NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Advisory Council Meeting
October 10, 2024

UGPTI Tribal Transportation Program & Northern Tribal Technical Assistance Program

Working with Tribal Nations and Colleges

Ronald Hall, Tribal Transportation Program Manager

Upper Great Plains Transportation Institute

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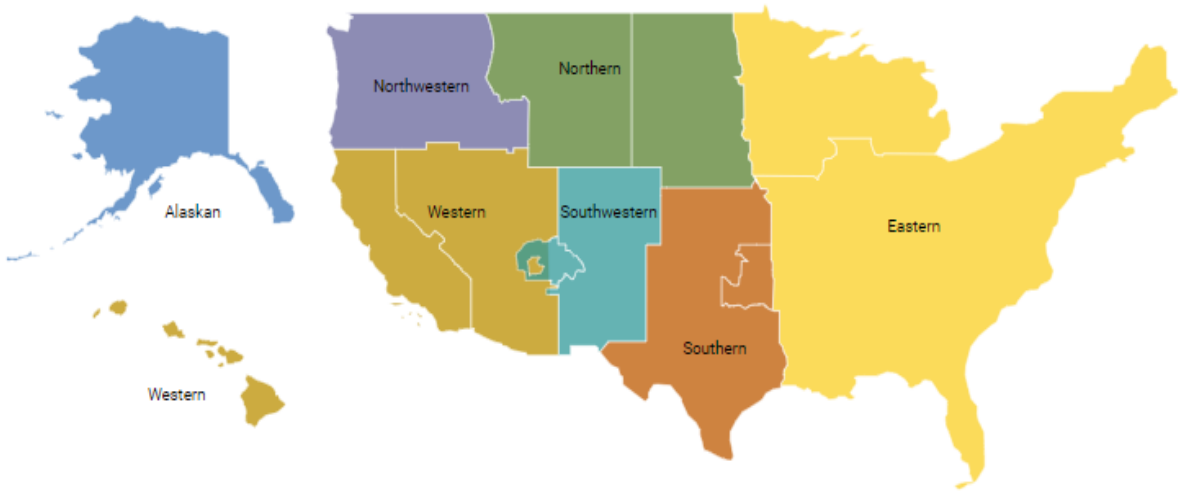
Goals

- Build internal capacities within Tribal Nations to plan and manage transportation systems
  - Means: technology transfer, training, technical assistance and context-sensitive research
- Support transportation research and education capabilities within Tribal College partners
  - Means: collaborative research, mentoring of faculty, joint workforce development programs
- Build technical and leadership skills needed to be successful in a highly-automated future based on data-driven decision-making
- Listen more than you talk to know how and where to begin

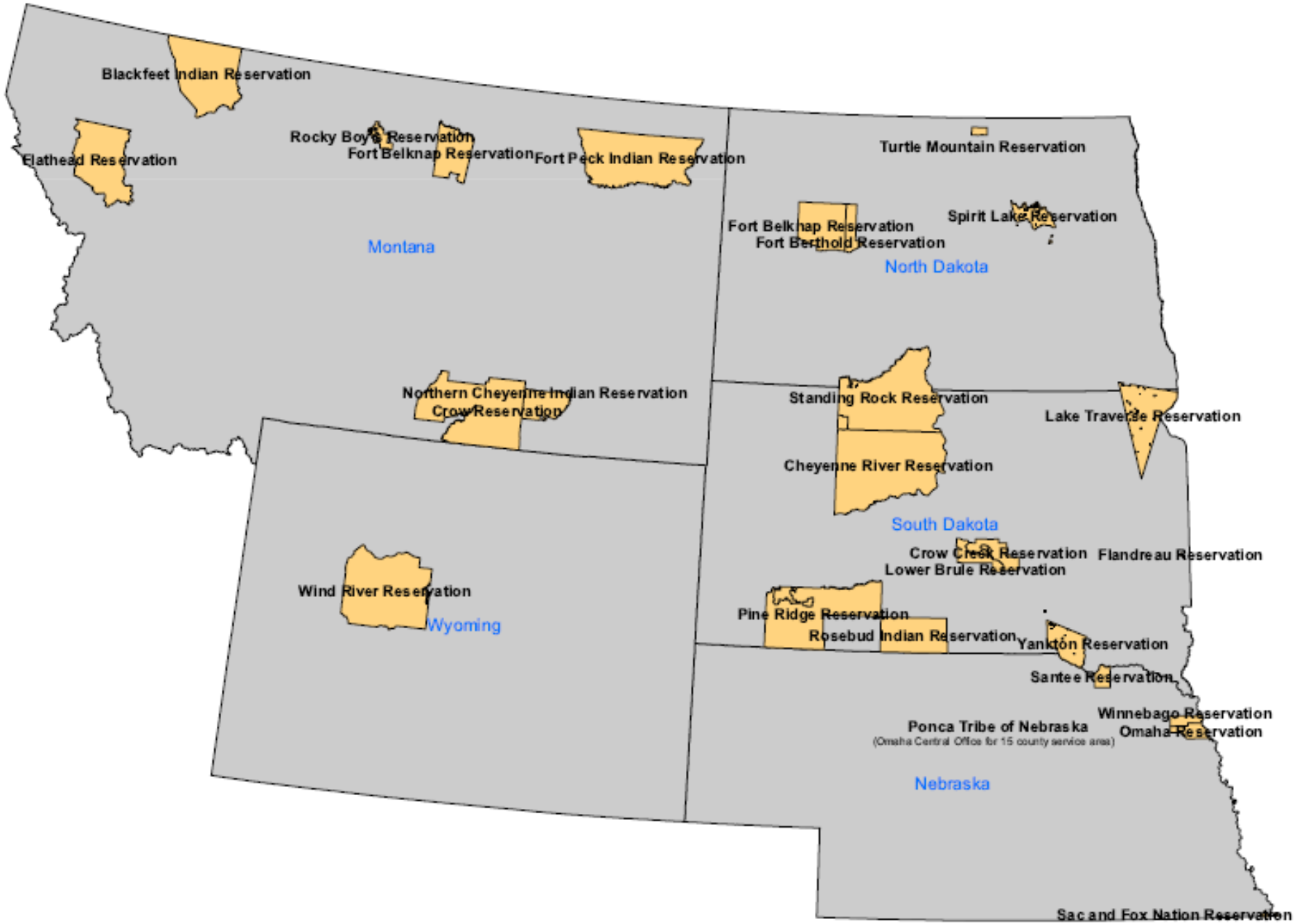
Northern Tribal Technical Assistance Program

- Co-Directed with Bryon Fuchs
- Completing year 2 of a 5-year agreement with FHWA
- North Dakota, South Dakota, Nebraska, Wyoming, Montana
- The program works with American Indian tribal governments to
  - Build tribal capacity in program management
  - Grow the tribal workforce
  - Cultivate and coordinate partnerships
  - Facilitate technology transfer and the implementation of innovations
  - Share results of similar initiatives across the country

Northern Tribal Technical Assistance Program (continued)



- Funded by FHWA
- Managed by FHWA Tribal Transportation Program
- 7 Regional Centers
- Northern TTAP is a consortium of 5 state LTAP Centers and part of UGPTI


Blackfeet Indian Reservation
Flathead Reservation
Rocky Boy's Reservation
Fort Belknap Reservation
Fort Peck Indian Reservation
Montana
Northern Cheyenne Indian Reservation
Crow Reservation
Wind River Reservation
Wyoming
Turtle Mountain Reservation
Fort Belknap Reservation
Fort Berthold Reservation
Spirit Lake Reservation
North Dakota
Standing Rock Reservation
Lake Traverse Reservation
Cheyenne River Reservation
South Dakota
Crow Creek Reservation
Flandreau Reservation
Lower Brule Reservation
Pine Ridge Reservation
Rosebud Indian Reservation
Yankton Reservation
Santee Reservation
Winnebago Reservation
Ponca Tribe of Nebraska
(Omaha Central Office for 15 county service area)
Omaha Reservation
Nebraska
Sac and Fox Nation Reservation

Partnerships

- **28** Tribal Governments
- **5** State Local Technical Assistance Programs (LTAPs)
- **2** Bureau of Indian Affairs (BIA) Regional Transportation Programs
- **2** Federal Highway Administration Tribal Transportation Program Offices
- National LTAP/TTAP Association
- National Highway Institute
- Center for Transformative Infrastructure Preservation and Sustainability (CTIPS)
- Transportation Learning Network (TLN)

Organizations and Collaborators

- CTIPS at Upper Great Plains Transportation Institute, NDSU
- Northern TTAP
- Tribal Associations
- ND Tribal College System
- LTAP Centers
- Philanthropic Organizations
- Tribal Associations
  - Great Plains Tribal Chairmen's Association
  - Rocky Mountain Tribal Transportation Planners Association
  - Great Plains Tribal Transportation Planners Association
  - Intertribal Transportation Association

Engagement with Tribal Nations

- Attend Tribal Meetings and Events
  - Stay informed about issues, accomplishments, challenges
- Understand foundations of tribal sovereignty
- Education on the administration of tribal transportation programs
  - Unique complexity of tribal transportation legal, administrative and financial environment
- Know the history of the tribe, tribal land, demographics of the area
- Build trust through straight talk, respect, transparency, and deliver results

Collaborations with Tribal Colleges

- Successful collaborations must be sustainable within a Tribal College framework
- Build on existing strengths and establish the foundation for future growth
- Bridge programs for 4-year degree programs require early and consistent student engagement
- Explore internships, fellowships, apprenticeships, and other career exposure opportunities
- R1 Research Institution resources and access
- Generating research problem statements
- Placement of graduates in Tribal Transportation Programs

Pursuing New Opportunities

- Training and Technical Assistance Needs Assessment
  - Tribal Programs require a specialized training curriculum in addition to existing technical programs
- Technology Deployment Initiative
  - Digital video data collection and analysis for run-off road crash analysis, safety planning, and grant applications
- Equity Research
  - TRB Consensus Committee: Data, Metrics, and Analytic Methods for Assessing Equity Impacts of Surface Transportation Funding Formulas

CTIPS Center for Transformative Infrastructure Preservation and Sustainability

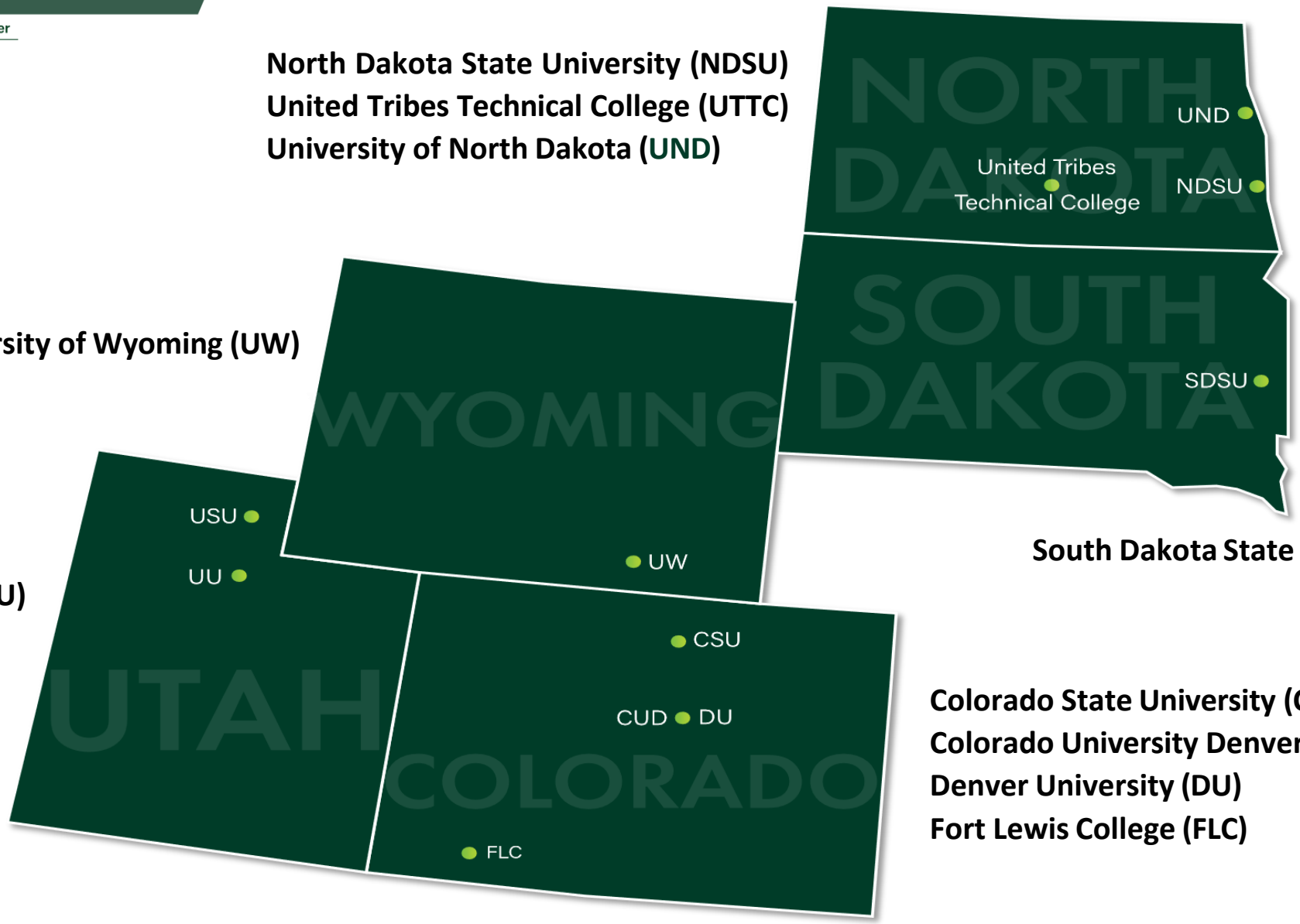
USDOT Region 8 University Transportation Center

North Dakota State University (NDSU)
United Tribes Technical College (UTTC)
University of North Dakota (UND)

University of Wyoming (UW)

University of Utah (UU)
Utah State University (USU)

South Dakota State University (SDSU)



Colorado State University (CSU)
Colorado University Denver (CUD)
Denver University (DU)
Fort Lewis College (FLC)

Goals

- Build human capacity in Tribal nations to manage and improve their surface transportation systems through collaborative/supportive programs
  - Leadership (roles, funding, stakeholders and importance of transportation in public safety, economic and community development)
  - Practitioners (road and transit planning knowledge and skills)
  - Resources (accessing Federal, State, and private funds)
- Train future transportation workforce
- Identify context-sensitive affordable solutions
- Serve as trusted source of expertise and support

