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Use of Dashboards for Winter Operations Case Study: North Dakota Department of Transportation

Clear Roads Project 22-05: Use of Dashboards for Winter Operations

December 2024

Technical Report Documentation Page

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16. Abstract Public works agencies at state and municipal levels have invested a large amount of personnel and funding resources in dashboards to improve winter maintenance operations. This document is one of the five case studies conducted for the Clear Roads project entitled *Use of Dashboards for Winter Operations*. This case study report summarizes the North Dakota DOT's experiences and lessons learned in using dashboards to support winter maintenance. The case study identifies the purpose of each North Dakota DOT dashboard, the performance measures tracked, the data sources, how the dashboards are maintained, difficulties encountered, and key lessons learned.			
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1. Overview of North Dakota Department of Transportation Dashboards for Winter Operations

This section provides an overview of this Case Study report detailing how the North Dakota Department of Transportation (NDDOT) has used dashboards for winter operations.

1.1 Case Study Background

This research project is being funded through the Clear Roads pooled fund program to develop Case Study Reports documenting how multiple State DOTs and public works agencies use dashboards for winter operations.

1.2 Agency Characteristics

NDDOT is divided into 8 Districts that is responsible for the maintaining surface transportation including highways, bridges, rail, transit, pedestrian, and bicycle paths across the state.

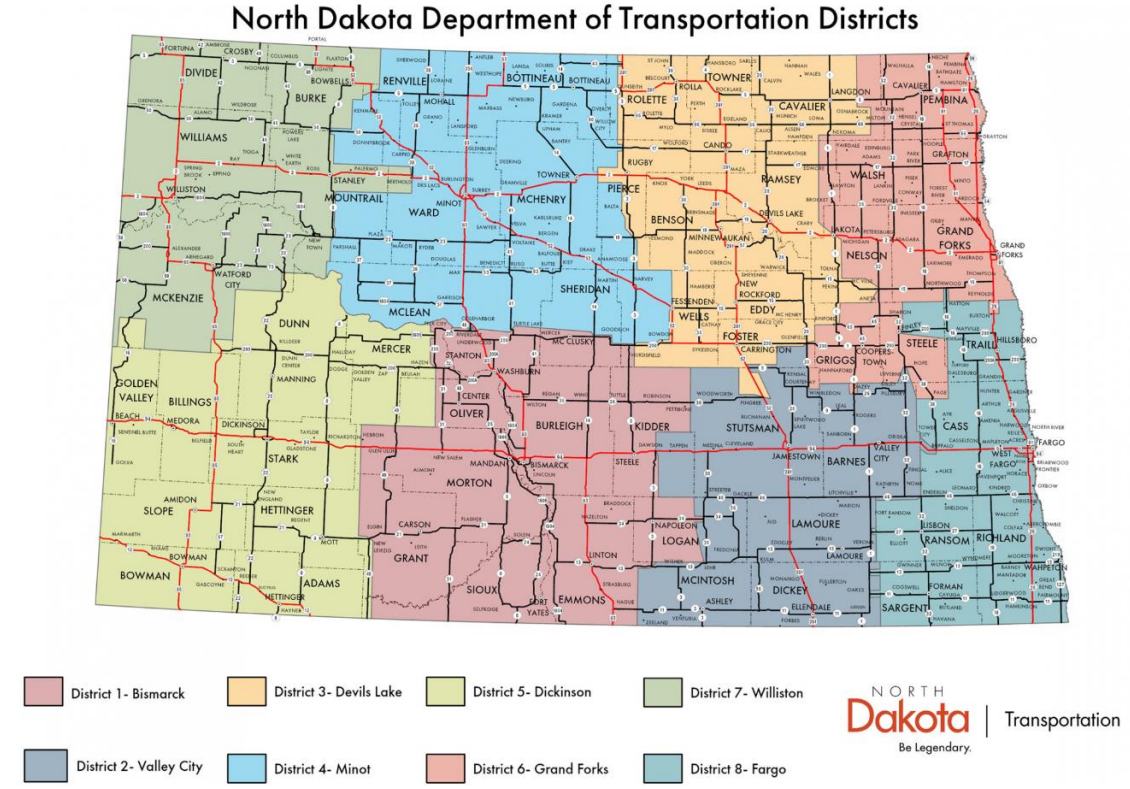


Figure 1 NDDOT Transportation Districts

NDDOT manages 17,300 total lane miles with 359 state-owned plow trucks with over 372 state employees. NDDOT maintains 98% of the state-owned roadways. In the 2022-2023 winter season,

NDDOT applied approximately 46,000 tons of sodium chloride and 3,173,000 gallons of liquids (sodium chloride brine) and 593,000 gallons of agricultural byproduct. The cost of salt in 2022 winter season was $105 per ton, resulting in $5.9 million dollars for material costs. The average accumulated winter season index was 2272[1]. These data were reported to the Clear Roads Winter Data Survey.

1.3 Agency Interviews

An interview was conducted virtually with NDDOT staff on Monday December 4th, 2023, at 1 PM CST. Table 1 contains a listing of the staff interviewed and the subjects discussed in those meetings. Appendix B to this report contains meeting minutes from the interview.

Table 1 Staff Interview Details

Staff Interviewed	Date / Time	Subjects Discussed
Brandon Beise, North Dakota Department of Transportation, Maintenance Engineer **Steeg Nelson,** North Dakota Department of Transportation, Engineer I **Brad Darr,** North Dakota Department of Transportation, State Maintenance Engineer	Dec 4th, 2023 / 1 PM	Dashboard objectives Description of each dashboard Limitations of each dashboard Process for developing a new dashboard Data accuracy Data storage and management Dashboard maintenance Costs Benefits of dashboards Recommendations and lessons learned Future enhancements

2. General Overview of Winter Dashboards

Development for winter dashboards began in 2020 when NDDOT's main goal was to establish speed recovery performance metrics. This effort stemmed from the growing need to quantity performance measures that could no longer be done manually. Shortly after, NDDOT was awarded a grant that same year that enabled the creation of data-driven dashboards to assist in these endeavors. These dashboards were created in collaboration with North Dakota State University (NDSU).

2.1 Maintenance Dashboard

The Maintenance Dashboard is a tool that is still currently being developed by NDDOT. The goal of the dashboard is to integrate in-house material usage inventory and finance data. The Maintenance Dashboard, as seen in Table 2, aims to track the cost of snow and ice control. The dashboard sorts the data by garage level and is used mostly by maintenance crew, management, and district representatives.

[1] https://mrcc.purdue.edu/research/awssi/indexAwssi.jsp

It will utilize data from the Maintenance Equipment Tracking System (METS) and Finance Data from PeopleSoft. The dashboard will be updated monthly and accessible to decision-makers and districts. It is built on the ESRI platform.

The tool displays a map of the state and pie charts and graph to create an easy-to-read user interface. Each district is color coded, and historical data from previous months can be viewed so that users may create a direct cost comparison between the months and districts based on their material usage cost.

Future implementation includes connecting AVL data that would be updated in real time. The dashboard filter would be setup at the route level and would be used to compare material usage, performance, and road conditions.

