DEPARTMENT OF TRANSPORTATION

Concept of Operations

Active Transportation and Travel Information System

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Acronyms

AASHTO	American Association of State Highway and Transportation Officials
API	Application Programming Interface
CARS	Condition Acquisition and Reporting System
CAV-X	Connected and Automated Vehicles Office
ConOps	Concept of Operations
CWZ	Connected Work Zone
DNR	Department of Natural Resources
IEEE	Institute of Electrical and Electronics Engineers
IT	Information Technology
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
MN MUTCD	Minnesota Manual on Uniform Traffic Control Devices
MnDOT	Minnesota Department of Transportation
NEMA	National Electrical Manufacturers Association
RTMC	Regional Transportation Management Center
TSMO	Transportation Systems Management and Operations
WZDx	Work Zone Data Exchange

1. Purpose of Document

This Concept of Operations (ConOps) describes a vision to integrate active transportation facilities into the Minnesota Department of Transportation (MnDOT)'s 511 Traveler Information System. It describes a concept to improve the provision of traveler information to active transportation users. The concept advocates for the inclusion of traveler information for all transportation modes, emphasizing the needs of active transportation users, including cyclists, pedestrians, wheelchair users, and micromobility users. The primary purpose of this document is to provide a common understanding among stakeholders of how the proposed system will function and what benefits it will deliver, ensuring that the final implementation is operationally feasible and meets user needs.

The ConOps serves as a foundational guide for project stakeholders on the solution and their corresponding roles and responsibilities in developing and implementing a system to collect and disseminate information on disruptions to active transportation facilities due to construction activities or natural events such as flooding, mudslides, or fallen trees. This ConOps defines the information sources, data interfaces, displays of information about active transportation routes, user interfaces, and the backend infrastructure needed for broadcasting this information to third-party platforms through the Work Zone Data Exchange (WZDx) and Connected Work Zone (CWZ) Standard feeds. By establishing consensus on the system concept early, this document sets the stage for subsequent requirements definition, design, development, and implementation activities.

2. Scope of Project

This project aims to explore a concept and investigate the feasibility of developing a unified approach for collecting, managing, and disseminating information about disruptions on active transportation facilities. This project focuses on active transportation facilities that are within or adjacent to MnDOT-managed roadways. Active transportation facilities considered in this project include sidewalks, bike lanes, trails, and shared-use paths. Types of disruptions considered include long- and short-term closures of the facilities due to work zones of construction projects and maintenance activities, as well as closures due to natural events, such as flooding, fallen trees, and mudslides, which make the facilities impassable. This project develops a concept that leverages the capabilities of MnDOT's Condition Acquisition and Reporting System (CARS), the WZDx Specification and/or the CWZ Standard, and the 511 Traveler Information System to disseminate information on impacts to these facilities to travelers of all transportation modes.

3. Referenced Documents

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4. Current Situation

Motorized travelers in Minnesota benefit from a well-established ecosystem of information sources, including MnDOT's 511 traveler information system, MnDOT-managed email distributions and social media accounts, third-party navigation tools and maps, and a variety of crowdsourced reporting applications. These resources collectively keep drivers informed of work zones, lane or road closures, and detour options. In contrast, users of active transportation facilities do not currently receive the same level of information. MnDOT 511 system does not provide information on active transportation facilities. While there are apps developed for and widely used by cyclists and pedestrians, these platforms generally offer static route information and do not provide updates on disruptions caused by construction or natural events. As a result, active transportation users often lack timely and accessible information, leading to inconvenience, potential safety risks, and inefficient trip planning.

MnDOT currently collects construction road and lane closure information using its 511 Statewide Road Work and Traffic Impact Form. The 511 Statewide Road Work and Traffic Impact Form is used for listing pertinent information about the purposed/requested lane or road closure. For Metro area, MnDOT requires that the request is submitted at least three business days prior to the proposed closure. A full weekend closure requires 14 days advance notice. For remaining greater Minnesota districts, MnDOT requires requests to be submitted one week prior to project start date. The system is not consistently used to report short-term closures that are typically less than 12 hours. These short-term closures fall outside the reporting requirements outlined in MnDOT's lane closure guidance and remain largely unreported. The request is completed and submitted by MnDOT construction and maintenance staff, and construction contractors. Once submitted, the information is reviewed by the RTMC staff or Metro Maintenance Dispatch (for Metro District) prior to entering into the CARS database. Once entered, the 511 Traveler Information System pulls the information from CARS via an Application Programming Interface (API). These data are also published through MnDOT's WZDx feed, allowing other agencies and third-party traveler information providers to access and use the work zone and lane/road closure information. MnDOT is currently updating the 511 Statewide Road Work & Traffic Impact Form to the Work Zone Request System to streamline the data entry, review, and ingestion process.

The current 511 Statewide Road Work & Traffic Impact Form does not include data fields for indicating impacts to active transportation facilities due to construction or maintenance activities. Adding data fields in the upgraded Work Zone Request System for indicating such impacts is not currently planned.