Tribal Specific Curriculum and Field Guidance

- Need for Tribal Transportation Program specific education and field support material
- Uniquely complex administrative options and requirements
  - Direct Service BIA
  - 638 Contract BIA
  - Government to Government Agreement BIA
  - Self-Determination Compact BIA
  - Tribal Transportation Program Agreement FHWA
  - Tribal Transportation Self-Governance Program USDOT
- Equity regarding resources provided through AASHTO, NHI, and other resources

Tribal Transportation Workforce Peer Exchange

- 20 – 30 Tribal Transportation Professionals from across the nation
- ESRI headquarters in Redlands, CA
- Assess current and future workforce needs and gaps
- Assess the current and future technology and program environment
- How do you accomplish Self-Determination while meeting Federal Aid policies and requirements
- Identify research problem statements
- Collaboration with other University Transportation Centers

CTIPS Center for Transformative Infrastructure Preservation and Sustainability
USDOT Region 8 University Transportation Center

NDSU-UGPTI
NDLTAP & Western Liaison

Bryon Fuchs, P.E. – NDLTAP Director

UGPTI Advisory Council Meeting

October 10, 2024

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NDLTAP

North Dakota Association of County Engineers

NDACo
NORTH DAKOTA ASSOCIATION OF COUNTIES

NDIRF NORTH DAKOTA INSURANCE RESERVE FUND
For North Dakota. For Local Government. For You.
www.ndirf.com

Northland Chapter Of ATSSA

NORTH Dakota | Transportation
Be Legendary.™

NDTOA NORTH DAKOTA TOWNSHIP OFFICERS ASSOCIATION

WESTERN DAKOTA ENERGY ASSOCIATION

ND North Dakota League of Cities

AMERICAN PUBLIC WORKS ASSOCIATION
APWA
North Dakota Chapter

U.S. Department of Transportation
Federal Highway Administration

NDLTAP Advisory Board

- City Representatives
- Consultant Representative
- ND FHWA Division
- NDIRF Representative
- County Representative
- NDDOT Representative
- Township Representative
- Tribal Representative

NDLTAP in Review – Last Year

NDLTAP 2024

- NDLTAP “Charter” Document
- Needs Assessment Surveys for Work plan
- Technical Certification Program
- Western Liaison
- 2025 Transportation Conference (Asphalt and Concrete)
- Local Roads Conference in SD – added Urban Track
- Winter Maintenance – Urban Focus
- 3 other new classes
- Revising and updating other classes

Infrastructure Needs:

County, Township and Tribal Roads and Bridges: 2024-2043

Alan Dybing
Senior Research Fellow

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Study Objective

- Estimate the funding needs to maintain the existing road system over the next 20 years
- Update of previous studies

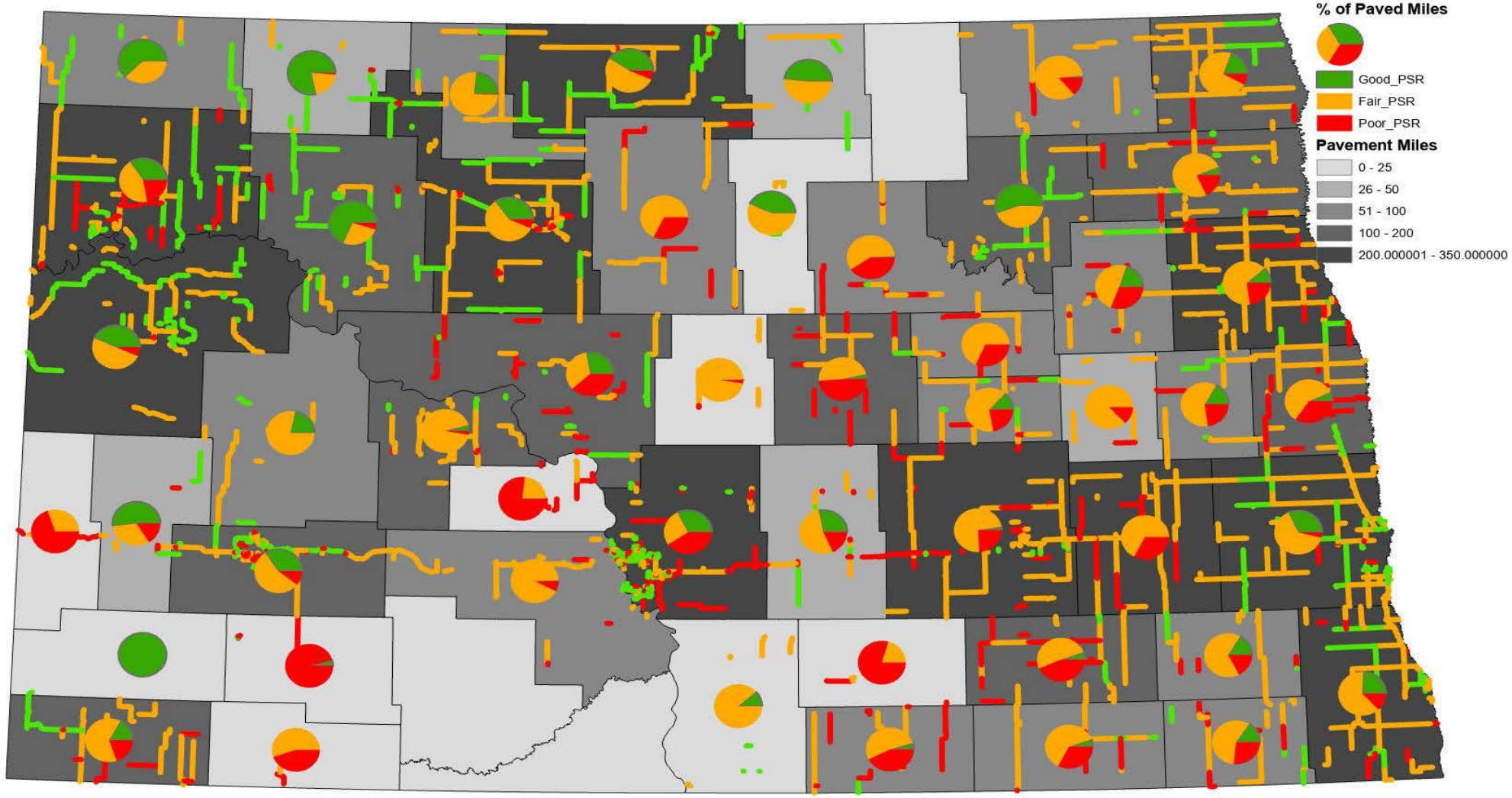
Study Components

- Traffic Model
  - Forecasts agricultural and oil related truck movements over the next 20 years
- Unpaved Roads Analysis
  - Cost and practices survey for counties and townships
  - In conjunction with traffic forecasts, estimate the funding needs

Study Components (continued)

- Pavement Analysis
  - Pavement data collection
    - Laser based profiler with GIS
    - ½ of the state each year
    - GoPro images collected
  - GRIT data – project entry from counties
  - AASHTO-93 model – uses pavement structure, condition and traffic estimates to forecast deterioration and improvement timing

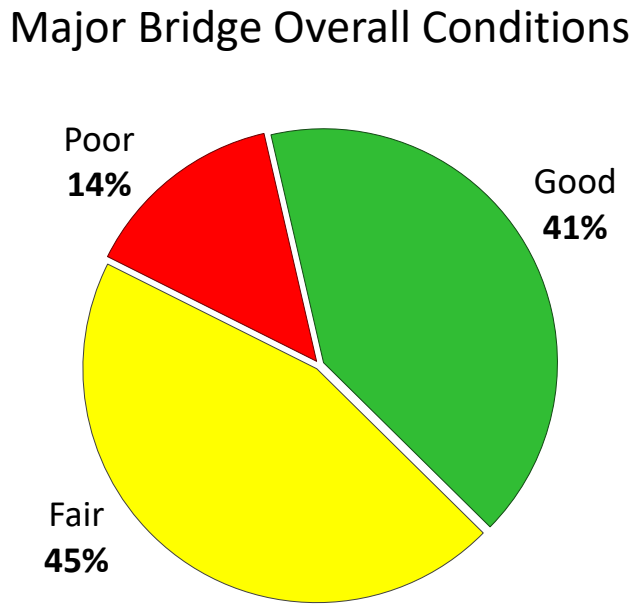
County Pavement Condition
2023 Combined ride and condition



Prepared by:
UGPTI - DOTSC
7/24/2024

Study Components (continued)

- Bridge Analysis
  - Utilizes National Bridge Inventory System (NBIS) data
  - Development of Bridge Needs Target (BNT) to evaluate bridge condition to estimate improvement and maintenance costs
  - Bridge unit cost increases:
    - $370/sq.ft. to $530/sq.ft.

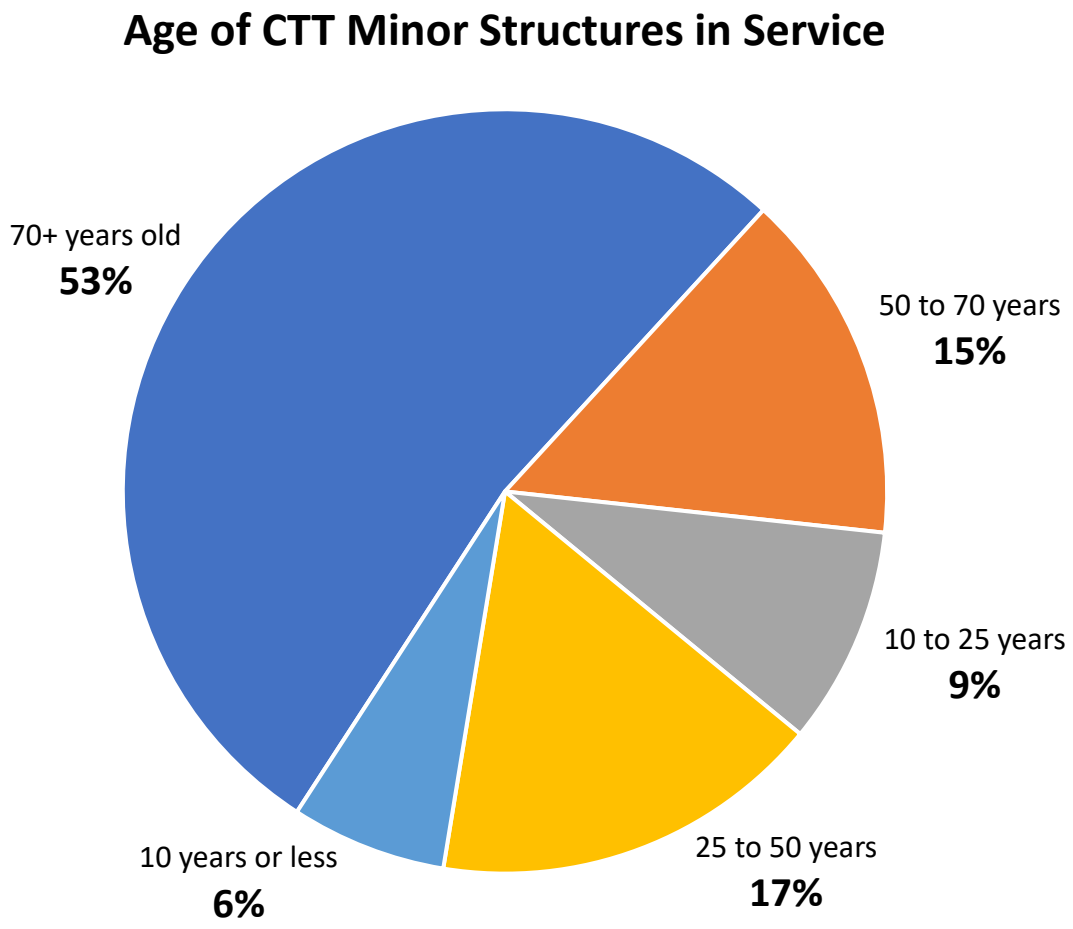


Study Updates for 2023

- Jurisdiction
  - NDDOT roads_county jurisdictional information
  - Previous jurisdiction data was collected long ago

- Minor Structures
  - Structures below 20’ are not reported in NBIS
  - NDDOT inventory from 1985
  - Import to GRIT for county approval, confirmation of condition, whether still in service
  - Categorical costing
  - Bridge steering committee input and guidance

Minor Structures



Timeline

- Data Collection
  - Pavement Data Collection – Summer 2022 and 2023
  - Traffic Data Collection – Summer 2023
  - County and Township Survey – Initial mailing, November 2023
  - Assumptions of Oil & Gas Development – October 2023
- Travel Demand Modeling – January 2024
- Gravel Modeling – June 2024
- Pavement Modeling – June 2024
- Bridge Modeling – May 2024
- Draft Report – August 2024
- County Outreach – August 2024
- Final Report – October 2024

Statewide Needs Results

Period	Unpaved	Paved	Bridges	Minor Structures	Total
2024-2025	$707.88	$433.82	$178.94	$151.06	$1,471.70
2026-2027	$694.93	$523.64	$178.94	$151.06	$1,578.57
2028-2029	$714.99	$436.78	$178.94	$151.06	$1,481.77
2030-2031	$716.56	$388.93	$178.94	$151.06	$1,435.49
2032-2033	$693.38	$368.57	$178.94	$151.06	$1,391.95
2034-2043	$3,443.71	$1,344.44	$192.45	$49.72	$5,030.32
2024-2043	$6,971.45	$3,496.17	$1,087.16	$805.00	$12,359.78

Comparison to Previous Study

Category	2022-2041 ($M)	2024-2043 ($M)	Percent Change
Unpaved	$6,506.61	$6,971.45	7.14%
Paved	$3,291.69	$3,496.17	6.21%
Bridges	$715.57	$1,087.16	51.93%
Minor Structures	N/A	$805.00	N/A
Total	$10,513.87	$12,359.78	17.56%

Small Urban and Rural Center on Mobility

Jeremy Mattson, Associate Professor

UGPTI Advisory Council Meeting

October 10, 2024

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Team Members

- Jeremy Mattson, Ph.D. – Associate Professor
- Ranjit Godavarthy, Ph.D. – Associate Professor
- Del Peterson – Associate Research Fellow

