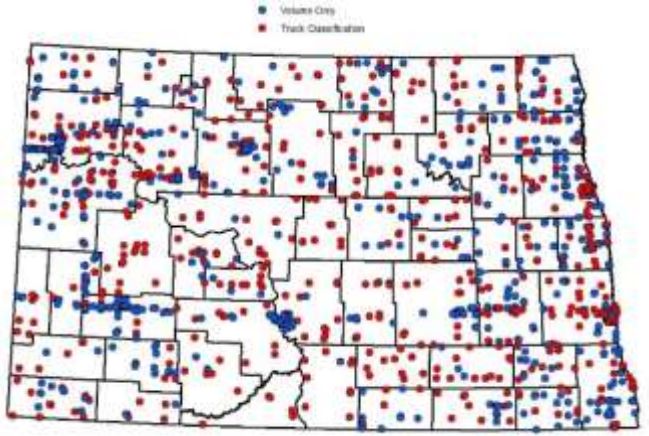
NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Study Objective

- Estimate the funding needs to maintain the existing road system over the next 20 years

Study Components

- Traffic Model
  - Key component for modeling pavement and gravel needs
    - Gravel – higher traffic results in more frequent maintenance
    - Paved – design is based on ESALs, higher traffic results in thicker pavements and accelerates deterioration
  - Based upon traffic generators, destinations
    - Agricultural Traffic
    - Oil Related Traffic
  - Calibrated using traffic counts



Study Components

- Unpaved Roads Costing
  - Statewide county and township survey
    - Component Costs
    - Practices at different traffic levels
    - Blading
    - Regraveling thickness and frequency
    - Dust suppressant and base stabilization
  - Establish annual per-mile costs by traffic category, county and jurisdiction

Study Components

- Pavement Model and Cost Projection
  - Data Collection
    - Pavement condition
    - GRIT – county entered data
    - Existing roadbed strength
  - Analysis (AASHTO 93)
    - Forecast pavement deterioration and improvement timing
      - Overlay
      - Reconstruction
      - Widening

Study Components

- Bridge Model and Cost Projection
  - Utilizes National Bridge Inventory System (NBIS) data
  - Development of Bridge Needs Target (BNT) to evaluate bridge condition to estimate improvement and maintenance costs
  - Developed with the assistance of a panel of county engineers

Study 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**

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%**

Upcoming Study

- Focus on model maintenance rather than redevelopment during each biennium
- Centralized data hub
  - Traffic counts from multiple sources
    - Traffic model output
    - Traffic prediction model
  - GRIT data
  - Cost and condition data

Upcoming Study

- Model maintenance (continued)
  - Streamline trip generation data updates
  - Automate traffic updating and network processing
  - Scenario analysis
- County road superintendent meetings
  - Verify jurisdiction/ownership/maintenance responsibilities
  - Identify county-specific issues and determine regional impacts
  - Identify traffic generators
    - Recent changes and potential facility location

Questions?

Alan Dybing

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701.231.5988

https://www.ugpti.org/downloads/road_needs/

Agricultural Activities

- ND Ag Producer Support in Transport/Logistics
  - ND Grain Movement Database (Jaclyn/Patrick)
  - Annual Elevator Transportation Survey
  - Rail Market Information
  - Market Developments and Trends
  - Containerized Grain Investigation
- USDA (Al/Megan/Bev)
  - Basis map & periodic rail grain market (adding tariffs)
  - *Quarterly grain truck market survey*
- *Central Region Farm Truck Survey (Al)*

Transport Technology Research

Surface Mobility Applications and Real-Time Simulation Environments (SMARTSe)

Raj Bridgelall
Co-PI: Denver Tolliver
Collaborations: CVSC, SURCOM, ATAC
Editing: Tom Jirik, Patrick Nichols

Graduate Research Assistants

Bhavana Bhardwaj, Ph.D.
Graduated Summer 2022

Neeraj Dhingra, Ph.D.
Graduated Summer 2022

Taraneh Askarzadeh
MPC 665 (Drones/AI)