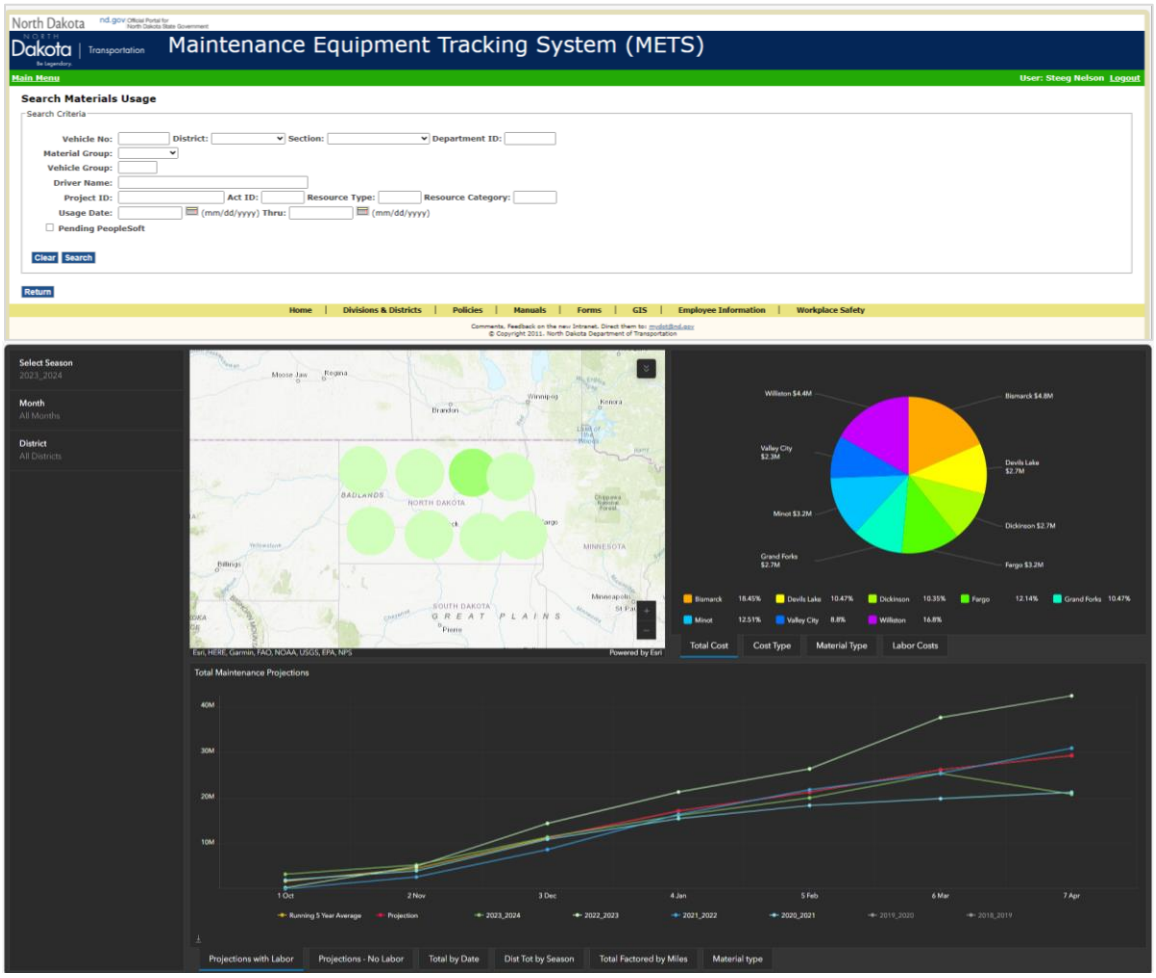


Figure 2 Maintenance Dashboard

Table 2 Maintenance Dashboard Overview

Purpose	This dashboard is still being developed; the goal is for it to be able to track the cost of snow and ice control.
Performance Measures	Cost of snow and ice control
Data Sources	Maintenance Equipment Tracking System (METS), Finance Data (via People Soft), and Automatic Vehicle Location (AVL)
Refresh Rate	Updated monthly
Users/Access	Decision makers and districts have access
Platform/Software	ESRI

2.2 Maintenance Speed Recovery Dashboard

The Maintenance Speed Recovery Dashboard is a tool that tracks the amount of time it takes for vehicle speeds to return to normal travel speeds due to snowstorms. If the speed of vehicles recovers to a rate of 90% of pre-storm speed, then it is determined that normal travel speeds have resumed. This dashboard can view historical data up to one year. By determining which districts speed recovery rates are slower than the rest, the NDDOT can allocate resources effectively to those areas.

Table 3 shows that the Maintenance Speed Recovery Dashboard is designed to monitor the time it takes for vehicle speeds to return to normal levels after snowstorm events. It uses data from the Maintenance Decision Support System (MDSS), roadway sensors (Automatic Traffic Recorders - ATR), and radar sensors on Roadside Weather Information System (RWIS) towers at 10-12 locations. The dashboard is updated every 24 hours and is accessible to districts. It is built on the ESRI platform.

The tool provides points along road segments that contain metrics such as average recovery time, snow recovery, friction, and speeds. Historical data is also provided to make direct comparisons between time periods for all the various metrics.

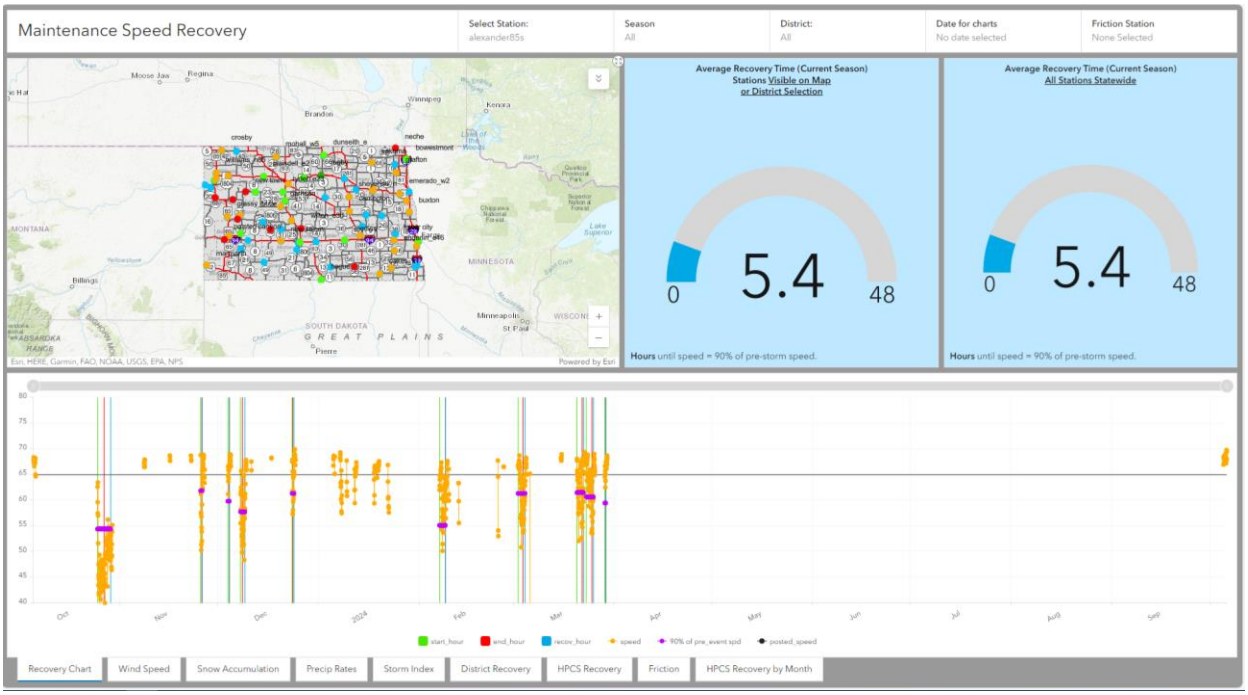


Figure 3 Maintenance Speed Recovery Dashboard

Table 3 Maintenance Speed Recovery Dashboard Overview

Purpose	Tracks how long vehicle speeds return to normal travel speed due to snowstorm events
Performance Measures	Snowstorm travel speed
Data Sources	Data is provided by Maintenance Decision Support System (MDSS), roadway sensors in the form of Automatic Traffic Recorders (ATR), radar sensors on Roadside Weather Information System (RWIS) towers (10-12 locations)
Refresh Rate	24 hours
Users/Access	Districts
Platform/Software	ESRI

2.3 Road Condition Dashboard

The Road Condition Dashboard is a tool designed to present real time data related to the road conditions within the state. The tool is mainly used by field operations and snowplow drivers and the dashboard presents variables such as visibility, weather conditions and the state of the roads themselves.

The Road Condition Dashboard's purpose, as noted in Table 4, is to offer real-time data on road conditions, focusing on mobility, weather, and road condition performance measures. Data is sourced from the Road Condition Reporting System (RCRS), and the dashboard is updated in real-time. It is accessible to internal users, field operators, maintenance personnel, and patrol teams, and is built on the ESRI platform. This tool provides road condition data in the form of bar graphs and pie chart and can organize them by district to display how much of the road segments in different districts are Seasonal/Good, Scattered Wet/Slush, and Wet/Slush. At the garage level, staff can compare road conditions in neighboring areas to see how a storm is progressing across the state.