Graduate Student Researchers

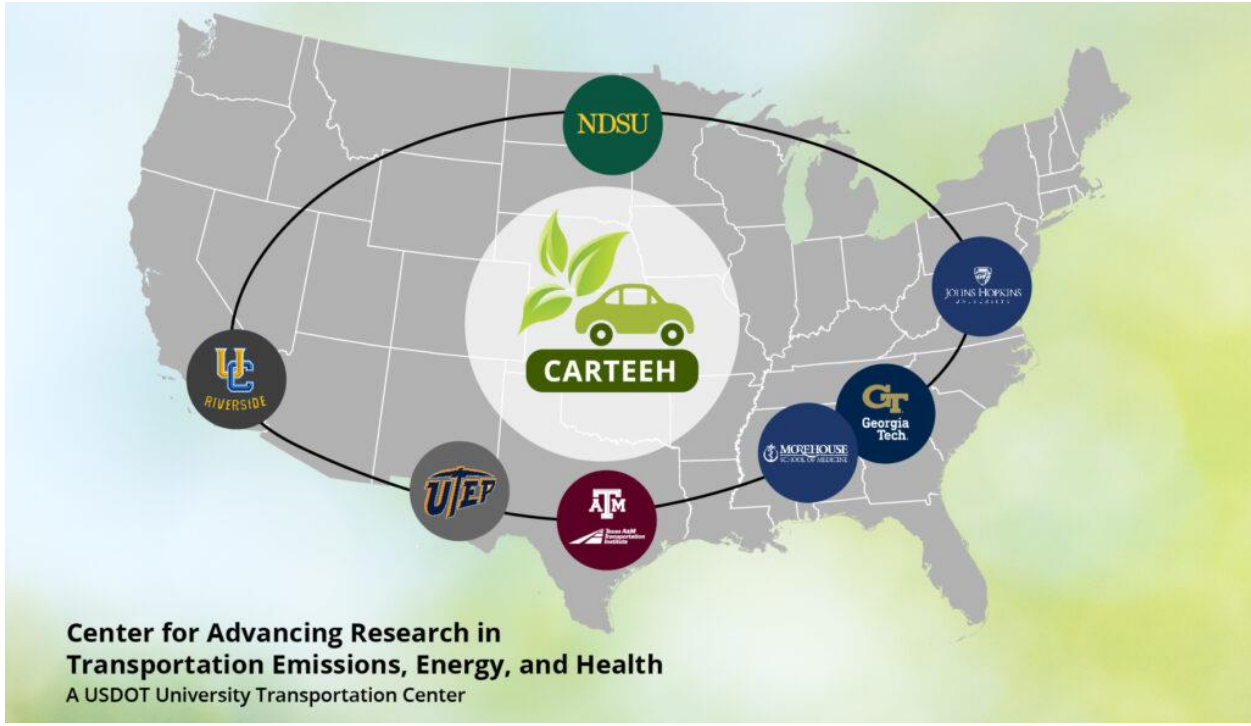
- Bright Quayson
- Evans Akoto
- Benedictus Nyan

Recently Completed SURCOM Projects

- Rural Transit Fact Book 2024
- Jaunt Rural Transit Needs Assessment
- Utilizing Public Transportation to End Food Insecurity in Rural and Small Urban Areas by Providing Better Access: A Case Study of Rural Counties in North Dakota
- Impacts of Transit on Health in Rural and Small Urban Areas
- Interest in Shared-Use Mobility Services in Tribal Communities
- The Association Between Tribal Transit and Food Insecurity Status Among Native Americans in North Dakota

Current SURCOM Projects

- Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH)
  - SURCOM is a partner in this University Transportation Center (UTC) led by Texas A&M Transportation Institute (TTI)
  - Current project: Low Emissions Technologies for Rural and Tribal Communities

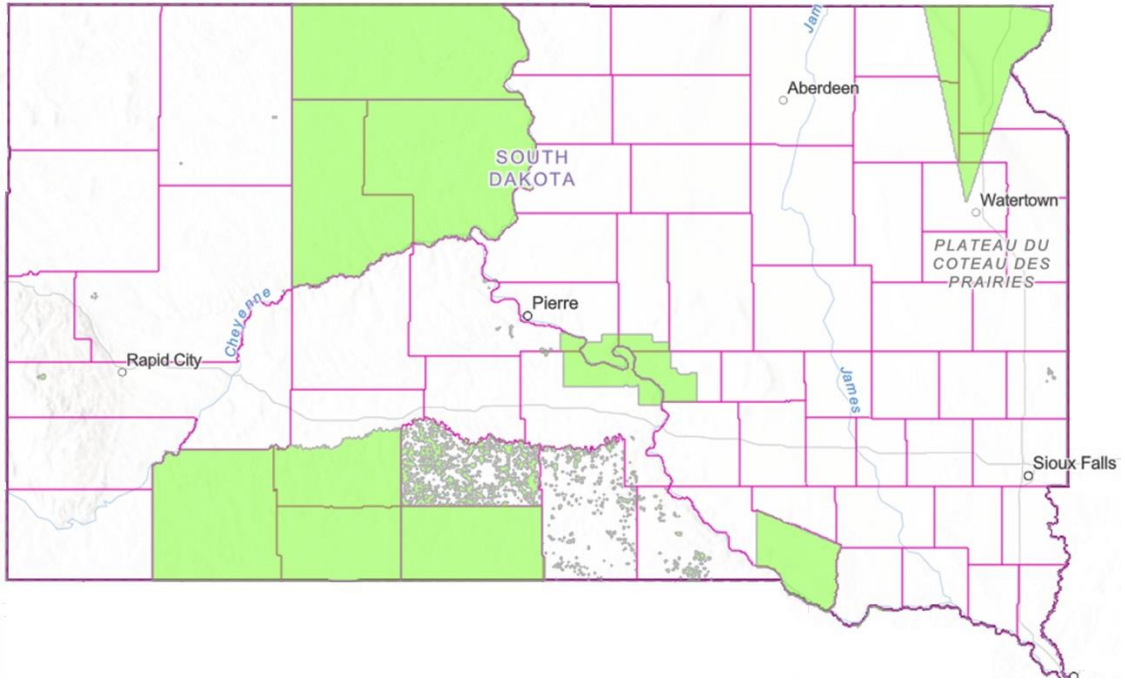


Current SURCOM Projects

- NCHRP 08-144: Rural Transit Fleet Mix and Vehicle Size Decision Trees
  - Partners: Montana State University and MG Tech Writing, LLC

Current SURCOM Projects

- Transit Development Plan for Tribal and Persistently High Poverty Regions in South Dakota
  - Funded by the Areas of Persistent Poverty Program of the Federal Transit Administration
  - Led by River Cities Public Transit



Advanced Traffic Analysis Center
DOT Support Center

Brad Wentz, P.E.
Program Director

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Advanced Traffic Analysis Center
DOT Support Center

- Hire student interns to gain real world transportation experience providing the industry high tech services and potential future employees
  - Primarily funded by NDDOT
  - Also MPO's and Counties

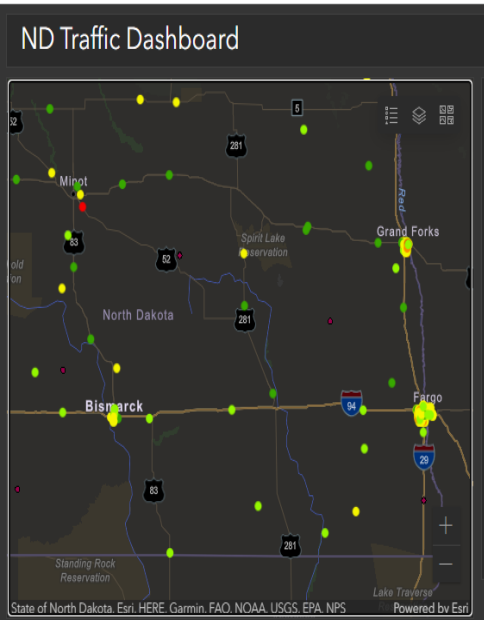
Mission: Promote Safe and Efficient Movement of People and Goods

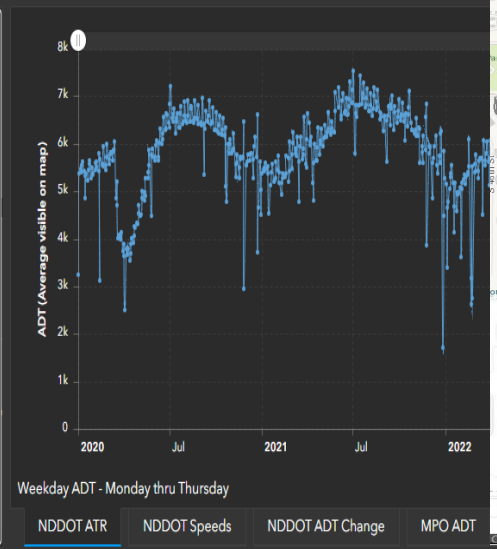
Advanced Traffic Analysis Center

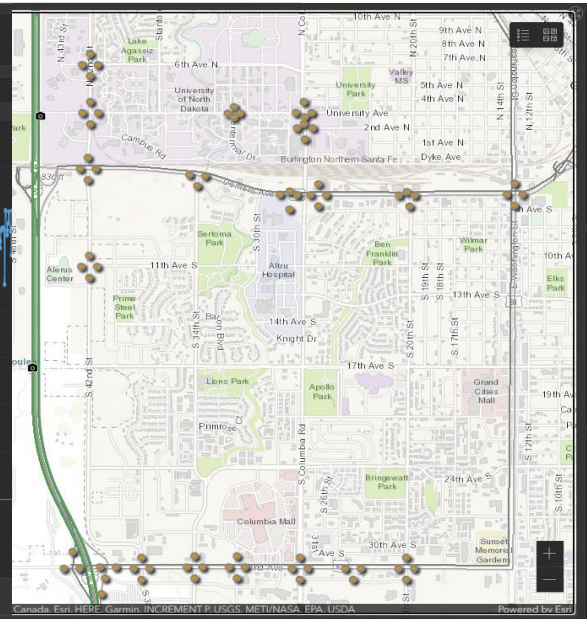
- Focus Areas and Staff
  - Traffic Operations and Data Collection
    - Kshitij Sharma, Ph.D., EIT
  - Travel Demand Modeling
    - Diomo Motuba, Ph.D.
  - Intelligent Transportation Systems
    - Sharijad Hasan, Ph.D., EIT
  - 3 to 6 traffic engineering students

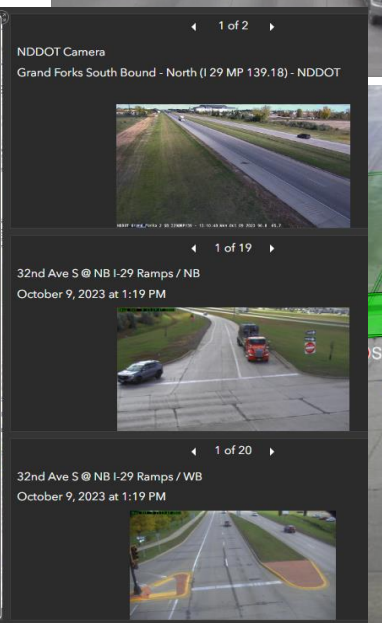
Traffic Operations and Data Collection

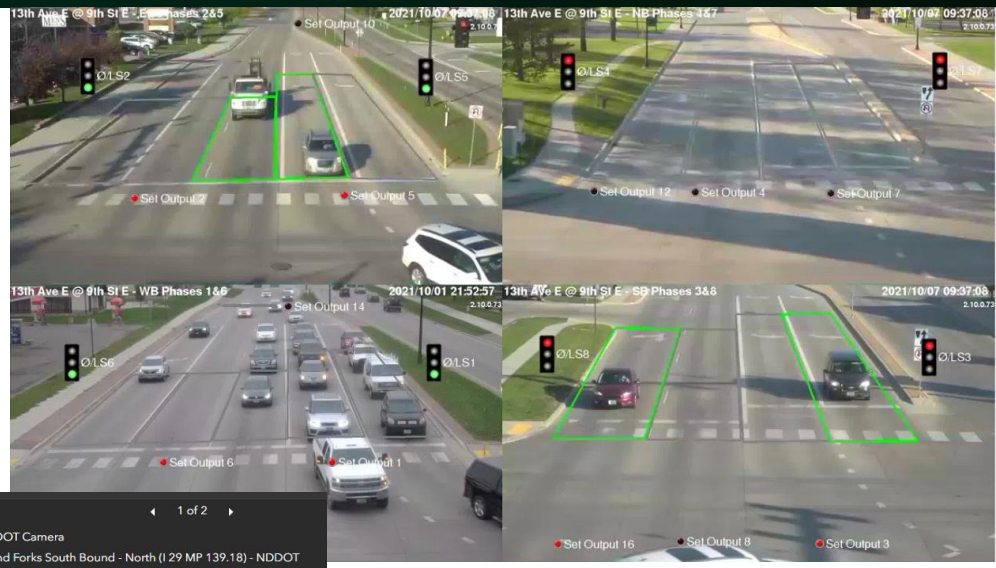
- Traffic Signal Data Collection and AI development
  - NDDOT Signals, ATR's & RWIS Sites – Plus video feeds
  - All MPO's – approaching 160 intersections
  - Adding pedestrian counting capabilities
  - Developing low cost, power AI cameras