Seguy Tchakounte-Wakem
MPC 666 (Drones/Logistics)

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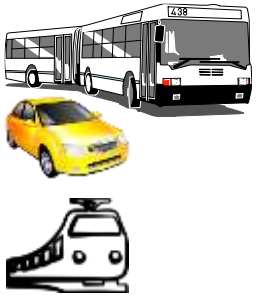
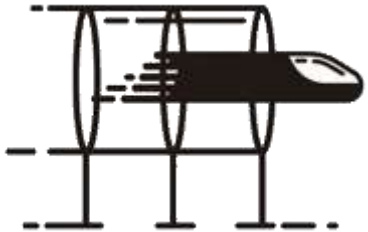
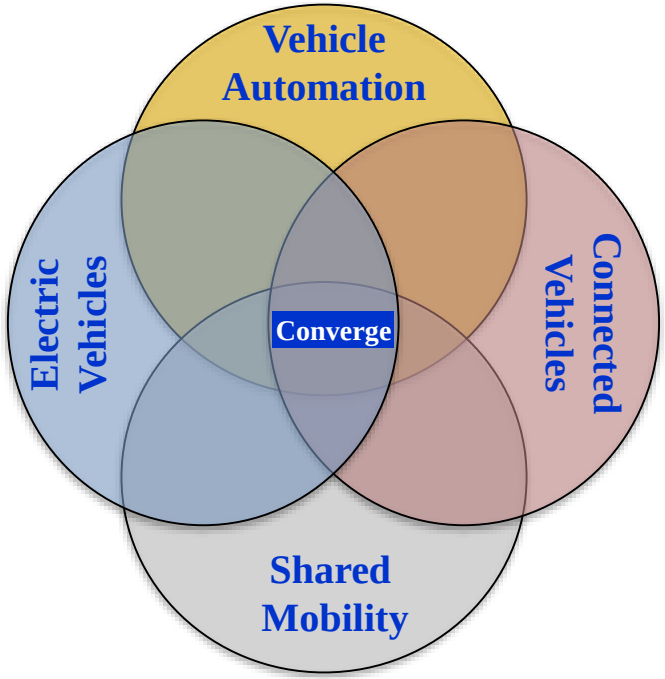
Emerging Transportation Technologies

Passenger Vehicles

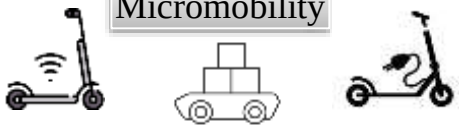


Hyperloops





Micromobility



Freight Vehicles

Passenger & Delivery Drones

Research Questions

Source: FHWA (2022)