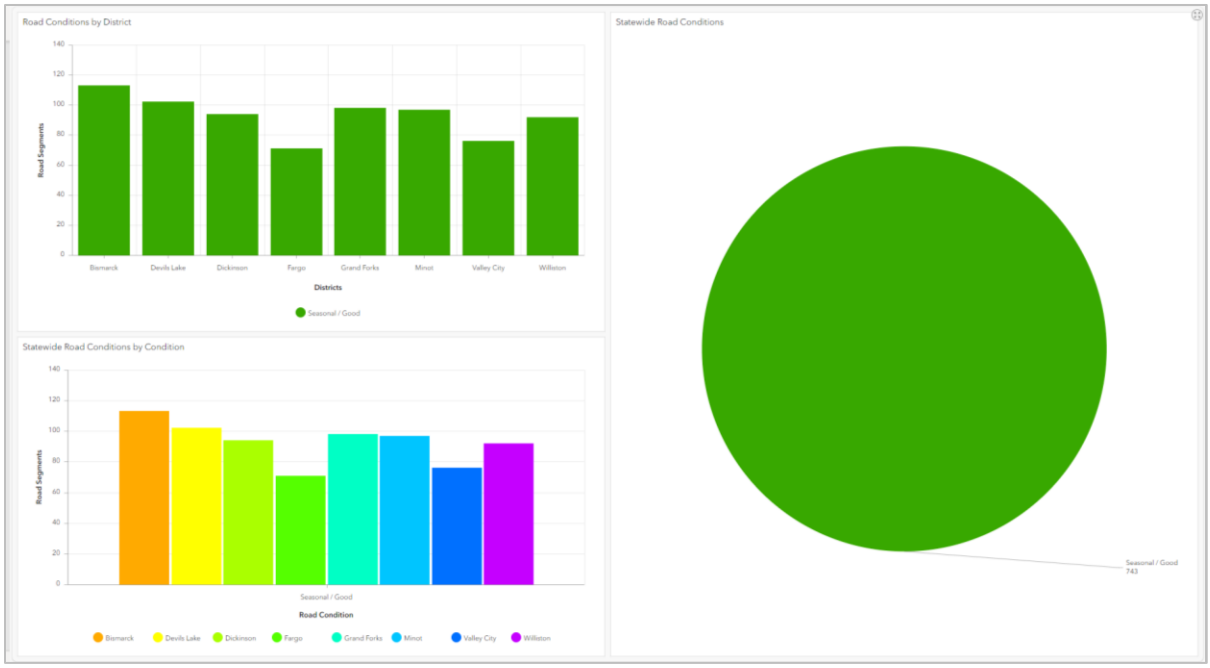


Figure 4 Road Condition Dashboard

Table 4 Road Condition Dashboard Overview

Purpose	Provide real time data of road conditions
Performance Measures	Mobility, weather, road condition
Data Sources	Road Condition Reporting System (RCRS)
Refresh Rate	Real time
Users/Access	Internal, field operators, maintenance, patrol
Platform/Software	ESRI

2.4 North Dakota Roads Dashboard

North Dakota Roads Dashboard visualizes current road conditions and sources data from RCRS as well as incident reports from local state and highway patrol. Without a Traffic Management Center (TMC) currently in place, this dashboard serves as the primary way to view road conditions in real time. This dashboard is also the data source of the Road Conditions Dashboard.

The North Dakota Roads Dashboard as seen in Table 5 is designed to track incidents and feed data into the Road Condition Dashboard. It focuses on performance measures related to road conditions, incidents, and weather. Data sources include the RCRS, state radios, and highway patrol reports. The dashboard is updated through manual input from the maintenance managers and is accessible to the public. It is built on the ESRI platform. The map on the ESRI platform provides filters for precipitation, visibility, condition, and travel speed. This allows users to find areas with the selected inputs and get a better understanding of road conditions.

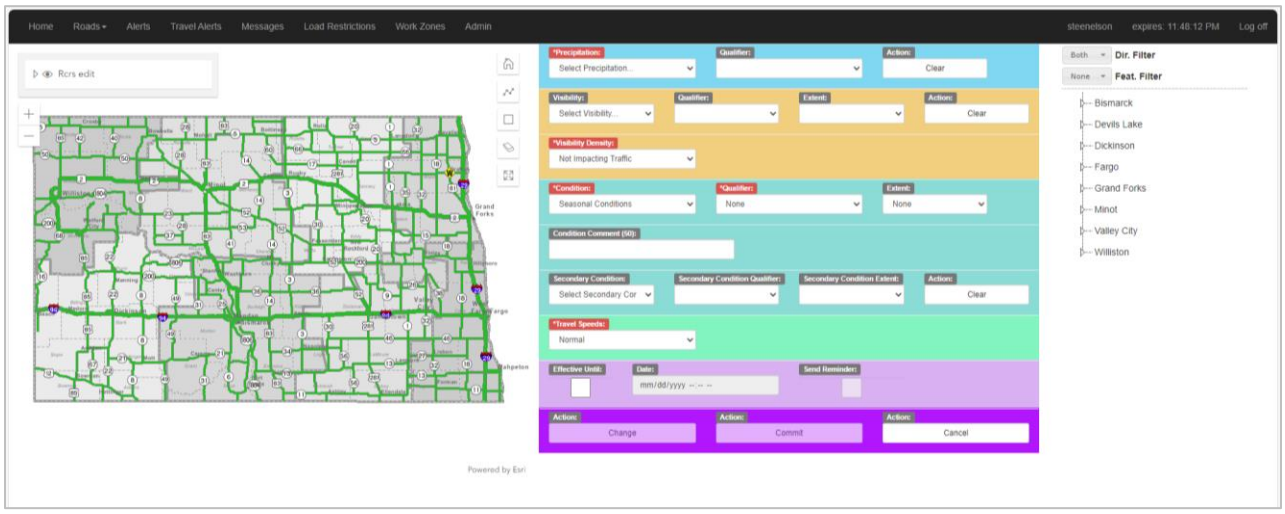


Figure 5 North Dakota Roads Dashboard

Table 5 North Dakota Roads Dashboard Overview

Purpose	Tracks incidents and feed into the Road Condition Dashboard
Performance Measures	Road conditions, incidents, weather
Data Sources	RCRS, state radios, highway patrol
Refresh Rate	Manual input
Users/Access	Public access
Platform/Software	ESRI
Source	https://gis.dot.nd.gov/external/rcrs/Account/Login?ReturnUrl=%2Fexternal%2Frcrs%2FRoads%2FMap

2.5 NDDOT Dashboard

The NDDOT Dashboard, as shown in Figure 6, is a tool that provides a thorough overview of the current state of NDDOT transportation infrastructure. It presents various metrics such as, conditions of roads and bridges, safety and Vision Zero, customer service indicators, types of transportation, available roads, and traffic volumes. Another function of the dashboard is to analyze road conditions through road imagery and specific performance metrics. Some of these metrics include temperature, wind, precipitation levels, friction, and visibility. The NDDOT Dashboard measures performance based on average travel speed recovery time for the current season, as well as factors like weather and mobility. Data is sourced from the dashboard datasheet and live data feed. The dashboard is updated daily and is accessible to the public. It is built on the ESRI platform. More details are presented in Table 6.

This dashboard provides various data for different road segments such as air temperature, dew point, surface temperature, friction, relative humidity and more. It also provides images of the road and serves as a general summary of roadside conditions.