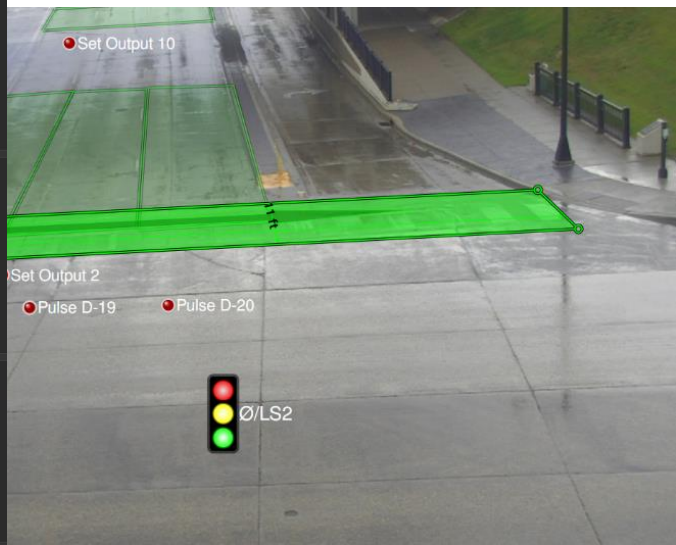






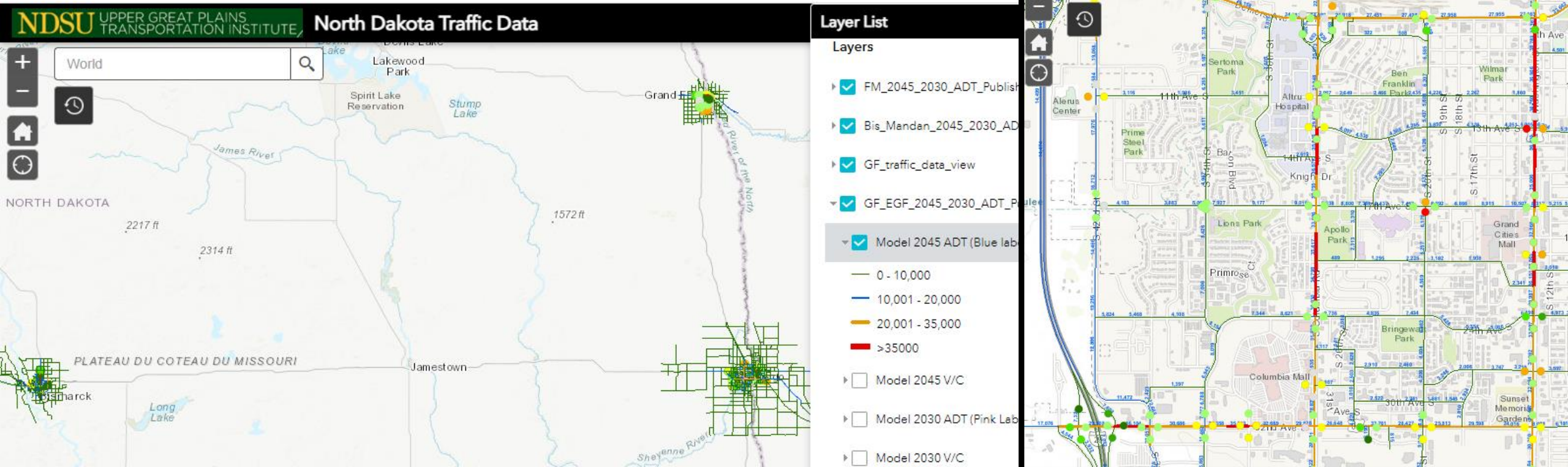






ND Travel Demand Modeling

- Develop a robust planning tool for MPOs to anticipate travel demand and optimize transportation infrastructure investments over the long term
  - Completed all 3 MPO's and working on new Minot MPO
  - Assist in LRTP development



ND Intelligent Transportation Systems

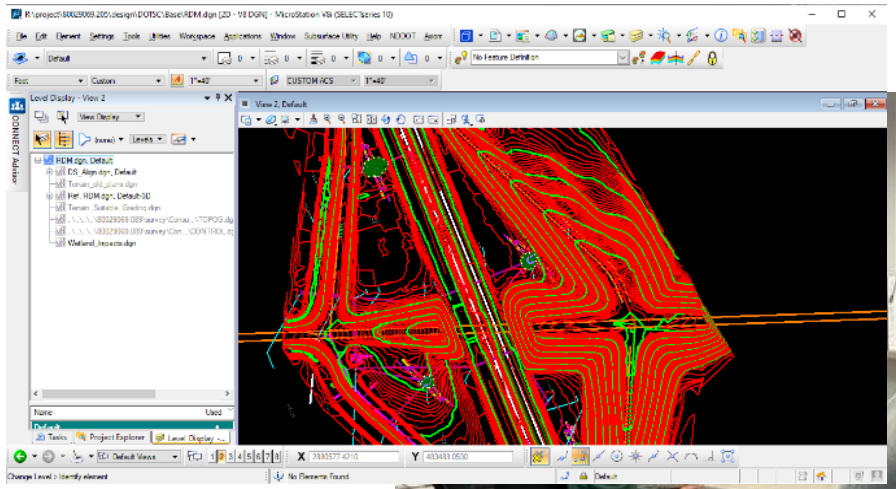
- Regional & State ITS Architecture
  - Updated The Forks MPO Architecture
  - Working with NDDOT on ITS & TMC Architecture
  - Developing architecture for Transp. Data Intelligence Center

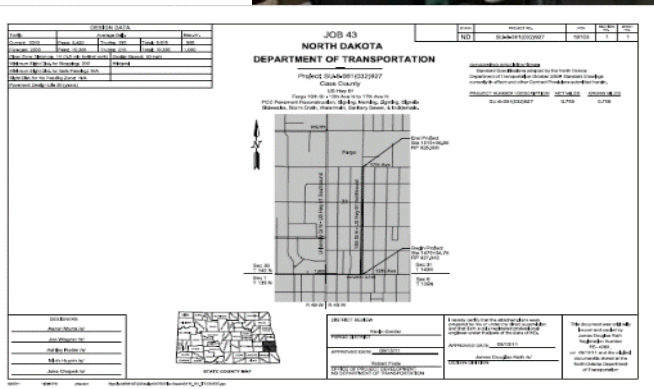
DOT Support Center - DOTSC

- Focus Areas and Staff
  - Design Section
    - Brady Haussler, P.E., NDDOT
    - Jennifer Kern, P.E., NDDOT
    - 10 to 12 Engineering students
  - IT Section
    - Sowmya Gudise, M.S.
    - 3 to 6 Computer Science students
  - Engineering Support
    - Special projects with engineers at UGPTI

DOTSC Design Section

- High Mast Lighting at Exits 59 & 61 on I-94 (Dickinson)
- Fort Yates Roundabout
- I-29 & 40th Ave N Interchange Technical Support (Fargo)
- Work Zone Traffic Control – Memorial Bridge (Bismarck)
- US 2 Reduced Conflict Intersections & Turn Lanes
- New South Interchange Technical Support (Grand Forks)
- I-94 Eastbound Reconstruct from RP 11 to Little Missouri
- 13th Ave S & I-29 Ramp – Median Modifications (Fargo)
- Lynchburg Interchange Structure Replacement
- ND 27 Improvements in Lisbon Technical Support
- Woodworth Wetland Bank / Mitigation Project
- I-94 from I-29 to 25th St Auxiliary Lane (Fargo)
- US 52 Passing Lanes
- US 2 Mill & Overlay from Montana line to ND 1804
- Railroad Coordination
- ND 22 Ditch Grading & Erosion Repairs (Dickinson)





DOTSC IT Section

- Application Development, Maintenance & Support
  - NDDOT Certification and Materials Testing Reporting
  - Traffic Analysis – Added all NDDOT ATR's and Dashboard
  - Maintenance Cost & Performance Measure Dashboards - NDDOT
  - Local Government Asset Management – GRIT
    - Pavement Performance Forecasting – Dashboards
    - Active Load Restrictions
    - Sign Inventory
  - Surface Selection Tool – Proposal to integrate with GRIT
  - Truck Weight Calculator – Updates to 129,900

★ Artificial Intelligence and Machine Learning

GRIT – Sign Inventory

GRIT - Inventory

Signs

Inventory | Activity

Location | Panel | Support | Condition | Photo Gallery

Primary of 1 | New | Delete

Sign Type # R1-1

Description Stop

Message

Text input

Last Installed/ Replaced Date

2019-11-21

Facing Direction

West

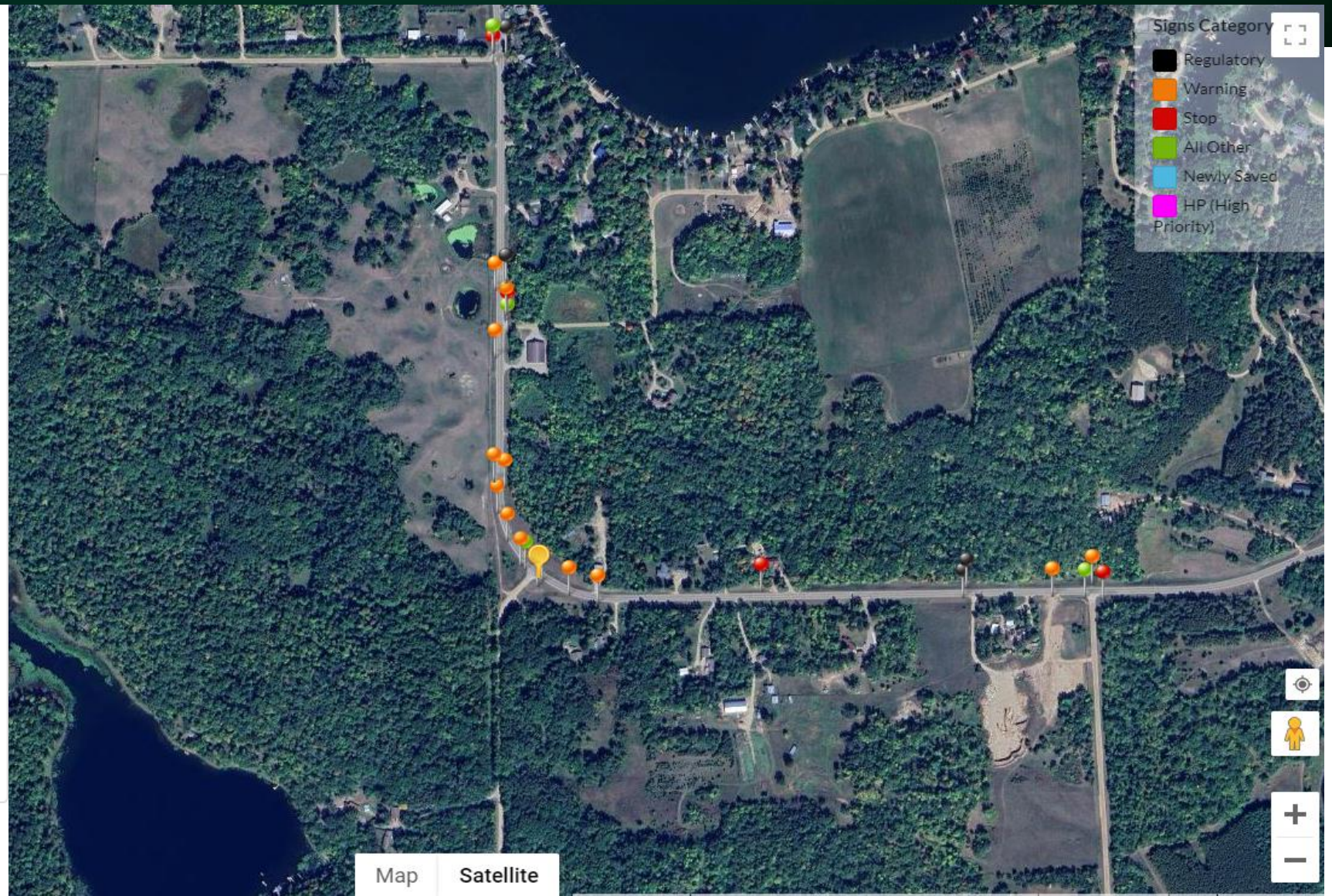
Material

type V

Height (in.) 30

Width (in.) 30

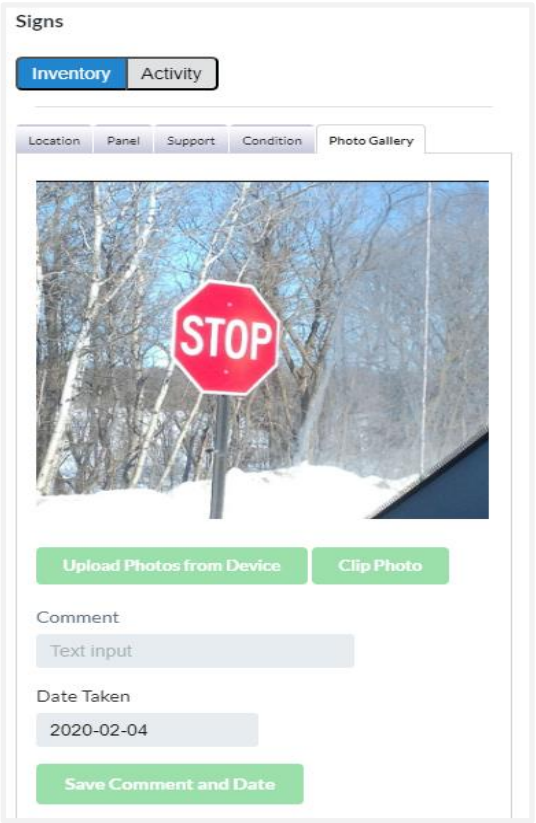
New | Edit | Cancel



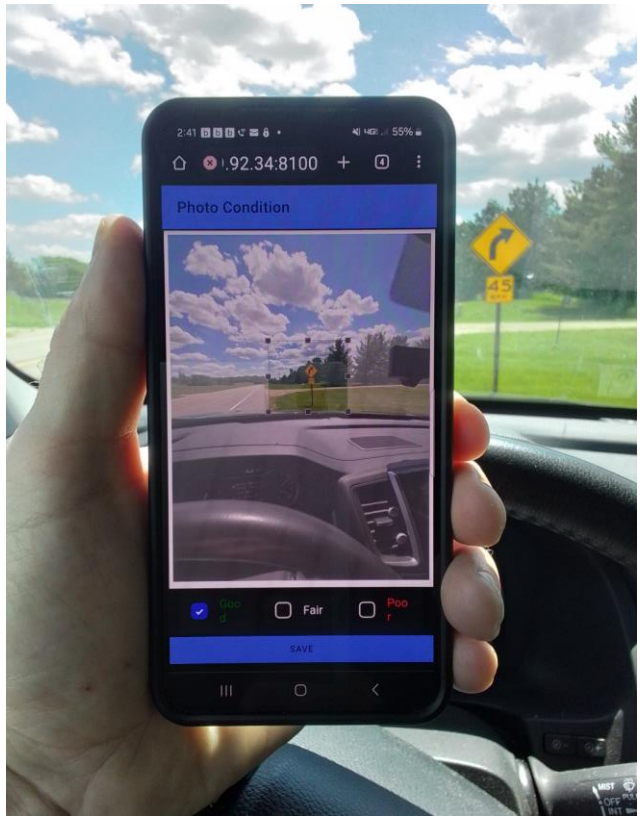
AI for Asset Management – Example 1

- Sign inventory / management
  - FHWA Reflectivity Requirements
  - Some Counties 10,000+ Signs
  - Difficult to rate and complete Inv.
- AI to assist data collection
  - Train ML based on existing Inventory & Photos
  - Small App to take photo and upload to server
  - AI Automatically extracts data from photo and updates GRIT
  - Future version will also rate condition
- AI models will forecast and make recommendations for sign management

Train AI on Existing Data



Build AI Model to Extract Info



AI for Asset Management – Example 2

- Gravel road inventory / management
  - Life cycle 3 days to 3 months
  - Many factors affect condition
  - Need condition and traffic - daily
- AI to assist data collection
  - Train ML to count vehicles and rate condition from camera images
  - Build in-expensive IoT camera that can run model during the Summer
  - Process data uploaded to GRIT and combine with other data
- AI models will forecast and make recommendations for GR management