In addition to the 511 Traveler Information System, MnDOT creates web pages for major construction projects to provide project information, road and lane closures, and construction updates. MnDOT construction staff share with MnDOT Office of Communications and Public Engagement information about upcoming projects on state-managed highways. This information is then published on the construction project webpages. MnDOT Office of Communications and Public Engagement updates the project webpages periodically as construction progresses. However, construction project webpages lack the details regarding impacts on active transportation facilities. For instance, while the Highway 5/East 7th Street and Highway 61/Arcade Street project in the Minneapolis-Saint Paul metropolitan area affects both roadway lanes and sidewalks, the traffic impacts section on the project webpage primarily highlights disruptions to vehicular traffic, with limited to no information on sidewalk-related impacts, closures, or detours. As a result, active transportation users may not be able to obtain the full context needed to plan for safe and accessible routes.

MnDOT also operates the Minnesota Bikeways Crowdsourcing App, which allows users to suggest corrections to MnDOT's bikeway network. However, this app focuses solely on updating bikeway routing data and does not collect or allow users to report information about conditions and disruptions of bikeways due to work zones or natural events.

The Minnesota Department of Natural Resources (DNR) maintains webpages to report trail conditions, including trail closures due to construction and natural events. Trail conditions information is reported by the Minnesota DNR field staff, and the information is published in open-text format on individual trail webpages and is not aggregated in a centralized, structured database.

Despite ongoing improvements to MnDOT's traveler information systems, significant gaps remain in the availability and accessibility of disruption data for active transportation users. These gaps stem not only from technical limitations but also from the absence of structured reporting mechanisms and policy guidance for non-motorized facilities. The following section highlights some of the current limitations that, if addressed, could help create a more inclusive and comprehensive information system for all travelers.

Key Limitations of the Current System

While the current 511 system is functional for reporting motorized vehicle lane closures, several critical limitations hinder its ability to report closures on active transportation facilities:

- **Lack of Active Transportation Closure Reporting Mechanism**
  The current Work Zone Request System (formerly known as the 511 Statewide Road Work & Traffic Impact Form or the Lane Closure Request Form) does not provide users the ability to report closures of active transportation facilities. Additionally, the system does not include data fields to enter detour routes for non-motorized users, which limits the ability to provide alternative route options during closures.

- **Challenges in Reporting Short-Term Closures**
  The Work Zone Request System is primarily used for reporting long-term closures (i.e., those lasting more than 72 hours). Planned short-term closures are infrequently reported, and unplanned or emergency closures are rarely captured. Furthermore, manually reviewing and verifying short-term closures poses a significant operational challenge due to limited staff time and resources, making timely updates difficult.

- **Limited Representation of Active Transportation Facilities on the 511 Map**
  While the 511 base map includes trails, it does not display sidewalks or bike lanes. Since sidewalks and bike lanes are typically integral components of the roadway system, their absence from the 511 map may not be a barrier to displaying relevant disruption or detour information for these facilities.
- **WZDx and CWZ Schema Limitation**
  The WZDx specification aims to standardize the format and content of work zone data, making it easier for different systems to interact with each other. Although the WZDx specification supports reporting lane types that include bike lanes and sidewalks, it does not include trails as a lane type. In addition, WZDx accommodates closure reasoning specifically for work zone activities. Disruptions due to natural events such as facilities flooded or blocked by fallen trees are not included in the specification, thus it hinders the ability to leverage the WZDx data feed for sharing non-work zone related disruption information.

  Separately, the Institute of Transportation Engineers (ITE) has recently published the CWZ standard, which focuses on enabling interoperable data exchanges between various components of a CWZ environment. While MnDOT is currently exploring the possibility of adopting the CWZ standard, and the adaptation may take place in an iterative manner as the CWZ technology matures over time. Similar to the WZDx specification, the CWZ standard does not support trail-related disruption data either and is limited to work zone contexts. If adopted, this standard will play a central role in gathering work zone disruption data from CWZ devices to the CARS database.

These challenges underscore the need for a more robust and inclusive system that can capture and share disruption data for all users of Minnesota's transportation network, including those using active transportation modes. Expanding the current data collection methods, automating reporting processes, incorporating active transportation facility disruption information into CARS and the 511 system, and enabling sharing of the information with third-party traveler information providers will be essential to achieving that goal.

5. Concepts for the Proposed System

To address the current gaps in MnDOT's ability to collect and disseminate information on active transportation facility disruptions, a wide range of existing and potential data sources were first identified and evaluated based on feasibility, reliability, integration effort, and alignment with MnDOT's current infrastructure and systems. This evaluation informed the viability of the data sources and supported the development of a proposed system concept.

5.1 Data Sources and Evaluation

Prior to developing concepts for the proposed system, identifying and evaluating potential data sources was a critical step. Through research and discussions with MnDOT, several sources were explored for their ability to capture impacts on active transportation facilities. Each source was assessed based on feasibility, data accuracy, coverage, compatibility with MnDOT's existing systems, and resource needs, as presented in Table 1.