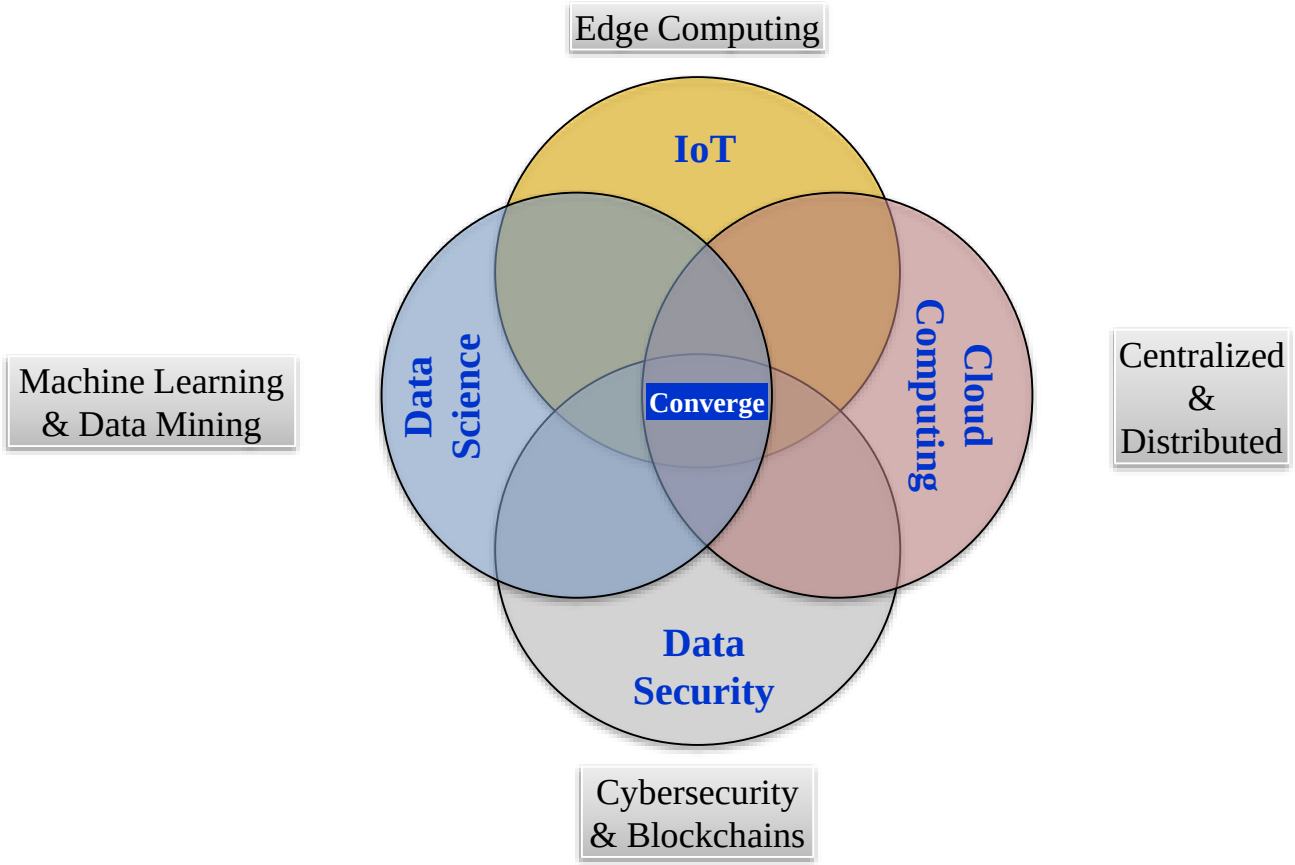
Safety

- What must be in place for connected and autonomous vehicles (CAVs) to eliminate accidents?
- How safe is vehicle platooning?
- How safe is mixed levels of vehicle automation?

Mobility

- Will CAVs eliminate or cause more congestion?
- Should AVs have their own lane?
- Will autonomous trucks reduce cost?
- How practical is truck electrification?

Emerging Information Technologies



Drone Opportunities and Challenges

Source: DHL (2022). Unmanned Aerial Vehicles in Logistics.

Source: Unmanned Systems Technology (2022). Nordic Unmanned partnered with BNSF to test the Staaker Railway Drone for infrastructure inspection and general data acquisition.

Sample of Research Products

Transportation Technology & Planning

- Introducing an Efficiency Index to Evaluate eVTOL Designs. *Technology Forecasting and Social Change.*
- Characterizing Ride Quality with a Composite Roughness Index. *IEEE Transactions on Intelligent Transp. Systems*.
- Budgeting the Adoption of Sensors on Connected Trains. *Transportation Planning and Technology*.
- Forecasting the Effects of Autonomous Vehicles on Land Use. *Technological Forecasting and Social Change*.
- Model Contrast of Autonomous Vehicle Impacts on Traffic. *Journal of Advanced Transportation*.
- Exploratory Spatial Data Analysis of Traffic Forecasting: A Case Study. *Sustainability*.
- A Cognitive Framework to Plan for the Future of Transportation. *Transportation Planning and Technology*.