Transport Technology Research

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

Raj Bridgelall

Co-PI: Denver Tolliver

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Student Research Collaborations

Taraneh Askarzadeh
Urban and Regional Planner
Drones/Sensors
Graduated 2024

Baishali Rahman
Director of a Central Bank
Drones
Vertiport Location Optimization

Faisal Habib
Traffic Analysis
Safety
Graduated 2024

Wesam Helmi
Independent Studies
Sensors & AI
Graduated 2024

Seguy Tchakounte-Wakem
Commander (Army Reserve)
Drones/Logistics
Battery Technology Impacts

Ryan Jones
National LTL Carrier
Autonomous Trucking
Deployment Opportunities

Shawn White
Freight Airline Pilot (B747)
Drones
Graduated 2024

Dr. Sattar Dorafshan &
Eberechi Ichi (Student)
University of North Dakota
Railroad Hyperspectral Inspections

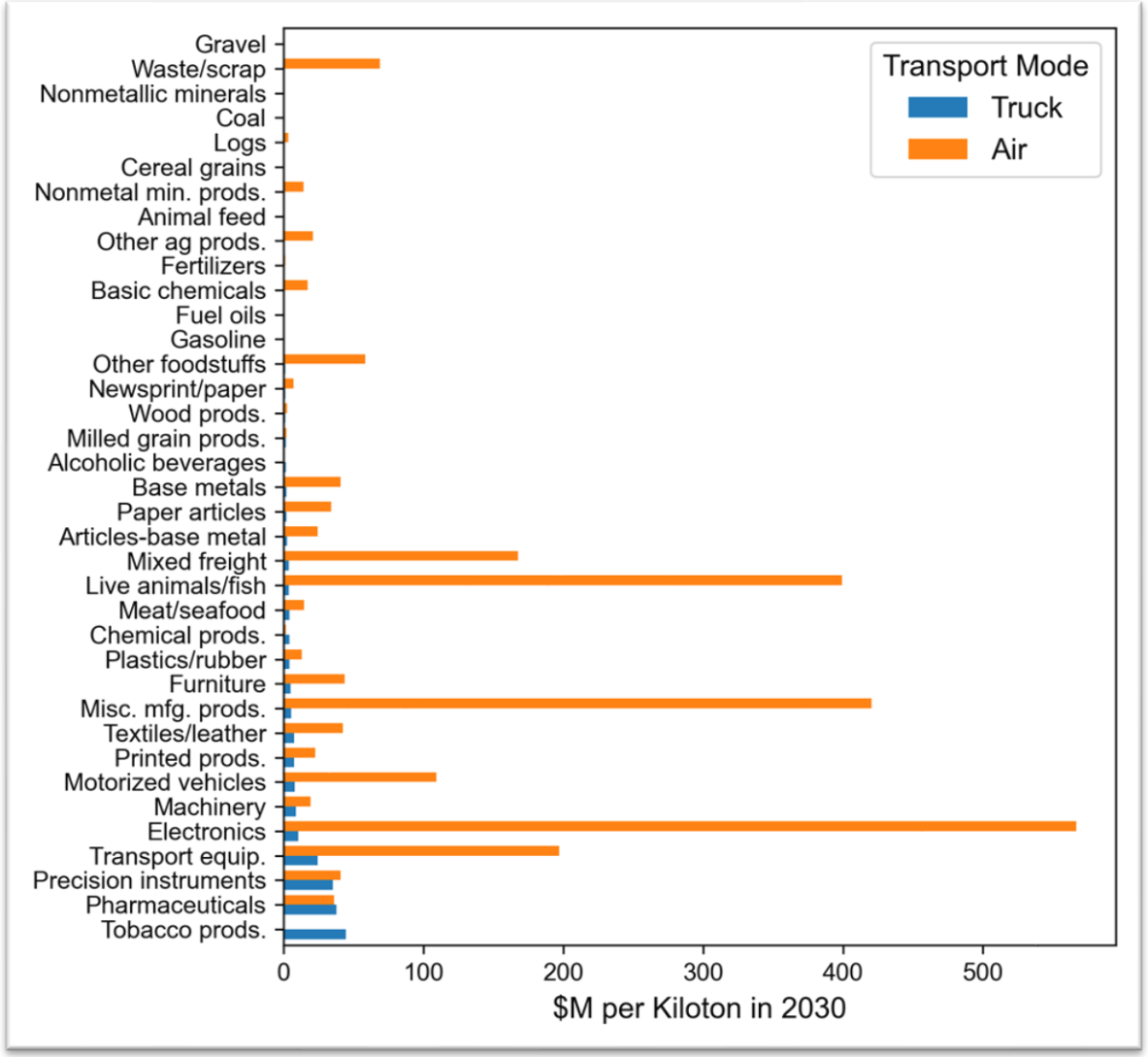
Advanced Air Mobility: A Case Study of North Dakota

- Electric Vertical Takeoff/Landing (eVTOL)
  - Payload: 1000 pounds
  - Capacity: 200 cubic feet
  - Cruise Speed: 150 mph
  - Range: 300 nautical miles
  - Noise: 65 dBA@330 ft. (dishwasher)
  - Charge Time: 1 hour
  - Wingspan: 50 feet
- Facilities
  - Vertiports or Airports
- Certification Expected: 2025

Source: Beta Technologies, Inc.

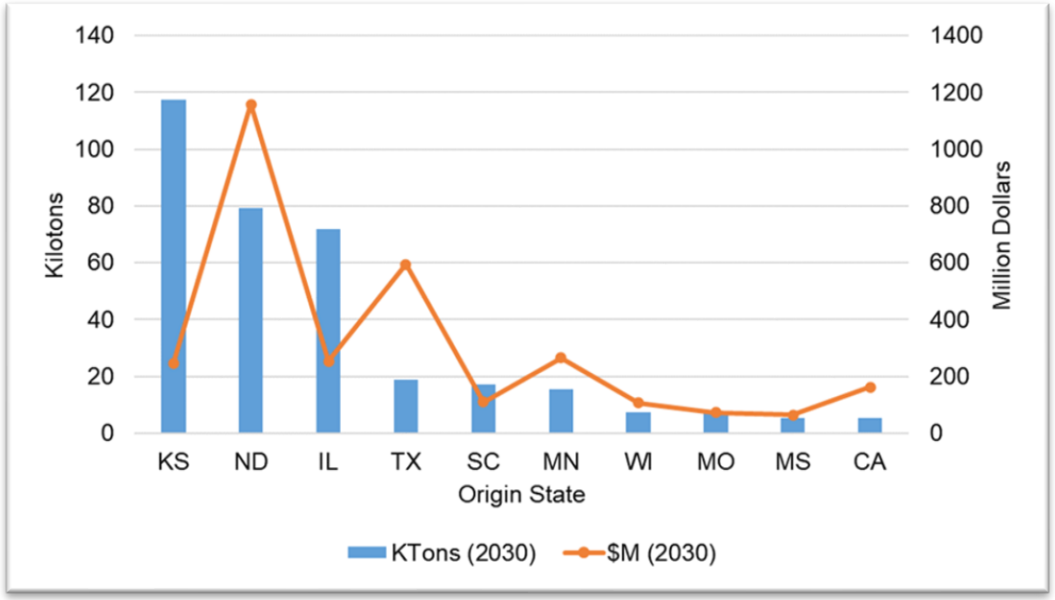
Case Study: Same Day Deliveries for ND Rural Communities

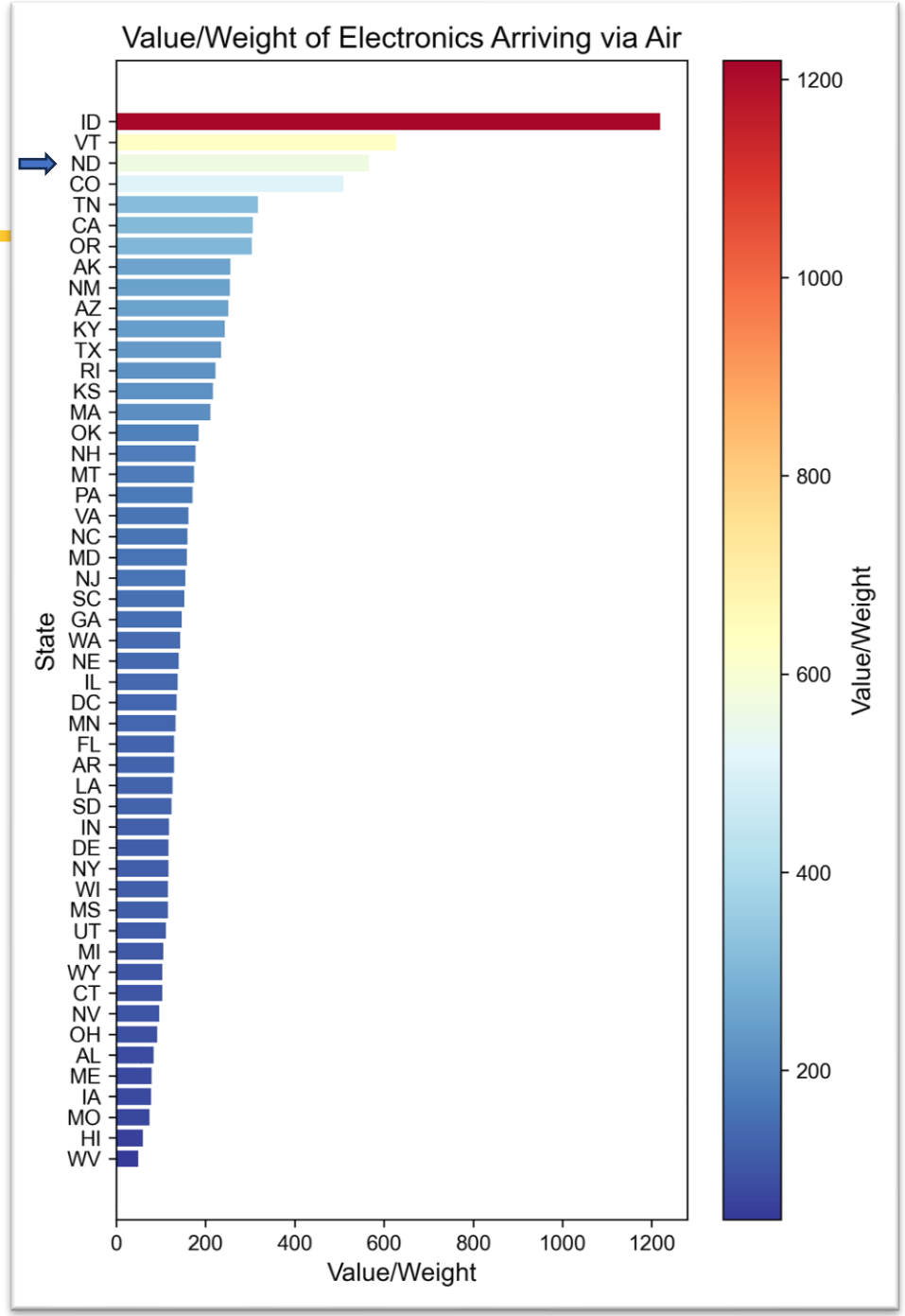
- Data Source
  - Freight Analysis Framework
  - Curated by FHWA and BTS
- High Value Imports
  - **Electronics**
  - Misc. Mfg. Products
  - Live Animals and Fish
- Cargo Drones
  - Enhanced accessibility
  - Less truck traffic/accidents
  - Infrastructure longevity
  - Environmental benefits



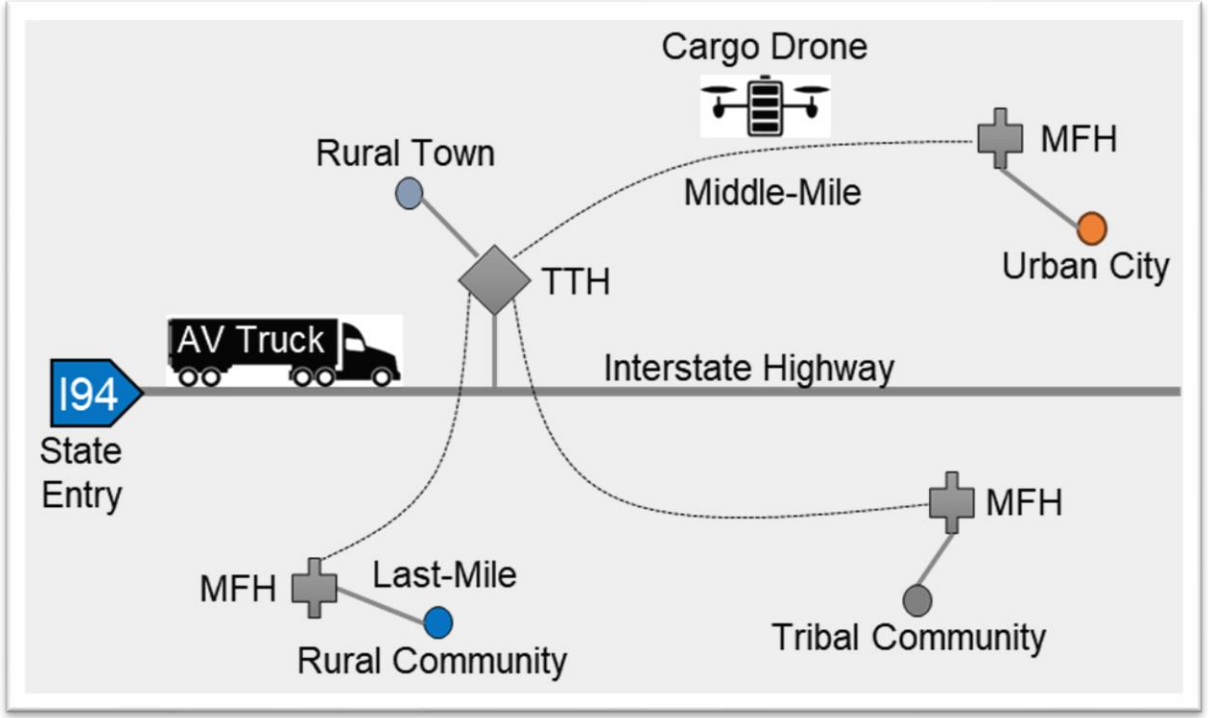
Case Study: Electronics

- Imported Value-to-Weight Ratio
  - ND will rank **third** in the nation (2030)
  - Behind Idaho and Vermont
- Origin States
  - Kansas and Illinois dominates
  - Eastern and Western entries to I94





Logistical Model



- Demand
  - 406 populated places in ND
- Supply
  - Public use airports in ND
  - Target underutilized.