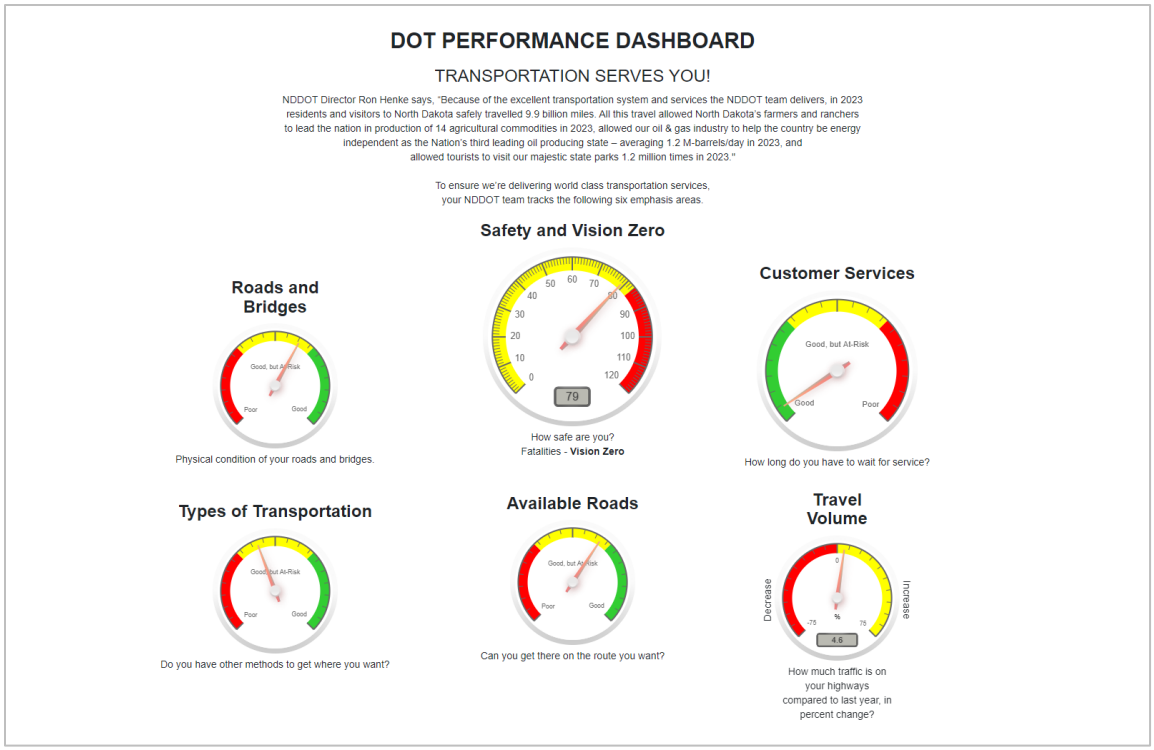


Figure 6 NDDOT Dashboard

Table 6 NDDOT Dashboard Overview

Purpose	Thorough understanding of the current state of NDDOT transportation infrastructure
Performance Measures	Average travel speed recovery time for the current season, weather, mobility
Data Sources	Dashboard datasheet, live data feed
Refresh Rate	Updated daily
Users/Access	Public access
Platform/Software	ESRI
Source	https://www.dot.nd.gov/dot/view/dotdashboard.aspx

3. Development of Dashboards

The development of maintenance dashboards was the result of a collaboration between a team of state maintenance engineers and the NDSU. This initiative stemmed from the NDDOT planning division's

interest in leveraging speed data to enhance their operations. During the COVID-19 pandemic the need for speed recovery data was emphasized, prompting a strong effort to prioritize its collection and analysis.

The team then successfully secured a state grant to facilitate the development of these dashboards. This funding not only enabled the acquisition of the tools needed, but also provided the necessary resources and expertise to ensure the success of these developments. Through planning and collaboration, the team was able to design and implement effective maintenance dashboards that have since become integral to the NDDOT's operations.

4. System Operations and Maintenance

Funding from a grant supported the development, implementation, maintenance, and enhancement of sixteen sites, with costs varying from $100,000 to $120,000. The following year, an additional seventy-three sites were included in the contract. The finance group played a key role in managing costs, ensuring that staff hours were allocated in accordance with internal policies.

5. Benefits and Lessons Learned

The implementation of these winter maintenance dashboards has resulted in improved Level of Service (LOS) on roads utilizing dashboard data. They support decision-making for resource allocation, offer valuable training insights, enable real-time monitoring of roadway conditions, and track material usage and labor costs.

Additionally, these dashboards automate specific processes, saving time, and provide the flexibility to view and extract data at any time. This capability allows for easier tracking of the impact of decisions made by state decision-makers. Notably, the National Cooperative Highway Research Program (NCHRP) utilized data from these dashboards for a study on snow and ice control measures, which was then presented to the state.

6. Plans for the Future and Potential Enhancements

NDDOT is exploring several enhancements for its winter dashboards. These include tracking weather severity alongside speed for normalization, monitoring salt usage on winter maintenance roads, implementing more predictive and proactive measures, and expanding AVL controller information and AVL pavement temperature data.

Moreover, NDDOT plans to develop new data sources and dashboards. This includes establishing a TMC to monitor area-wide traffic conditions and deploy management strategies as needed. Additionally, they aim to create smart corridors, sections of roadway equipped with dynamic signs that adjust based on roadway conditions.

7. Key Points

- Development for winter dashboards started when NDDOT wanted a way to establish speed recovery metrics and there was a need to quantify performance metrics that was no longer manually feasible.
- Utilizing the university that has a long history of collaboration with NDDOT for the development of these dashboard helps minimize the needs for internal resources.
- During the COVID-19 pandemic the need for speed recovery data was emphasized, prompting a strong effort to prioritize its collection and analysis.
- The Maintenance Dashboard integrates in-house material usage inventory and finance data by tracking the cost of snow and ice control. The Maintenance Speed Recovery Dashboard tracks the amount of time it takes for vehicle speeds to return to normal travel speeds. The Road Condition Dashboard presents real time data related to road conditions such as visibility, weather conditions, and the state of the roads. North Dakota Roads Dashboard tracks road conditions, incidents, and acts a data source for the Road Conditions Dashboard.
- The NDDOT Dashboard provides an overview of the current state of NDDOT transportation infrastructure with various metrics such as conditions of roads, bridges, safety, Vision Zero, customer service indications, types of transportation, available roads, and traffic volume.
- NDDOT has learned that implementing winter maintenance dashboards has allowed the agency to utilize data to enhance the LOS of intersections that are being analyzed. Furthermore, by tracking material usage, speed, and other metrics, the DOT can allocate resources more effectively and offer training insights.
- A valuable enhancement that NDDOT plans to make in the future is, tracking the salt usage on maintenance roads. This is a very valuable metric to track and will allow NDDOT to make sure the roads are being maintained within budget and expectations, while also potentially leading to increased efficiency.

Appendix A Survey Response

Contact Information

Name	Miles
Title	Maintenance Engineer
Agency	NDDOT
Email	steenelson@nd.gov
Phone	701-328-2549

Survey Information

1. Do you have any dashboards (with interactive performance measures) using data of winter maintenance operations?	Yes
If yes, how many?	3
1A. If you answered yes to the previous question (you do have dashboards) please briefly describe how each on is used.	One dashboard is in development that shows status of highways. Dashboard displays how many roads are closed, snow covered, ice. Dashboard displays for each district. The second dashboard is a performance measure dashboard that tracks how long a snowstorm takes to return to normal travel speed. The third dashboard displays how much inventory of material districts have on hand such as salt and aggregate stockpiles.
2. Do you find these dashboards useful during an event in real-time?	Yes
3. Do you find these dashboards useful after an event, such as after-action reports?	Yes
4. Do you use the dashboards to inform beneficial / best practices?	No
5. What data are you using in your dashboard(s)? (Select all that apply)	6
Automatic Vehicle Location/Global Positioning System (AVL/GPS)	
Material Usage total	X
Material Usage Rates	X
Weather Data (For example: Road Weather Information System (RWIS))	X
Cycle Time	
Plow Position	X
Traffic Data (Speed and/or Volumes)	X
Connected Vehicle (CV) data	
Incident Data	X
Finance data	
Other (please specify)	

6. What are the sources of the data in the dashboards? (Select all that apply)	5
Automatic Vehicle Location/Global Positioning System (AVL/GPS)	X
Spreader/Sprayer Controller	
Plow Position Sensor	
Mobile Weather Sensors, etc.	X
Maintenance Decision Support Systems (MDSS)	X
RWIS Stations	X
Advance Traffic Management System (ATMS)	X
Maintenance Management System	
Probe Traffic Data	
Connected Vehicles (CVs)	
Crowd Sourced data (e.g. Waze)	
Other (please specify)	
7. How are the data ingested into the dashboard? (Select all that apply)	
Application Programming Interface (API) from data source	X
SQL database updated	
Excel spreadsheets	
CSV/Text File	
Access Database	X
Other (please specify)	
8. What is the frequency of the data refresh? (Select all that apply)	5
Minutes / Close to real-time (5)	X
Hourly (4)	
Daily (3)	
Weekly (2)	
Monthly (1)	
Other (please specify)	
9. How are data stored? (Select all that apply)	
Cloud-based	
Client-Owned Server	X
Third-Party Server	X
Enterprise Content Management System (For example: SharePoint)	
Other (please specify)	
10. What dashboarding platforms are used? (Select all that apply)	
PowerBi	
Tableau	
ArcGIS	X