Transportation Security

- An Application of Natural Language Processing to Classify what Terrorists Say They Want. *Social Sciences*.
- Using Artificial Intelligence to Derive a Public Transit Risk Index. *Journal of Public Transportation*.
- Applying Artificial Intelligence to Identify Factors Associated with Terrorist Attack Locations. *Security Journal*.
- Applying Unsupervised Machine Learning to Counterterrorism. *Journal of Computational Social Science*.
- Attack Risk Modelling for the San Diego Maritime Facilities. *Marine Policy*.

Transportation Safety

- Railroad Reliability Engineering by Natural Language Processing. *Reliability Engineering & System Safety.*
- Railroad Accident Analysis Using Extreme Gradient Boosting. *Accident Analysis and Prevention*.
- Detecting Pavement Anomalies by Ensemble Connected Vehicle Signals. *International Journal of Pavement Engineering*.
- Signal Feature Extraction and Combination to Enhance the Detection and Localization of Railroad Track Irregularities. *IEEE Sensors*.
- Calibration of Smartphone Sensors to Evaluate the Ride Quality of Paved and Unpaved Roads. *International Journal of Pavement Engineering*.

Questions?

Contact

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408-607-3214

Research Updates and Activities

Infrastructure Management and Safety

Pan Lu

Mountain-Plains Consortium

Upper Great Plains Transportation Institute

North Dakota State University

Pan.Lu@ndsu.edu

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

UGPTI Advisory Council Meeting

Fargo, October 6, 2022

People and Partners

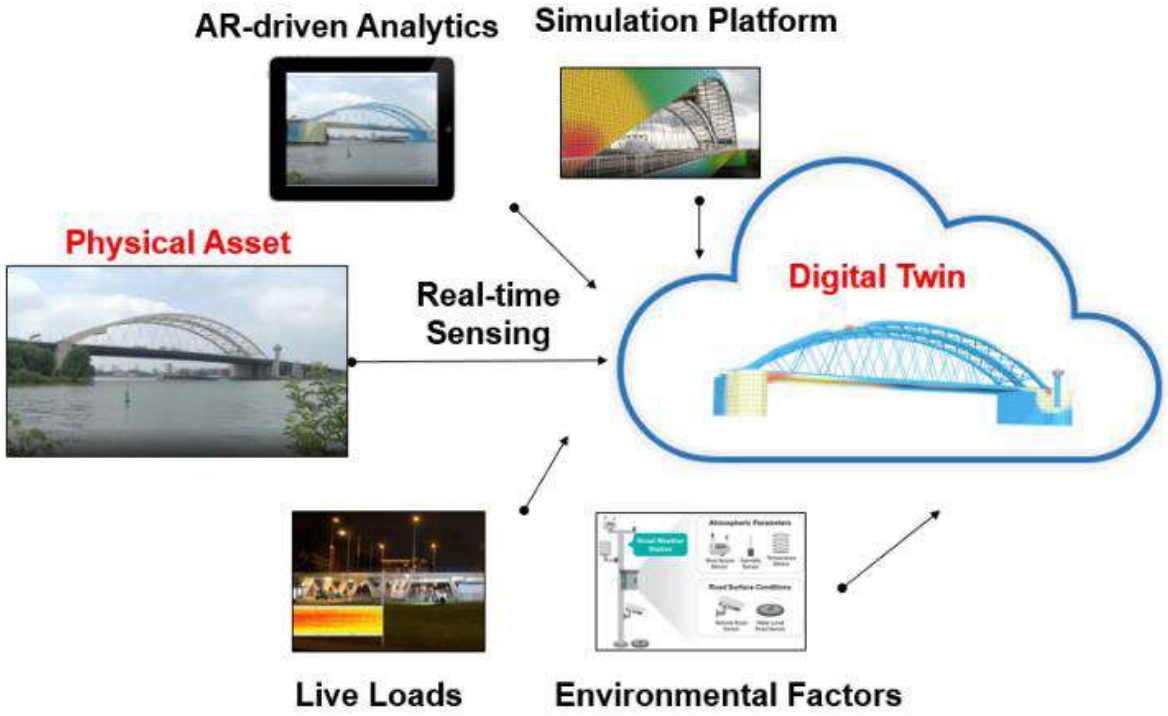
- **Pan Lu, Ph.D. (PI):** Associate Research Fellow / Associate Professor
- **People at UGPTI and NDSU (5 CO-PIs):** Dr. Denver Tolliver, Dr. Raj Bridgelall, Dr. Ying Huang, Dr. Alan Dybing, and Tim Horner
- **Graduate Research Assistants (11):** Jiahui Chong (UndG), Cybele Lemuh (UndG), Hailun Wang (MS), Salman Ahmad (MS), Leonard Chia (PhD), Heshani Manaweera (PhD), Yihao Ren (PhD), Xinyi Yang (PhD), Asad Ali (PhD), Awuku Bright (PhD), and Gul Badin (PhD),
- **Post-Doc Researchers (2):** Jingnan Zhao (Rutgers), and Jianbang Du (Texas Southern)
- **Faculties at other Universities (Federal Proposal Writing):** the Texas Southern University, the Rutgers University, the University of Houston, the University of Utah, the Oklahoma State University, the University of Maryland, the University of Massachusetts Amherst, and the University of Wyoming.
- **Sponsors:** Mountain Plains Consortium (UTC regional center, major financial sponsor), NDDOT (in kind support), National Academy Sciences (NCHRP, financial), Various Universities (collaborators), Minnesota DOT (in kind), Red River Valley and Western Railroad Company (in kind), and Northern Plains Railroad (in kind).