- Truck Transfer Hubs (TTHs)
  - Long-haul trucks (potentially AVs) arrive at an airport near the state boarder.
  - Minimize ND travel based on I94 entry from origin state.
  - Cargo transfer to drones for middle-mile transport.
- Multimodal Freight Hubs (MFHs)
  - Middle-mile: TTH ↔ MFH
  - Last Mile: MFH ↔ Population Centers
  - Last Mile: Potentially AV trucks or drones
- GIS Optimization
  - Select optimum number and location of existing public use airports.

GIS Optimization Model

Minimize: $C = \sum_{i \in I} \sum_{j \in J} c_{ij} x_{ij}$

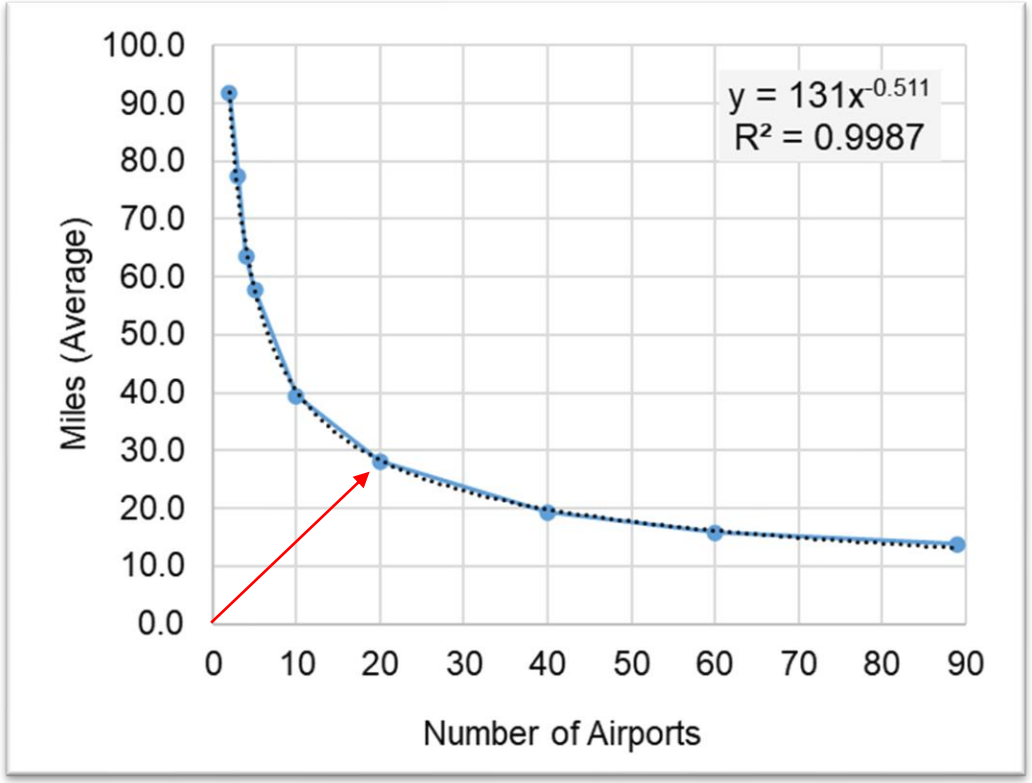
Constraint 1: $\sum_{j \in J} x_{ij} = 1 \quad \forall i \in I$

Constraint 2: $x_{ij} \leq Y_j \quad \forall i \in I, \forall j \in J$

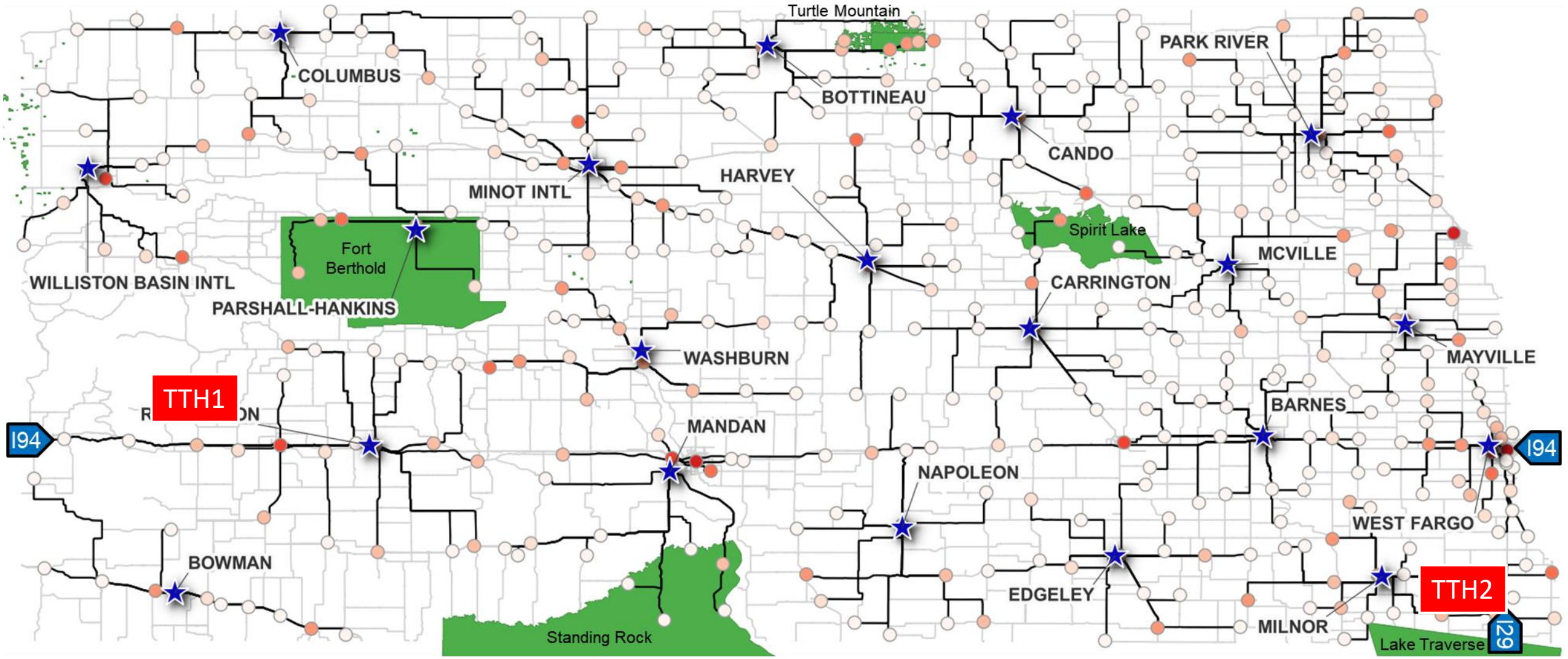
Constraint 3: $\sum_{j \in J} Y_j = N \quad \forall j \in J$

- Equations in English
  - Minimize average last-mile transport distance
  - Assign each populated place *i* to exactly one airport *j*
  - Airport *j* is assigned to at least one location
  - Assign exactly *N* airports

- Point of diminishing returns
  - 20 of the 89 ND public use airports selected to minimize the total last-mile network distance.
  - Average miles: 28 by truck or 23 by drone



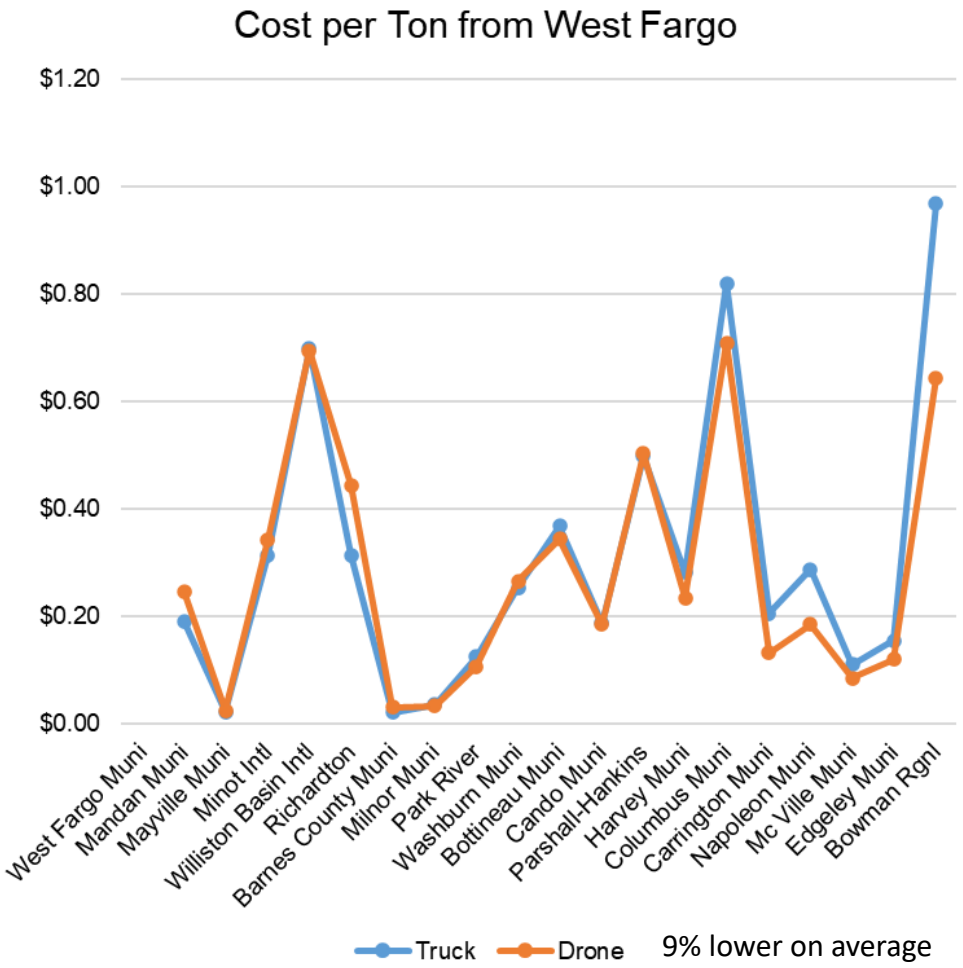
GIS Optimization Results

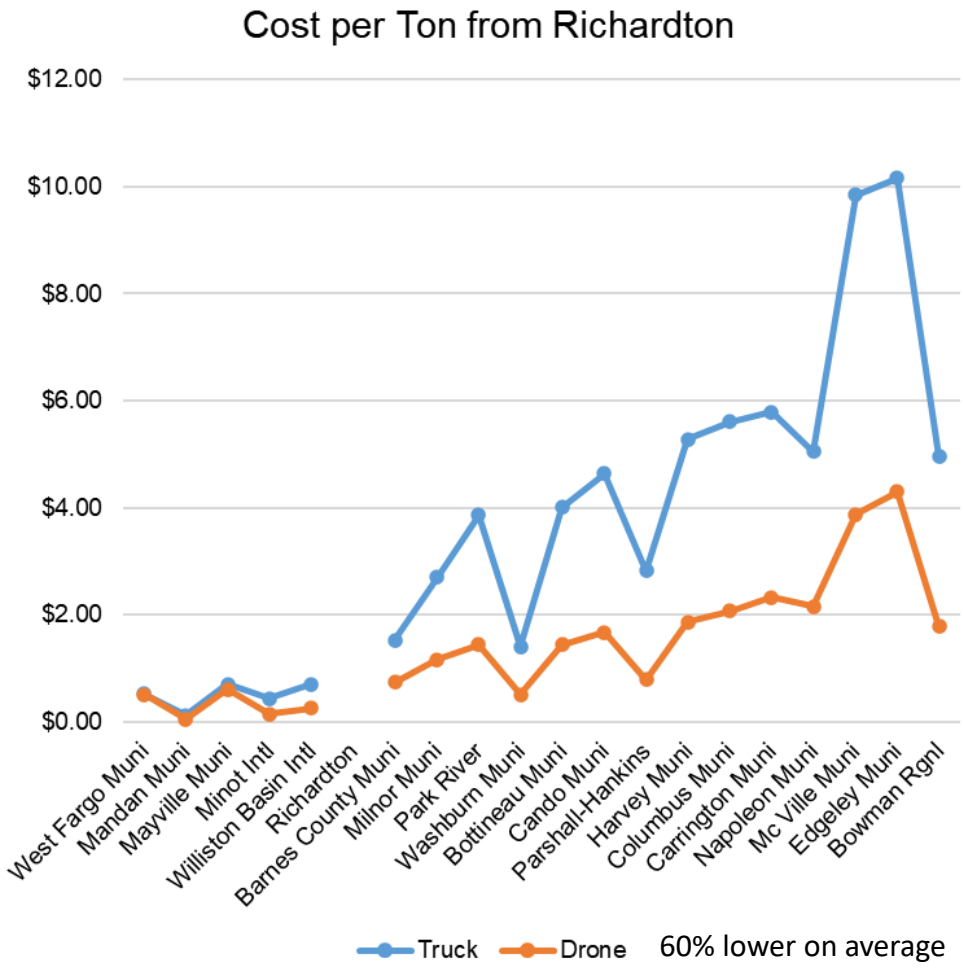


TTH1: 409 big-rigs annually

TTH2: 15,715 big-rigs annually

Middle Mile Costs from Eastern and Western TTHs





- Average Cost for LTL Box Truck: $2.34/mile (ATRI).
- For equal total logistical cost per day, the average cost for drones must be less than $1.18/mile (50%)

$$\mathrm{DCM} = \mathrm{TCM} \times \frac{\sum_{j \in J} TM_j \times \lceil TPR_j \rceil}{\sum_{j \in J} DM_j \times \lceil DPR_j \rceil}$$

Conclusions

- Same Day Delivery of Electronics for Rural Populations
  - Daily long-haul truck arrivals at TTHs (16,124 big rigs annually)
  - Middle-Mile: truck transfer hubs (TTHs) near I94 entry points.
  - Multimodal freight hubs (MFHs) at select public use airports.
  - Last-mile by trucks (average 28 miles) or drones (average 23 miles)
- Model
  - GIS optimization minimized distance from public use airports to population centers.
  - Price per mile threshold based on equal total logistical cost using trucks.
  - Drones must cost roughly 50% lower than trucks per mile.
- Average Cost per Ton
  - Drones at West Fargo TTH: 9% less than trucks.
  - Drones at Richardton TTH: 60% less than trucks.
- Average Underutilization Rate
  - Drones at West Fargo TTH: 9% less than trucks.
  - Drones at Richardton TTH: 40% less than trucks.