Internally custom created or other platform (please describe)	
11. What metrics/performance measures presented on the dashboard(s) do you find most helpful for operations? And describe why they are the most helpful.	Currently working on new dashboards will have to test them out this winter to understand what performance measures work well.
12. Are you able to generate static reports / outputs from the dashboard?	No
13. Who has access to view the dashboards? (Select all that apply)	1
Internal agency	X
Partner Agencies	
Contractors	
Public	
Other (please specify)	
14. Who developed the dashboard(s)? (Select all that apply)	
Internal agency	X
Consultant	
AVL / GPS Vendor	
Other Third-Party vendor	X
University	X
Other (please specify)	
15. If an external entity developed any of your dashboards, were you a part of the design process?	Yes
15A. Is your dashboard customizable to fit your needs?	Yes
16. Who maintains the dashboard and data used?	Future small budget dashboard created with powerBI would be maintained by the division requesting the dashboard. Larger budget dashboards are maintained by information technology. Medium budget dashboard created with Arcmap would be maintained by a vendor.
17. How are the data checked for accuracy and who is responsible for checking?	Individuals using the dashboard would check for accuracy. Accuracy is checked when the numbers do not make sense.
18. What data do you wish you had within a dashboard? And why?	Information that would help the traveling public. The reason being most of the dashboards currently being created are for internal use.
19. What are the limitations of your current dashboard(s)?	Connecting to the data source is the biggest limitation. The next limitation would be policy about budget amounts to create dashboards.
20. Do you have any enhancements to current dashboards, or new dashboards, you want to develop or are in the process of developing?	Yes
If yes, please describe:	Currently working on a dashboard that will display maintenance costs including labor and materials. Another dashboard that is being worked on will display stockpile inventories and will help with reordering salt.
21. Has your agency deployed or planned to deploy connected vehicle technology that may assist with winter operations?	We plan to deploy
22. Has your agency used or planned to use connected vehicle data for winter maintenance dashboards?	No

23. What issues has your agency experienced with developing the dashboard(s)?	Cost to develop dashboard. Finding a programmer who has the time to create the dashboard. Connecting to traditional data sources and where to store the data.
24. What issues has your agency experienced with using the dashboard(s)?	Most of the dashboards are currently being developed. Dashboards that have been developed would need to be viewable on a mobile device.
25. What practical advice and/or lessons learned can be offered to others interested in developing and implementing dashboards to support winter maintenance operations?	Create different budget amounts to develop dashboards. Figure out how the agency wants to create dashboards with a small budget. Smaller budget dashboards require less programming time and less maintenance time. Figure out what dashboard program is easy to maintain and create, as that will help reduce the overall cost. Determine who will perform the work based on cost internal department, information technology, or a consultant.
26. May we contact you with follow-up questions?	Yes

Appendix B Virtual Interview Meeting Minutes

PROJECT 22-05: USE OF DASHBOARDS FOR WINTER OPERATIONS

SUMMARY OF NORTH DAKOTA DOT VIRTUAL INTERVIEW

Overview

Virtual interviews were conducted by Ming-Shiun Lee and Mallory Crow of AECOM and coordinated with the assistance of Steeg (Miles) Nelson with the North Dakota Department of Transportation (NDDOT) on Monday December 4th, 2023, at 1 PM CST.

NDDOT Staff Interviews

Meeting attendees on Monday, December 4th included the following individuals:

- Brandon Beise
- Steeg (Miles) Nelson
- Brad W. Darr

Introduction

In 2020, the NDDOT initiated the development of dashboards with the primary objective of determining speed recovery performance measures. This initiative was driven by an increasing necessity for quantifying performance metrics that were beyond manual computation capabilities.

Subsequently, the state awarded a grant to NDDOT in the same year, facilitating the creation of data-driven dashboards. This development was conducted in collaboration with North Dakota State University (NDSU).

In recent endeavors, NDDOT and NDSU have been working together to consolidate manual snow and ice cost data from various sources. The goal is to integrate this data into a dashboard that is updated monthly. This effort exemplifies the continuous strive for improvement and efficiency in their operations.

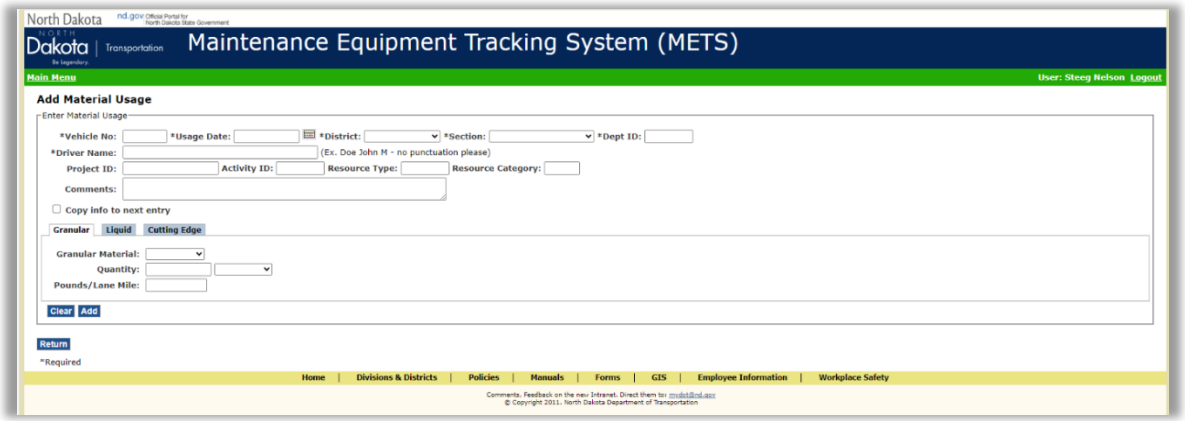
Maintenance Dashboard

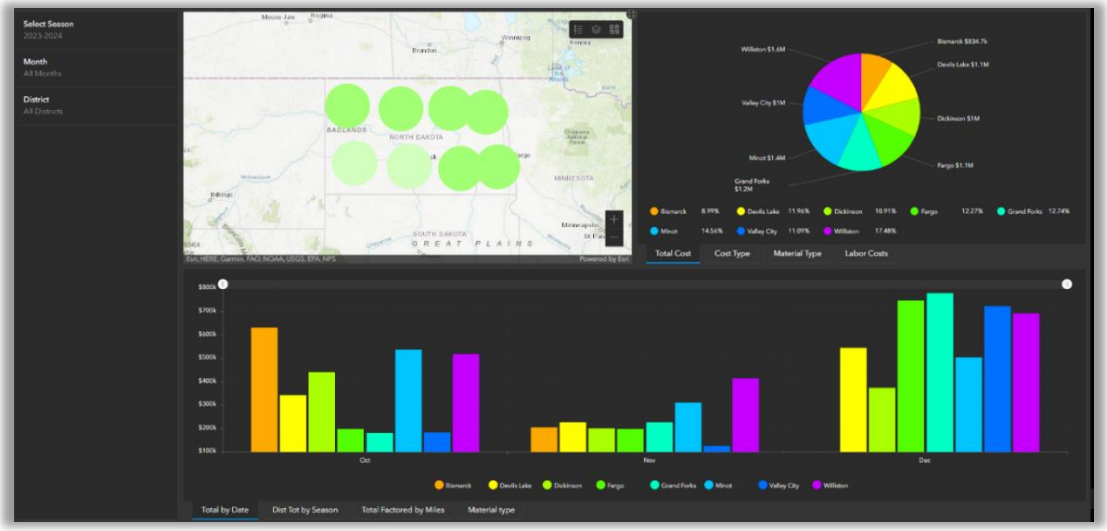
Maintenance Dashboard Overview

Purpose	This dashboard is still being developed; however, the goal is for it to be able to track the cost of snow and ice control.
Performance Measures	Cost of snow and ice control
Data Sources	Maintenance Equipment Tracking System (METS), Finance Data (via People Soft), & Automatic Vehicle Location (AVL)
Refresh Rate	Updated monthly
Users/Access	Decision makers and districts have access
Platform/Software	ESRI

The Maintenance Dashboard is an internal tool under development by NDDOT. The goal for this dashboard is to seamlessly integrate their in-house material usage inventory and finance data from People Soft. The current policy reflects a monthly update of both data sources; however, all historical data throughout the month is dated manually upon creation. The dashboard currently filters by garage level and is primarily used by the maintenance crew, management, and district representatives to track costs of snow and ice maintenance.