Scope and Focal Areas

- Research and Outreach
  - Exploratory analysis
    - Data-driven decision-maker support
    - Innovative technology application pilot study
- Focal Area
  - Means
    - Big Data Analytics
    - Operation Research
    - Smart Transportation and Infrastructure Health Monitoring with Sensor Applications
  - Area
    - Transportation Safety
    - Asset Management System
    - Smart Transportation

Smart Transportation and Asset Management System

- Describes a real physical asset through sensing technologies
- Generates actionable data-driven management improvement plan through AI model
- Research focus on future asset management using digital technologies and data-driven analytics



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Transportation Safety

- Understand
  - Identify contributor factors
  - Quantify effectiveness of various countermeasures
- Improve Safety Performance/ Reduce Crashes
  - Prioritize hazard locations
  - Improvement Decision Support


Roadside Crash


At-Grade Crossing Safety


Hazmat Involved Crash


Commercial Truck Involved Crash


Work Zone Safety


Pedestrian/Cyclist Safety

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List of Current Active Projects

1. Safety Support System for Highway-Rail Grade Crossing (MPC/UTC)
2. Knowledge-Based Machine Learning for Freeway COVID-19 Traffic Impact Analysis and Traffic Incident Management (MPC/UTC)
3. Sensitivity and Accuracy Assessment of Vehicle Weight-in-Motion System Measurement Errors using In-Pavement Strain-Based Sensors (MPC/UTC)
4. Multimodal, Multistate Corridor Modeling for Long-Distance Movements of Food and Containerized Goods (MPC/UTC)
   - Risk Assessment of Hazardous Materials Transported by Rail
5. MPC Regional Emergency Evacuation Analysis in Traffic with Connected and Autonomous Vehicles (MPC/UTC)
6. Low-Cost Lidar Applications in Rail Track Condition Monitoring (UGPTI)
7. Assessing Safety Effectiveness of Treatments and Technologies at Highway-Rail Grade Crossing (NCHRP/NAS, new)

Deliverables

In year 2022:

Journal Publications

1. Neeraj Dhingra, Raj Bridgelall, Pan Lu, Joseph Szmerekovsky, and Bhavana Bhardwaj. "*Ranking Risk Factors in Financial Losses from Railroad Incidents: A Machine Learning Approach*", **Transportation Research Record**, 2022 (Accepted 8/18/2022) (B)
2. Yihao Ren, Zhenyu Dai, Pan Lu, Chengbo Ai, Ying Huang, and Denver Tolliver. "*Rail Gage-Based Risk Detection using iPhone 12 Pro", Proceedings of the Institution of Mechanical Engineers*, **Part F: Journal of Rail and Rapid Transit**, 2022 (accepted at July 8)
3. Xingju Wang, Jiayu Liu, Fenjie Long, Pan Lu, Yihao Ren, and Jinjie Chen. "*A Life-Cycle Cost Model of High-Speed Railway Considering Carbon Emissions*", **Journal of Infrastructures Systems**, (accepted at June/23), 2022
4. Lu Gao, Ke Yu, and Pan Lu. "*Missing Pavement Performance Data Imputation Using Graph Neural Networks*", **Transportation Research Record**, 2022 https://doi.org/10.1177/03611981221095511 (B)
5. Yihao Ren, Chengbo Ai, Pan Lu, Zhenyu Dai, and Hao Wang. "*An automated rail extraction framework for low-density LiDAR data without sensor configuration information*", **IEEE Sensors Journal**, 2022 10.1109/JSEN.2022.3177698 (A)
6. Jianbang Du, Fengxiang Qiao, Pan Lu, and Lei Yu. "*Forecasting ground-level ozone concentration levels using machine learning*", **Resources, Conservation, and Recycling**, Volume 184, September 2022, 106380. https://doi.org/10.1016/j.resconrec.2022.106380 (A)
7. Qiang Li, Wenyao Liu, Xue Yang, Pan Lu, and Kelvin Wang. "*Statistical safety performance models considering pavement and roadway characteristics*", **Journal of advanced Transportation**. Volume 2022, Article ID 5871601, 12 pages. 2022 https://doi.org/10.1155/2022/5871601 (A)
8. Bridgelall, Raj, Bhavana Bhardwaj, Pan Lu, Denver Tolliver, Neeraj Dhingra, "*Detecting Sources of Ride Roughness by Ensemble-Connected Vehicle Signals*", **International Journal of Pavement Engineering**, 2022 https://doi.org/10.1080/10298436.2022.2069243 (B)
9. Hafiz Ahmed, Ying Huang, Pan Lu, and Raj Bridgelall. "*Technology Developments and Impacts of Connected and Autonomous Vehicles: An Overview*", **smart cities**, 5, 382-404, 2022 https://doi.org/10.3390/smartcities5010022
10. Arshid, Asif, Ying Huang, Pan Lu, and Denver Tolliver. "*Validation of a Numerical Model (Adytrack) Against Existing Simulation Tools and Field Measurements*". **International Journal of Civil Engineering** 20 (2), 115-123 (2022). https://doi.org/10.1007/s40999-021-00673-1
11. Jingnan Zhao, Hao Wang, Pan Lu, and Jiaqi Chen. "*Mechanistic-Empirical Analysis of Pavement Performance Considering Dynamic Axle Load Spectra Due to Longitudinal Unevenness*", **Applied Sciences**. 12 (5), 2600, 2022 https://doi.org/10.3390/app12052600

APP Developed

1. Amin K., Pan L., and Denver T., HRGC countermeasure effectiveness visualization tool for state of ND, https://kmtgis.shinyapps.io/ak_plot/

Conference Presentations and Publications

We published and presented 10 conference presentations and proceedings at **Transportation Research Board Annual Meeting 2022**, **SPIE Sensor and Smart Structure Technologies for Civil, Mechanical, and Aerospace System 2022**, and **ASCE International Conference on Transportation and Development 2022.**

Graduate Research Assistant Graduated with Degree

Three PhD students, two M.S. students, and one undergraduate student are trained through our research projects and graduated in 2022.