Rural Transportation Safety and Security Center (RTSSC)

Highlights

Dr. Kimberly Vachal

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

RTSSC Scope

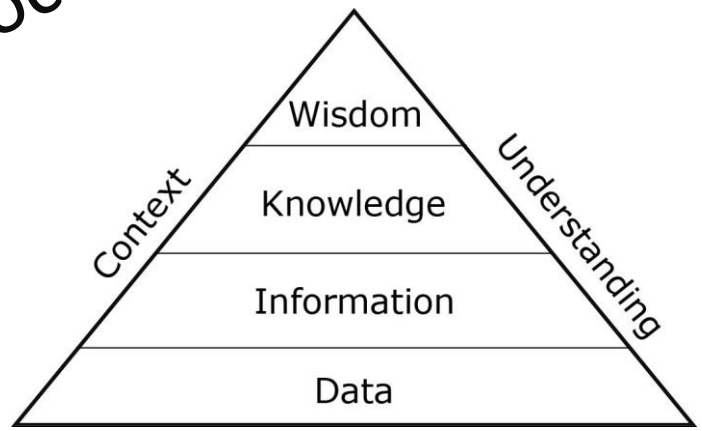
- Research and Outreach
  - Program evaluation
  - Data quantity/quality and decision-maker support
  - Exploratory analysis, POC/pilot, risk modeling
- Human behavior with engineering/environmental features
- Evidence-based and innovative strategies
- Leverage support/funding to conduct research

RTSSC Emphasis Areas

- Road Departure
- Speed
- Alcohol / Drug Related
- Unbelted Vehicle Occupants
- Speeding / Aggressive Driving
- Young / Aging Drivers
- Tribal Nation Traffic Safety Support

VISION ZERO
Zero fatalities. Zero excuses.

...Local Roads!



RTSSC Team & Projects

- Assessment
  - Observed & Self-Reported Surveys
  - Impaired Driving Investigations
  - High-Risk Driver Groups
- Research
  - Drug Impairment, Teen/Aging Drivers, Recidivism Risk, Lane/Road Departure
  - Empirical Studies, Systemic Safety Analysis, Local/Rural Road Safety
- Education/Outreach
  - VZ Partner Conference/Coordinators
  - ATSIP, TRB, Lifesavers, AASHTO

Photo Facebook, Traffic Safety

RTSSC Project Highlights

- Oral Fluids Pilot Project
  - Training, Database, Analysis, and Resource Support
  - Pilot Project End, Transition to Roadside Testing
- SS4A, NHTSA Pedestrian, and Tribal Roads Safety
  - Township Road Safety Survey
  - Rural Road Engineering Specialist
  - usRAP Safety Planning
- CMV Winter Storm Mobility & Public Education
- In the upcoming year: NDDOT VZ Support, Impaired Driving Studies, Teen Crash Risk & Drivers Education Curriculum, NHTSA Tribal Pedestrian Safety Guide

Questions/Comments

Agricultural & Freight Information

- Traditional ND Ag Producer Support in Transportation
  - ND Grain Movement Database
  - Annual Elevator Transportation Survey
  - Market Development, Trade Teams, and Trends
  - USDA Coop 1) Basis map 2) Grain truck market survey

- Growing ND Freight Transportation Information

  Goal: North Dakota's Current Transportation Supply and Expectations for the Future Demand: Competitiveness, Agility, Responsiveness
  - ND Freight Facts Resources
  - Poll/Survey: Prioritizing Transportation Factors; Community Business Development with NDDOC Regional Economic Development
  - More to come… Business Survey/Processor Interviews, Farm Truck Sample, VIUS

Commercial Vehicle Safety Center

Highlights and Activities

Brenda Lantz

Advisory Council Meeting

October 10, 2024

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Commercial Vehicle Safety Center

- Established fall 2017 through Federal Motor Carrier Safety Administration (FMCSA) grants
- The 2017-2019 grant - **Commercial Driver's License** (CDL) focus
- The 2019-2021 grant - **data quality** focus
- The 2021-2023 grant - focus on

  work zone safety & distracted driving

Commercial Vehicle Safety Center

- Current 2023-2025 grant - focus on **technologies and tools** to promote safe driving behaviors and to identify high-risk corridors
- Next **CMV Safety Summit - December 4-5, 2024** – Denver, Colorado
  - www.ugpti.org/events/safetysummit2024/

Commercial Vehicle Safety Center

- Goal is to improve CMV Safety and CDL Compliance through University Partnerships
  - www.ugpti.org/outreach/cvsc/
  - Biennial Commercial Vehicle Safety Summits and technical assistance
- Point of contact for universities, law enforcement, and driver licensing agencies to establish partnerships
- Provide resources and host webinars
  - Best Practices for Law Enforcement and Driver Licensing Agencies
  - FMCSA Rulemakings and Programs
  - Research and Partnerships between Government, Universities, and Industry

Research Projects – Ongoing with the ND Highway Patrol

- Commercial Vehicle Safety Plan
  - With Kim and other RTSSC staff
  - Assist with assembling data, completing analysis, and identifying goals
- Update Program Plan/Top Level Design for FMCSA Innovative Technology Deployment (ITD) Program
  - With Brad, Sharijad and other ATAC/DOTSC staff
  - Creates a framework and system architecture to guide ITD projects
- CMV Traffic Safety Dashboard
  - With Kim, Brad, and other RTSSC and ATAC/DOTSC staff and students
  - Provides timely traffic information flows such as crash events, traffic density, vehicle speed, and environmental information

Research Projects – In Progress

- Effectiveness of Third-Party Testing and Minimum Standards for CDL Knowledge and Skills Tests
  - With toXcel and eScience Technology & Solutions (eSTS)
- CMV Driving with Limb Loss or Impairment
  - With toXcel, the American Transportation Research Institute (ATRI), and the Association for Driver Rehabilitation Specialists
- CDL Specific Training for Clerks of Courts
  - With Univ. of Cincinnati, eSTS, and the National Center for State Courts (NCSC)
- Quantifying the Benefits of Creating New Truck Parking Spaces
  - With toXcel, ATRI, and the Owner-Operator Independent Driver Association
- Preparing for Autonomous Trucking in Rural Areas
  - Denver is the PI, with Raj, Kim, Al, Ron, Pan, and Ryan contributing

Research Updates and Activities

Mountain-Plains Consortium

Pan Lu, Ph.D.
Upper Great Plains Transportation Institute
North Dakota State University
pan.lu@ndsu.edu

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Intelligent Infrastructure and Transportation Management Team

Research Focus:

- **Transportation Infrastructure**
- **Safety and Transportation Risk**
- **Mobility, Accessibility, and Traffic**
- **Autonomous Trucking in Rural US**

Our Team

Pan Lu, Phd
Team Director, Advanced Researcher

Xinyi Yang
PhD Student, Senior Research Assistant

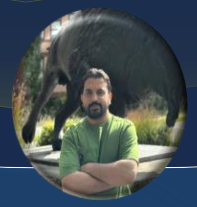
Ryan Jones
PhD Student, Senior Researcher

Asad Ali
PhD Student, Senior Research Assistant

Mingwei G.
PhD Student, Senior Research Assistant

Talha A.
PhD Student, Junior Research Assistant

Emmanuel T
PhD Student, Junior Research Assistant



Imran B.
PhD Student, Junior Research Assistant

Melika A.
PhD Student, Junior Research Assistant

Miranda W
PhD Student, Junior Research Assistant

Currently Funded Projects

1) **NCHRP 17-99**: Assessing Safety Effectiveness of Treatments and Technologies at Highway-Rail Grade Crossings
2) **CMMM** (Center for Multi-Modal Mobility) **YR1-PR1**: Analysis of Traffic Safety and Mobility for Tribal Communities under Severe Weather Conditions
3) **CMMM YR1-PR2**: Mobility and Safety Analysis of Mixed Traffic with Connected and Autonomous Vehicles in Rural and Small Urban Area under Severe Weather Conditions
4) **FHWA/NDDOT**: All-in-One Data Collection Station for Real-Time Traffic and Pavement Bottom-up Cracking Monitoring
5) **CMMM YR1-CP1**: Agent Based Simulation Suite for Public Transit Planning and Design
6) **NDAES/NDSU**: Sustainable Urban Agriculture for Food Deserts in Cold Regions
7) **CTIPS-YR1-PR1**: Assessing Condition of Rehabilitated Concrete Pavement with Slab Fracturing and Asphalt Overlay using Distributed Fiber Optic Sensors
8) **FMCSA**: Preparing for Autonomous Trucking in Rural Area: Impacts on Safety, the Environment, and Economic Development in Rural and Tribal Regions
9) **UGPTI-UMD/NDSU**: Accelerating the Deployment of Autonomous Trucks in Rural Areas
10) **Oak Ridge National Laboratory / DOE**: Assessing Critical Vulnerabilities to Natural Gas Power Plants from Pipeline Infrastructure Disruptions
11) **CMMM YR2-PR1**: Exploring IoT Impact on Rural Mobility: Navigating Mixed Traffic with Varied Levels of Autonomation on Rural Roads
12) **CMMM YR2-PR2**: Environmental Impact Assessment for Hazmat Transportation by Rail in a Vital Multi-Modal Freight Corridor

Year 2024 – Peer-Reviewed Journal Publications

1) Asad Ali, Mingwei Guo, Salman Ahmad, Ying Huang, and **Pan Lu**. “Optimizing Wildfire Evacuations through Scenario-Based Simulations with Autonomous Vehicles”, *Fire*, 7(10), 340, 2024 https://doi.org/10.3390/fire7100340
2) Prathyush Kumar Reddy Lebaku, Lu Gao, **Pan Lu** and Jingran Sun. “Deep Learning for Pavement Condition Evaluation using Satellite Imagery”, Infrastructures, 9(9), 155, 2024 https://doi.org/10.3390/infrastructures9090155
3) Yaobang Gong, Tanner Isom, **Pan Lu**, Xianfeng (Terry) Yang and Aaron Wang. “Modeling the Impact of COVID-19 on Transportation at Later Stage of the Pandemic: A Case Study of Utah”, *Journal of Intelligent Transportation Systems*, volume 28, Issue 4, 2024. https://doi.org/10.1080/15472450.2022.2157212
4) Heshani Manaweera Wickramage, **Pan Lu**, Peter Oduor, and Jianbang Du, “Estimating the Spreading Rates of Hazardous Materials on Unmodified Cellulose Filter Paper: Implications on Risk Assessment of Transporting Hazardous Materials”, *Journal of Porous Media*, Volume 27, Issue 9, PP 29-53, 2024 https://doi.org/10.1615/JPorMedia.2024047621
5) Xinyi Yang, Xingyu Wang, Joseph Podolsky, Ying Huang, and **Pan Lu**. “Addressing Wander Effect in Vehicle Weight Monitoring: An Advanced Hybrid Weigh-in-Motion System Integrating Computer Vision and In-Pavement Sensors”, *Measurement,* volume 234, July 2024, 114870, 2024 https://doi.org/10.1016/j.measurement.2024.114870
6) Ahmed, Hafiz Usman, Salman Ahmad, Xinyi Yang, **Pan Lu**, and Ying Huang, “Safety and Mobility Evaluation of Cumulative-Anticipative Car-Following Model for Connected Autonomous Vehicles”, *Smart Cities*, 7(1), 518-540, 2024 https://doi.org/10.3390/smartcities7010021
7) Lu Gao, Ke Yu, and **Pan Lu**. "Considering the Spatial Structure of the Road Network in Pavement Deterioration Modeling", *Transportation Research Record*, 2678 (5) PP 153-161, 2024. https://doi.org/10.1177/03611981231188373
8) Salman Ahmad, Hafiz Ahmed, Xinyi Yang, Yihao Ren, Ying Huang, and **Pan Lu**. “Evaluating Driving Behavior Patterns during Wildfire Evacuations in Wildland-Urban Interface Zones using Connected Vehicles Data, *Fire safety journal, volume 142, January 2024, 104015* https://doi.org/10.1016/j.firesaf.2023.104015

Year 2024 – Journal Papers Under Review

1) Ryan Jones, **Pan Lu**, and Denver Tolliver. “The Marketing Potential of Autonomous Trucks in the United States: An Industry Review,” Transportation Research Part E: Logistics and Transportation Review, 2024
2) Heshani Manaweera Wickramage, **Pan Lu**, Peter Oduor, and Jianbang Du. “Estimation of the Infiltration Depth of Hazardous Materials on Glass Beads: Implications on Risk Assessment of Transporting Hazardous Materials,” Transportation Research Record, 2024
3) Yihao Ren, **Pan Lu**, and Chengbo Ai. “A Hybrid Local-Feature-Based Approach for Automated Rail Extraction from LiDAR Data,” Optics and Laser Technology, 2024
4) Yihao Ren, Chengbo Ai, and **Pan Lu**. “An Advanced Deep Learning Based Hybrid Rail Exaction Algorithm Leveraging LiDAR Technology,” Journal of Infrastructure Systems, 2024
5) Jianbang Du, **Pan Lu**, Amin Keramati, Lu Gao, Xue Yang, and Joshua Li. “The Imbalanced Machine Learning Prediction on Highway-Rail Grade Crossing Crash Severity with Comprehensive Variables,” Reliability Engineering & System Safety, 2024
6) Melika Ansarinejad, Ying Huang, and **Pan Lu**. “Assessing Environmental Impacts of Vehicles in Inclement Weather using VISSIM and Bosch Module,” Transportation Research Part D, 2024
7) Amin Keramati, **Pan Lu**, and Afrooz Kazerouni. “Evaluating Crash Severity at Highway-Rail Grade Crossings using an Analytic Hierarchy Process-Based Hazard Index Model,” Accident Analysis and Prevention, 2024
8) Thompson, Emmanuel Anu, and **Pan Lu**. “Analyzing the Determinants of Rail Freight Impact on Port Competition in West Africa,” Transportation Research Record, 2024
9) Thompson, Emmanuel Anu, Philip Kofi Alimo, **Pan Lu**, Bernard Kwei Tetteh, Gideon Ofori-Addai, and Ruhaimatu Abudu. “Expert Sytems in Container Terminals: A Compreehensive Review of Digital Twin Technology,” Int. J. of Shipping and Transport Logistics, 2024

Year 2024 – Publications and Impacts

- **12** MS/PhD/undergraduate/Post-doc mentored
- **2** PhD graduated
- **1** refereed technical report publications
- More than **6** conference presentations and conference proceeding publications
- More than **20** times field/lab visits to collect data

Thank you!