Future implementation includes connecting AVL data that would be updated in real time. The dashboard filter would be setup at the route level and would be used to compare material usage, performance, and road conditions.





Maintenance Speed Recovery Dashboard

Maintenance Speed Recovery Dashboard Overview

Purpose	Tracks how long vehicle speeds return to normal travel speed due to snowstorm events
Performance Measures	Snowstorm travel speed
Data Sources	Data is provided by Maintenance Decision Support System (MDSS), roadway sensors in the form of Automatic Traffic

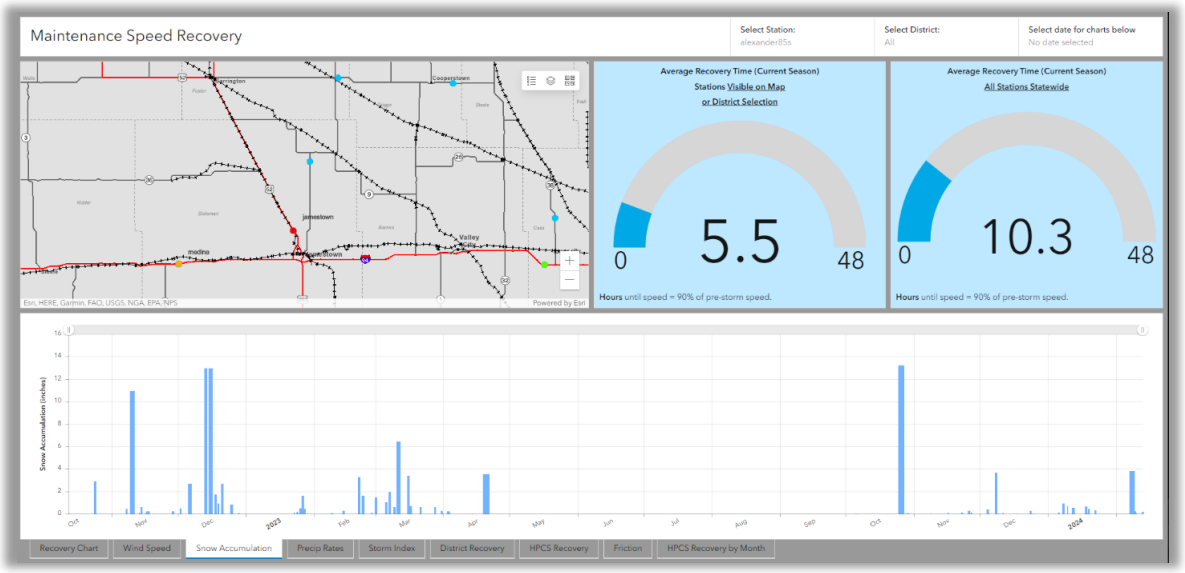
	Recorders (ATR), radar sensors on Roadside Weather Information System (RWIS) towers (10-12 locations)
Refresh Rate	24 hours
Users/Access	Districts
Platform/Software	ESRI

Speed sensors, ATRs, and radar sensors are deployed across various locations within the state to gather data during storm events. This data is analyzed to measure the duration required for traffic speeds to return to pre-storm conditions. A recovery rate of 90% of the pre-storm speed is deemed as a return to normalcy. The dashboard can be used to view historical data of up to one year.

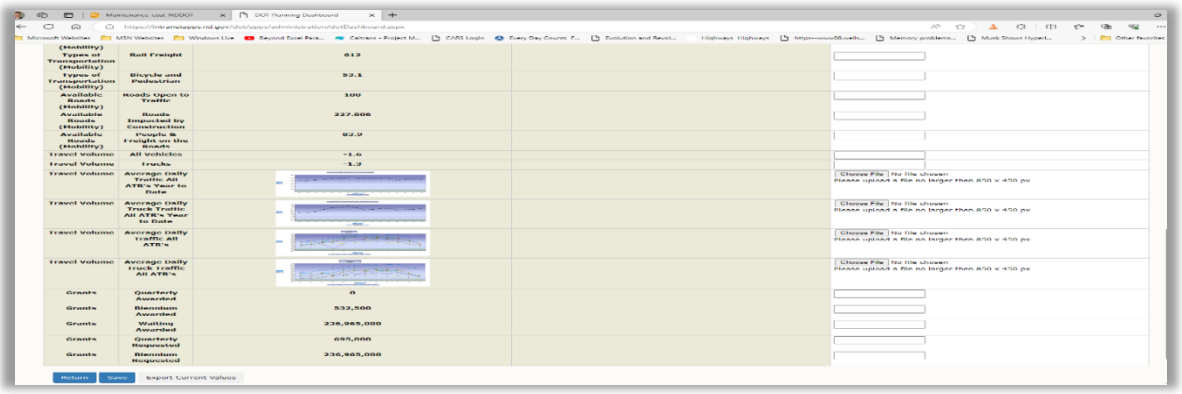
While there is potential for the integration of newer speed data sources, the rural characteristics of North Dakota limit the availability of highly dense areas. The Maintenance Speed Recovery Dashboard, which is automated, serves as the primary source of data for the public-facing NDDOT dashboard. Manual data extraction from the internal dashboard is necessary to populate the NDDOT dashboard.

An intermediate step in this process involves completing a DOT dashboard tool questionnaire form, which ensures that only the necessary data is pulled for the NDDOT dashboard. The primary function of this dashboard is to monitor the performance of speed recovery rates at the district level, thereby facilitating the allocation of resources to areas where recovery rates are suboptimal.

The dashboard provides a range of metrics, including snow recovery, friction, and speeds. Future enhancements to the dashboard may include the incorporation of correlations between decreases in friction and speed readings.


Maintenance Speed Recovery
Select Station:
alexander85s
Select District:
All
Select date for charts below
No date selected
Average Recovery Time (Current Season)
Stations Visible on Map
or District Selection
5.5
0
48
Hours until speed = 90% of pre-storm speed.
Average Recovery Time (Current Season)
All Stations Statewide
10.3
0
48
Hours until speed = 90% of pre-storm speed.
Snow Accumulation (inches)
Recovery Chart
Wind Speed
Snow Accumulation
Precip Rates
Storm Index
District Recovery
HPCS Recovery
Friction
HPCS Recovery by Month


Maintenance Speed Recovery
Select Station:
alexander85s
Select District:
All
Select date for charts below
No date selected
Average Recovery Time (Current Season)
Stations Visible on Map
or District Selection
10.3
0
48
Hours until speed = 90% of pre-storm speed.
Average Recovery Time (Current Season)
All Stations Statewide
10.3
0
48
Hours until speed = 90% of pre-storm speed.
Recovery Chart
Wind Speed
Snow Accumulation
Precip Rates
Storm Index
District Recovery
HPCS Recovery
Friction
HPCS Recovery by Month