Acknowledgement

MOUNTAIN PLAINS CONSORTIUM

NDSU|UGPTI

- Thanks for MPC/UGPTI for the great research opportunities!
- Thanks for all the team researchers, our collaborators, and our industrial supporters!

DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA

NDDOT

NORTHERN PLAINS RAILROAD

Red River Valley & Western RAILROAD COMPANY

DEPARTMENT OF TRANSPORTATION

Thanks !!

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Questions/Comments

Commercial Vehicle Safety Center Highlights and Activities

Brenda Lantz

Advisory Council Meeting – October 6, 2022

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Commercial Vehicle Safety Center

- Established fall 2017 through a Federal Motor Carrier Safety Administration (FMCSA) grant
- Goal to improve Commercial Vehicle Safety and Commercial Driver License (CDL) Compliance through University Partnerships
  - www.ugpti.org/outreach/cvsc/
  - Commercial Vehicle Safety Summits & Technical Assistance
    - Point of contact for universities, law enforcement, and driver licensing agencies to establish partnerships

Commercial Vehicle Safety Center (continued)

- We are in the third FMCSA grant to continue work
  - The 2017-2019 grant had a CDL focus
  - The 2019-2021 grant had a data quality focus
  - The current 2021-2023 grant has a focus on work zone safety and distracted driving
- Post resources and host webinars in the following areas –
  - Commercial Driver Licensing
  - Connected and Autonomous Vehicles
  - FMCSA Rulemakings and Programs
  - Research and Partnerships

2022 Commercial Vehicle Safety Summit

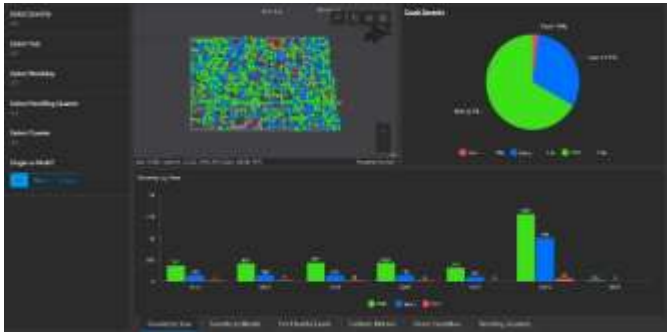
- FMCSA Program Updates
- State Best Practices
  - State operations, campaigns, techniques, and programs to reduce distracted driving and improve work zone safety

- Resources and Tools
  - Tools, resources, education, and training available
- Research and Partnerships
  - Select projects conducted in partnership with state and federal agencies
- Cross-Agency Efforts
  - NTSB, CVSA, FHWA, NHTSA
- Roundtable Discussions of State Issues and Topics of Interest

Additional Projects

- ND Highway Patrol
  - Update Program Plan/Top Level Design for FMCSA Innovative Technology Deployment (ITD) Program Core Compliance
    - With Seguy, Sharijad, Kim, Brad, and Ed
    - Created a management framework and system architecture to guide ITD deployment in the areas of safety information exchange, credentials administration, and electronic screening
- CMV Traffic Safety Dashboard
  - Kim is PI, Satpal is senior developer,

  with Brad, Sowmya, Sharma, Seguy, and graduate students contributing



Additional Projects (continued)

- FMCSA Research & Technology
  - Investigating the Safety of Commercial Motor Vehicle Operation by Deaf and Hard of Hearing Drivers
    - With toXcel, ATRI, and SMEs in ASL linguistics and audiology
  - Effectiveness of Third-Party Testing and Minimum Standards for CDL Knowledge and Skills Tests
    - With toXcel and eScience Technology & Solutions
  - Automated CMV Inspection Demonstrations and Evaluations
    - With toXcel, eScience Technology & Solutions, JFL Solutions, QS-2, ATRI, and PrePass Safety Alliance
- National CDL Program Assessment
    - With UC, UCLA, and eScience Technology & Solutions

Questions / Discussion

- Contact –
  - Brenda Lantz
  - brenda.lantz@ndsu.edu, 720-470-1871