SATELLITE COMMUNICATIONS
TERRESTRIAL BROADCAST
MOBILE
MAN
ITS-G5
Crash Avoidance
Navigation
Safety Systems
Intermodal Communications
Passenger Information

TRANSPORTATION LEARNING NETWORK

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Preservation and Sustainability (CTIPS) universities

MISSION

TO SUPPORT QUALITY TRANSPORTATION THROUGH A NETWORK OF PEOPLE AND TECHNOLOGY THAT SERVES TRANSPORTATION LEARNING NETWORK MEMBERS BY ENHANCING COMMUNICATION, EDUCATION, PROFESSIONAL DEVELOPMENT, TECHNOLOGY TRANSFER, AND RESEARCH.

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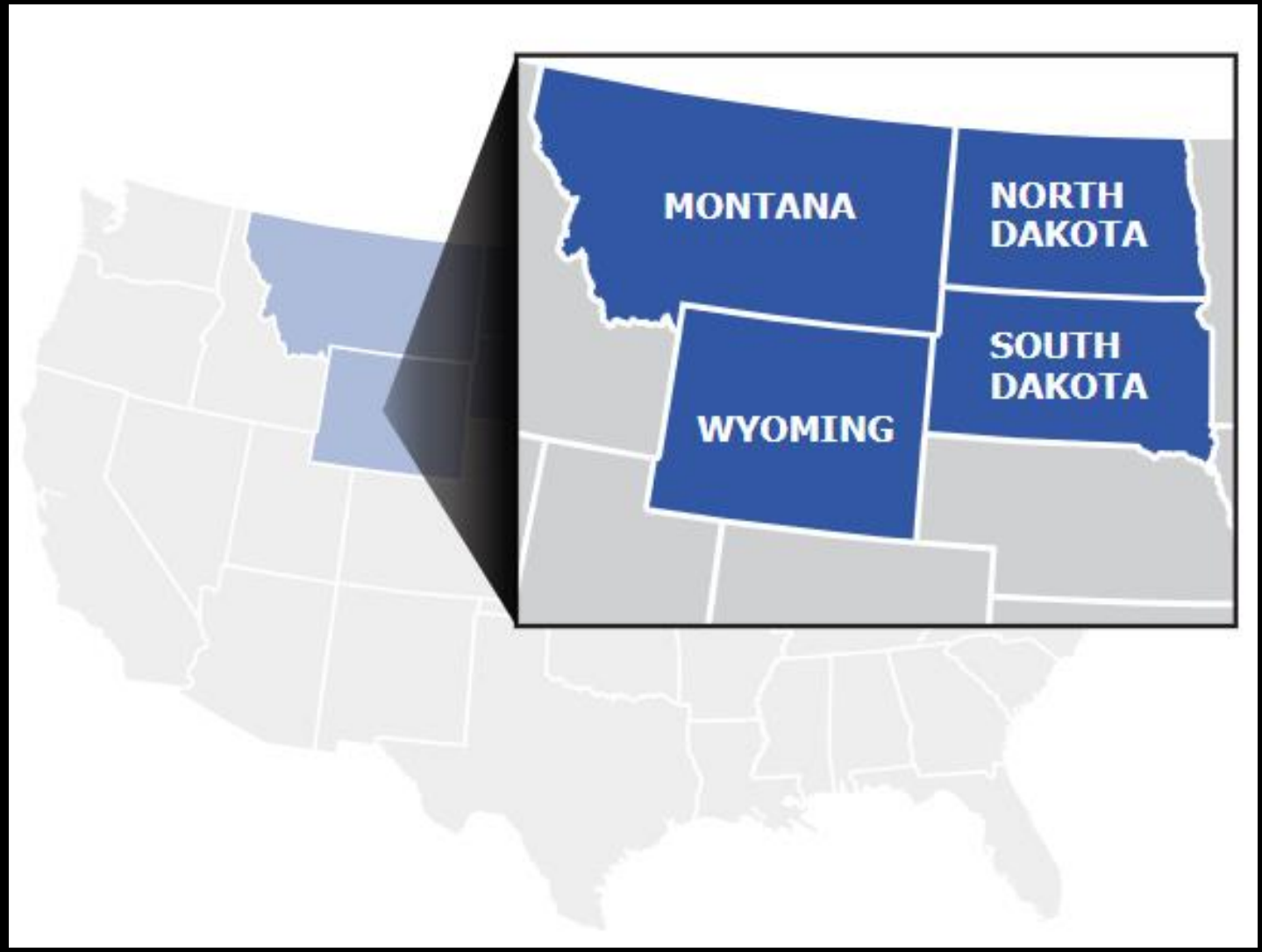
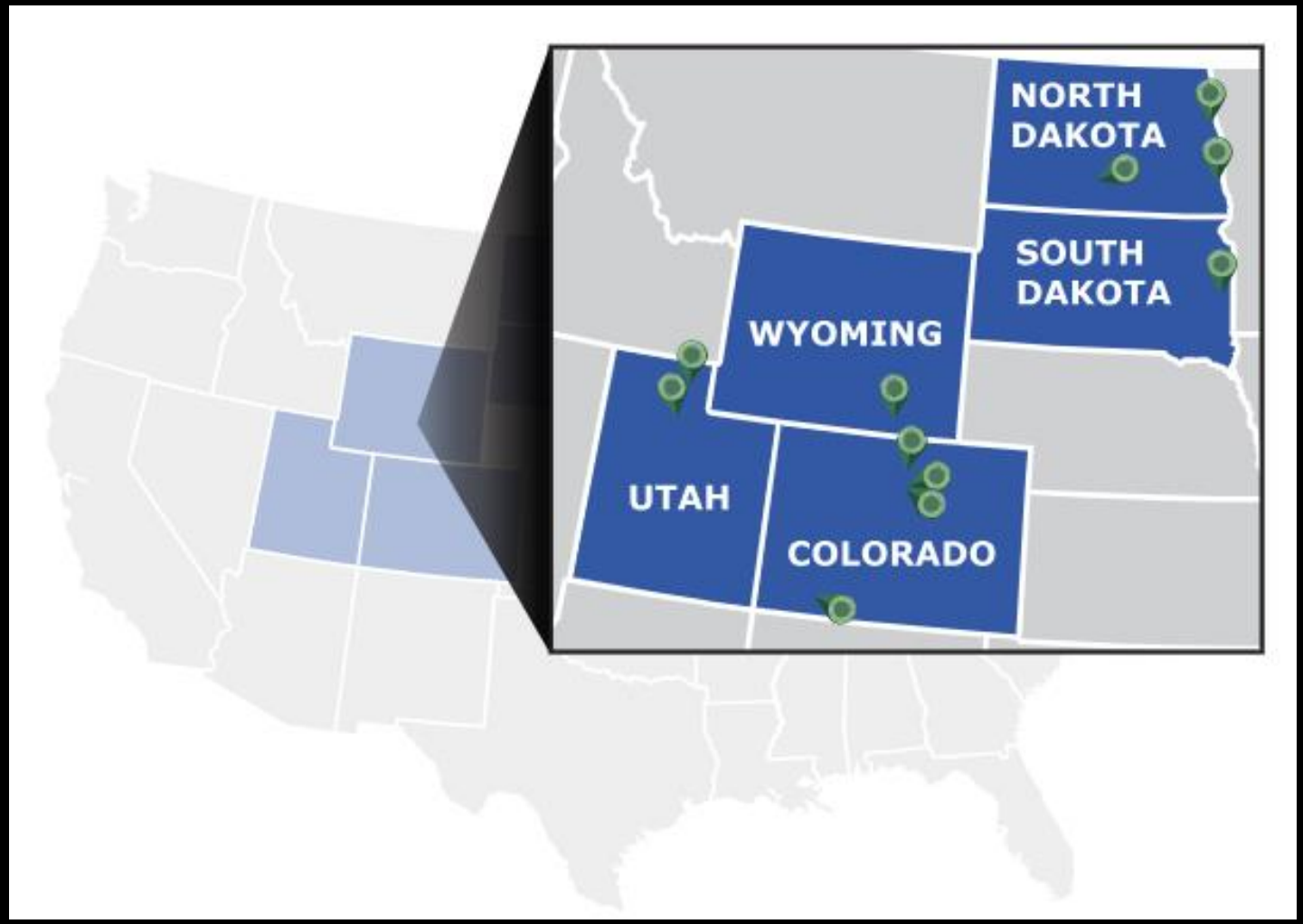
DOT PARTNERS



CENTER FOR TRANSFORMATIVE INFRASTRUCTURE PRESERVATION AND SUSTAINABILITY (CTIPS)

formerly the ~~Mountain-Plains Consortium~~



AASHTO TECHNICAL TRAINING SOLUTIONS

nhi 50TH ANNIVERSARY national highway institute

ARTBA American Road & Transportation Builders Association

NDSU | UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTHERN TRIBAL TECHNICAL ASSISTANCE PROGRAM

ATSSA SAFER ROADS SAVE LIVES

CLEAR ROADS research for winter highway maintenance

OTHER PARTNERS

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

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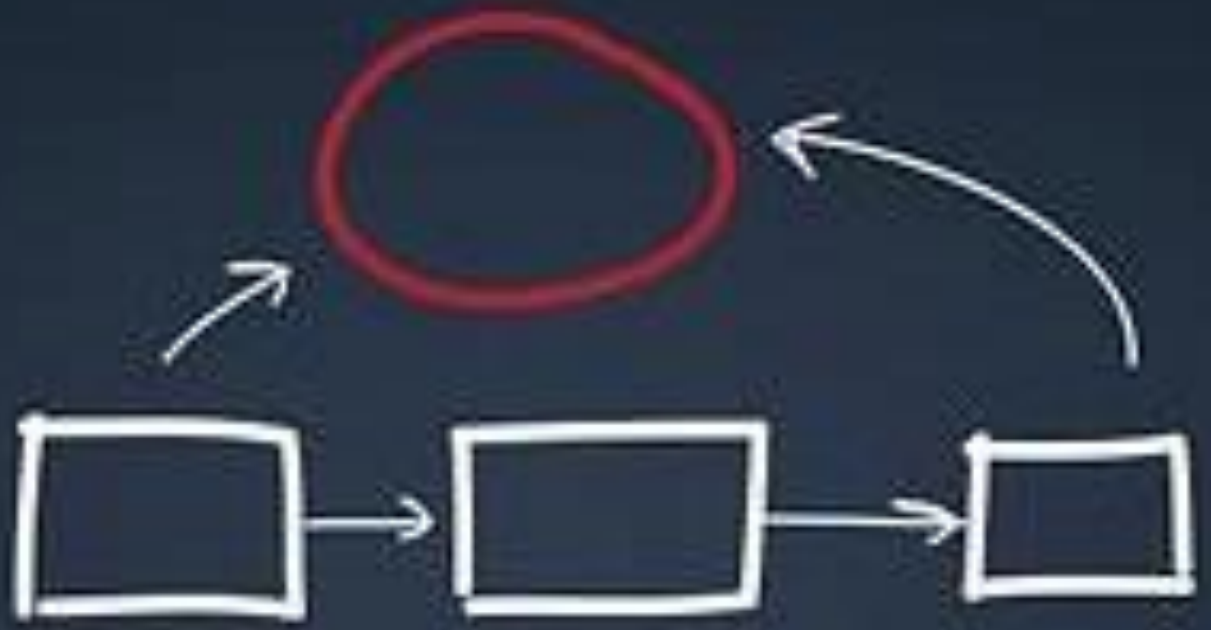
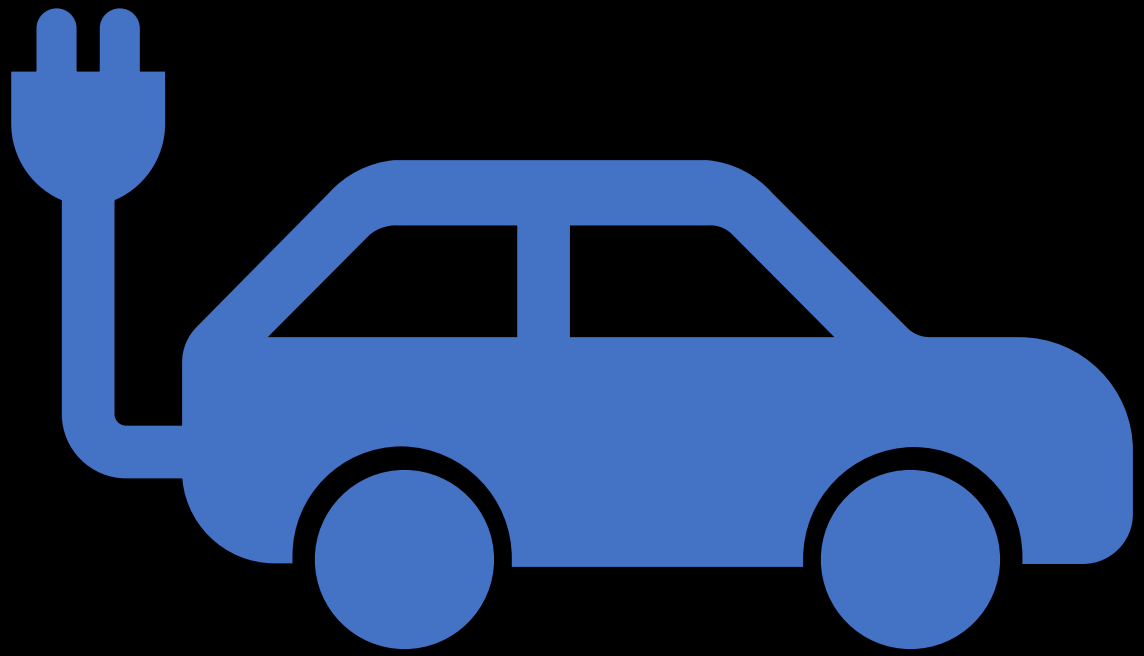
‘23-‘24 IMPACT


42
LIVE EVENTS
6855
PARTICIPANTS


LEARNING
MANAGEMENT
SYSTEM
ADMIN • SUPPORT • REPORTING



- EXPANSION/ENHANCEMENT OF LMS
- ENGAGING NEW PARTNERS (IDAHO & NEBRASKA DOT)



TRANSPORTATION LEARNING NETWORK PLAYS A VITAL ROLE IN OUR TRANSPORTATION INDUSTRY!

HOW TO GET INVOLVED

- ATTEND WEBINARS
- SHARE EVENTS WITH PARTNERS
- PROVIDE IDEAS AND SPEAKERS FOR LIVE EVENTS

Transportation Learning Network (TLN)

Don’t Forget to be Awesome!

Thank you!

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