Road Condition Dashboard

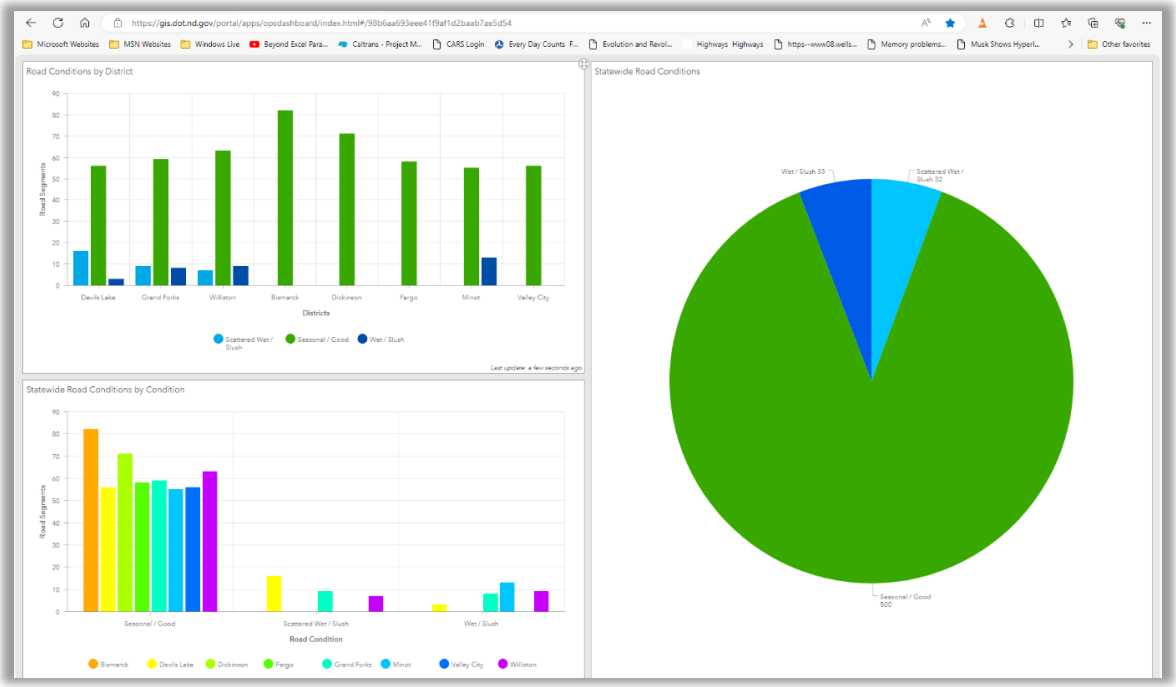
Road Condition Dashboard Overview

Purpose	Provide real time data of road conditions
Performance Measures	Mobility, weather, road condition
Data Sources	Road Condition Reporting System (RCRS)
Refresh Rate	Real time
Users/Access	Internal, field operators, maintenance, patrol
Platform/Software	ESRI

The Road Condition Dashboard, developed by the Information Technology department in 2023, offers real-time data, effectively presenting a snapshot of the prevailing road conditions. This data is derived from 511 maps, which in turn source their information from the RCRS.

The RCRS serves as a tool for field operators and snowplow drivers, facilitating the manual input of road condition data. This includes parameters such as visibility, visibility density, weather conditions, and the state of the roads themselves. The integration of these data sources ensures that the Road Condition Dashboard provides a comprehensive and up-to-date

overview of road conditions. At the garage level you can compare neighboring road conditions to see how a storm is progressing across the state.

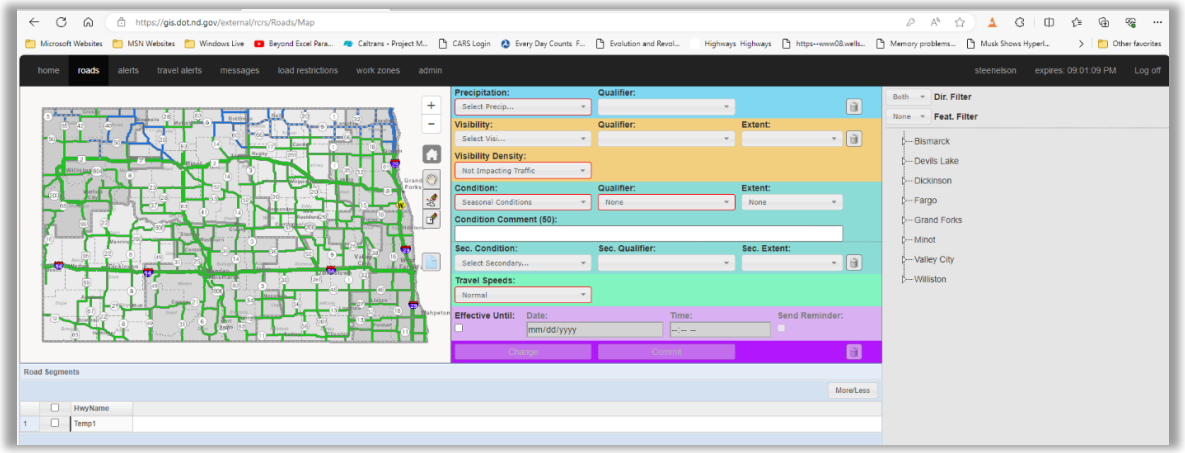


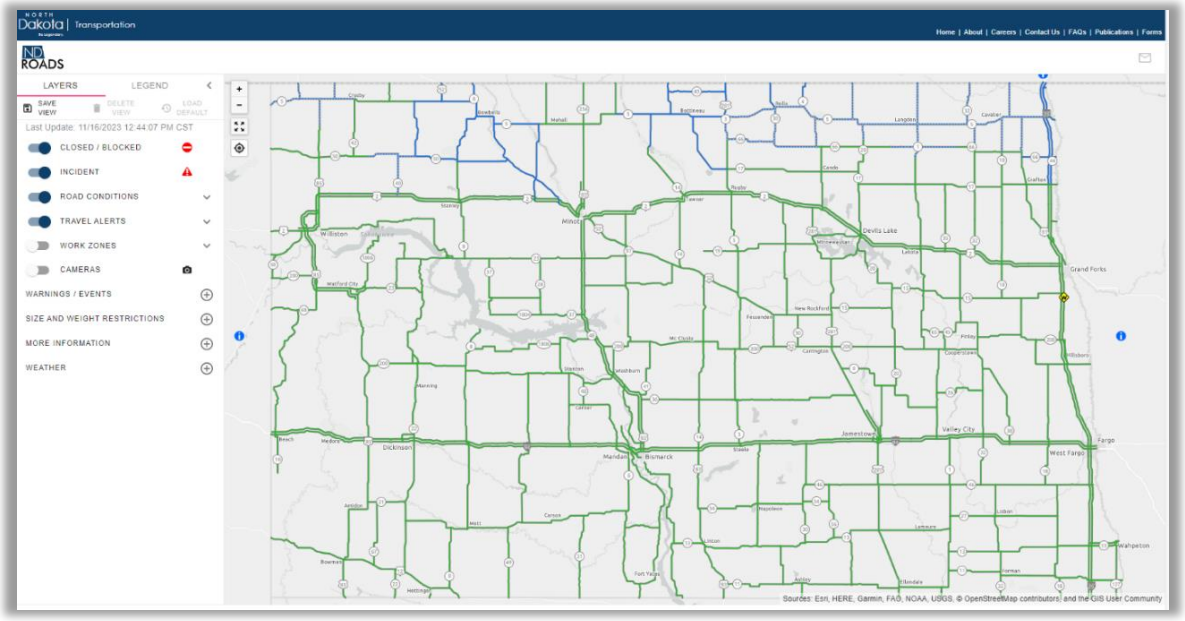
North Dakota Roads Dashboard

North Dakota Roads Dashboard Overview

Purpose	Tracks incidents and feed into the Road Condition Dashboard
Performance Measures	Road conditions, incidents, weather
Data Sources	RCRS, state radios, highway patrol
Refresh Rate	Manual input
Users/Access	Public access
Platform/Software	ESRI

The North Dakota Roads Dashboard utilizes data from the RCRS and occasionally incident reports from local state and highway patrol. The main goal for this dashboard is to visualize current road conditions as there is not a state Traffic Management Center (TMC) in place at the time the interview was conducted. This dashboard also serves as source for the newly developed Road Conditions Dashboard.





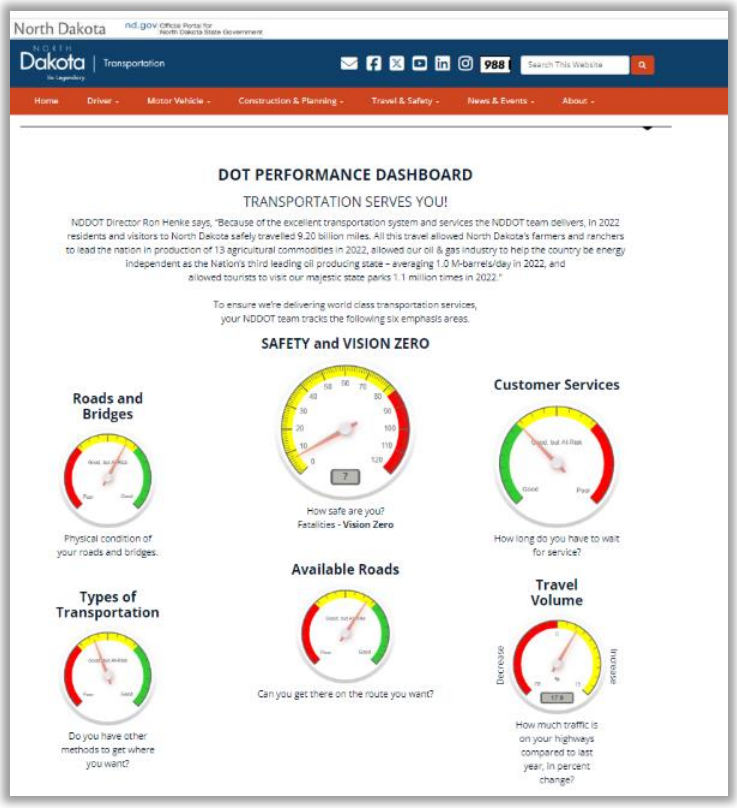
NDDOT Dashboard

NDDOT Dashboard Overview

Purpose	Thorough understanding of the current state of NDDOT transportation infrastructure
Performance Measures	Average travel speed recovery time for the current season, weather, mobility
Data Sources	Dashboard datasheet, live data feed
Refresh Rate	Updated daily
Users/Access	Public access
Platform/Software	ESRI

The NDDOT Dashboard was developed in-house by the Information Technology department and the planning division, with parameters established internally. The dashboard presents a range of metrics, including the condition of roads and bridges, safety and Vision Zero metrics, customer service indicators, types of transportation, available roads, and traffic volumes.

The dashboard also enables the analysis of road conditions using road imagery and a variety of performance metrics. These include temperature, wind, precipitation levels, friction, and visibility. This approach ensures a thorough understanding of the state's transportation infrastructure and its performance.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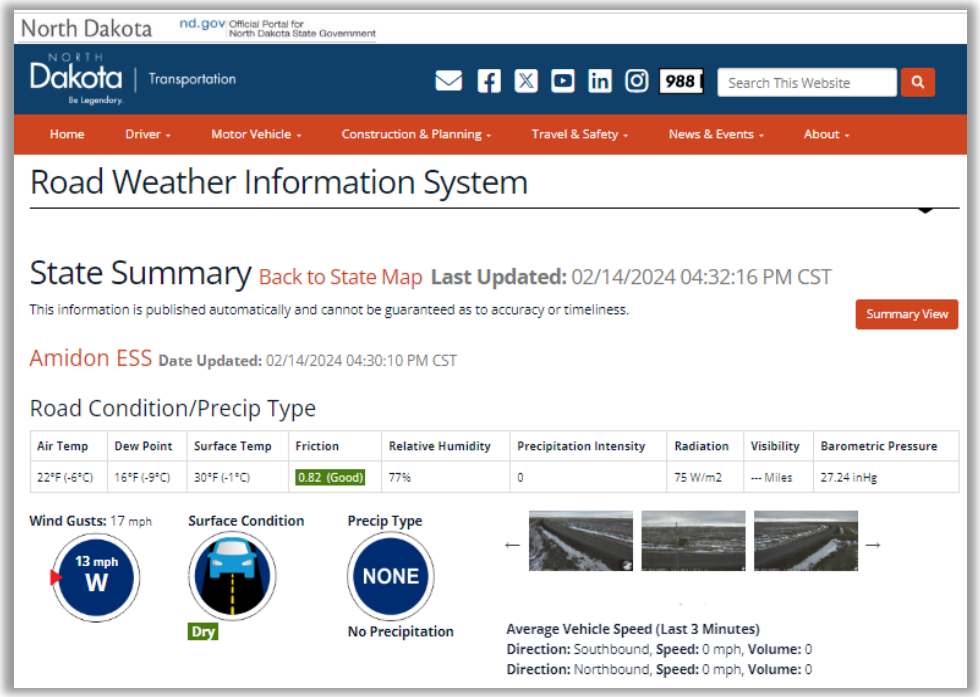
DOT PERFORMANCE DASHBOARD
TRANSPORTATION SERVES YOU!
NDDOT Director Ron Henke says, "Because of the excellent transportation system and services the NDDOT team delivers, in 2022 residents and visitors to North Dakota safely travelled 9.20 billion miles. All this travel allowed North Dakota's farmers and ranchers to lead the nation in production of 13 agricultural commodities in 2022, allowed our oil & gas industry to help the country be energy independent as the Nation's third leading oil producing state – averaging 1.0 M-barrels/day in 2022, and allowed tourists to visit our majestic state parks 1.1 million times in 2022."
To ensure we're delivering world class transportation services, your NDDOT team tracks the following six emphasis areas.
SAFETY and VISION ZERO
How safe are you?
Fatalities - Vision Zero
Roads and Bridges
Physical condition of your roads and bridges.
Customer Services
How long do you have to wait for service?
Available Roads
Can you get there on the route you want?
Types of Transportation
Do you have other methods to get where you want?
Travel Volume
Decrease
Increase
How much traffic is on your highways compared to last year, in percent change?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State Summary Back to State Map Last Updated: 02/14/2024 04:32:16 PM CST
This information is published automatically and cannot be guaranteed as to accuracy or timeliness.
Summary View
Amidon ESS Date Updated: 02/14/2024 04:30:10 PM CST
Road Condition/Precip Type
Air Temp | Dew Point | Surface Temp | Friction | Relative Humidity | Precipitation Intensity | Radiation | Visibility | Barometric Pressure
22°F (-6°C) | 16°F (-9°C) | 30°F (-1°C) | 0.82 (Good) | 77% | 0 | 75 W/m2 | --- Miles | 27.24 inHg
Wind Gusts: 17 mph
13 mph W
Surface Condition
Dry
Precip Type
NONE
No Precipitation
Average Vehicle Speed (Last 3 Minutes)
Direction: Southbound, Speed: 0 mph, Volume: 0
Direction: Northbound, Speed: 0 mph, Volume: 0

Development of Dashboards

The decision to develop maintenance dashboards was a collaborative effort between a team of state maintenance engineers and NDSU. This initiative was driven by the NDDOT planning division's interest in speed data. During the COVID-19 pandemic, the prioritization of speed recovery data was emphasized. Subsequently, a state grant was secured to facilitate this process.

System Operations and Maintenance

The development, implementation, maintenance, and enhancement of sixteen sites were funded through a grant, with costs ranging between $100,000 and $120,000. An additional seventy-three sites were incorporated into the contract in the following year. The finance group was actively involved in the cost management of the dashboards to ensure that staff hours were allocated within the confines of internal policies.

Benefits / Lessons Learned

The implementation of these dashboards has led to an increase in the Level of Service (LOS) across roads that utilize dashboard data. They aid in resource allocation decisions, provide valuable training, enable real-time monitoring of roadway conditions, and track material usage and labor costs.

Additional benefits include the automation of certain processes, saving time, and the ability to view and extract data at any time. This allows for the tracking of the impact of decisions made by state decision-makers. The National Cooperative Highway Research Program (NCHRP) utilized data from the dashboards for a snow and ice control measure study, which was subsequently presented to the state.

Future / Enhancements

NDDOT has expressed interest in several future enhancements for its winter dashboards. These include the ability to track weather severity alongside speed for normalization, track salt usage for winter maintenance roads, implement more predictive and proactive measures, and expand Automatic Vehicle Location (AVL) controller information and AVL pavement temperature data.

NDDOT also plans to develop new data sources and dashboards in the future. This includes the development of a TMC to monitor traffic conditions throughout the area and deploy traffic management strategies as needed. Additionally, they aim to develop smart corridors, which are sections of roadway equipped with dynamic signs that change based on roadway conditions.