Table 1. Evaluation of Potential Active Transportation Closure Data Sources

Data Source	Description	Feasibility	Evaluation Rationale
Work Zone Request System	The Work Zone Request System (formerly known as the 511 Statewide Road Work & Traffic Impact Form) is a widely used tool through which MnDOT construction staff and contractors report planned lane closures and traffic impacts within or adjacent to MnDOT-managed highways focused on motorized users. Information submitted through this form, including location, timing, and nature of work, is used to update the 511 traveler information system and WZDx data feed. The proposed data source is to expand this system to include fields to submit information about active transportation facility closures.	Require minimum effort to update the current system. High likelihood to be a viable data source in near term.	• Existing system used statewide. • Alignment of enhancements with MnDOT's vision. • Strong support from MnDOT RTMC and construction division to implement these updates.
Short-Term Maintenance and Unplanned Closure Reporting Tools	MnDOT's Work Zone Request System does not currently support reporting of short-term or unplanned closures for sidewalks, bike lanes, and trails. This data source represents a potential future tool or tools that MnDOT would develop to collect closure information due to short-term maintenance activities. Alternatively, MnDOT may update its lane closure policies and manuals to promote or require the use of the Work Zone Request System for reporting short-term maintenance and unplanned closures.	Developing new tools is unlikely due to the effort and resources required. Updating the lane closure policy and manuals has a higher likelihood of being implemented.	• MnDOT construction staff and contractors are familiar with submitting long-term active transportation closures and can adapt to reporting short-term closures. • MnDOT can introduce related policy updates to educate these users.
CWZ Devices	These emerging technologies—such as Smart arrow boards, intelligent cones, and connected signage—are capable of automatically detecting and transmitting dynamic information about the location and status of work zones to CARS, including potential impacts on bike lanes, sidewalks, and trails. As development and adoption of CWZ devices continues to grow, MnDOT may implement solutions that automate work zone data entry through these smart devices, reducing the need for manual reporting over time. By using the WZDx/CWZ standards, data can be transmitted in a consistent format.	CWZ devices have a moderate likelihood of being viable data sources in the near term as the technologies are under development. With rapid technological evolution, they may become available within the next 5 to 10 years.	• CWZ devices capable of collecting and transmitting disruption location and status information from field in real time. • MnDOT anticipates an increased use of those devices when the technologies are mature. • The application of those devices aligns with MnDOT Transportation Systems Management and Operations (TSMO) vision.

Data Source	Description	Feasibility	Evaluation Rationale
DNR Trail Conditions Database	This data source represents a future database that may be developed by the Minnesota DNR to store trail conditions data. The Minnesota DNR currently collects trail conditions information through field staff and provides the information through its Trail Conditions webpage and the ParkFinder webpage. Those webpages provide closures and conditions on trails, including those in state forests and state parks. However, the information is currently presented in free-form text on individual webpages, with no centralized or structured database available for external integration.	The likelihood of DNR developing and maintaining a database for trail conditions information is low in the near term. The likelihood may increase in longer term as the DNR may be motivated by user demand for digital information.	• Valuable trail conditions data collected through existing processes. • Assuming structured database availability in future. • Assuming DNR allows MnDOT to access the database.
Third-Party Active Transportation Apps and Third-Party Maps	Platforms such as Google Maps, Apple Maps, Strava, etc. are widely used by cyclists, runners, and pedestrians for trip planning, activity tracking, and navigation. However, they do not currently offer data on disruptions or conditions of active transportation facilities or allow users to report the data. As these platforms continue to expand their features, including building an interface for users to report their observations, they could become valuable sources of crowdsourced or aggregated closure information.	As third-party providers see the benefits and potentially the demand for information, they might implement features to collect crowdsourced disruptions from their users. However, the likelihood is low.	• Assuming third-party platforms introduce structured closure data and data-sharing capabilities in future. • Possibility of high-value disruption data that can supplement existing sources.
MnDOT Construction Project Websites	MnDOT's State Highway Project webpages offer information on current and upcoming construction efforts across the state. However, the information is largely targeted to motorized vehicle users. In addition, the contents are presented in free-form text, making it difficult to extract for automated data ingestion.	Low feasibility due to limited information provided on impacts to active transportation facilities and challenges with ingestion of free-form text information.	• Reliance on unstructured data. • Information may overlap with the Work Zone Request System. • Further coordination required to include information on impacts to active transportation facilities.

Data Source	Description	Feasibility	Evaluation Rationale
Citizen Reports via Email, Calls, or Social Media	These communication channels were evaluated as potential sources of crowdsourced information about active transportation facility conditions and closures. However, MnDOT does not currently maintain dedicated channels or formal processes (e.g., specific contact points, intake procedures, or monitoring systems) to receive and manage this type of user-submitted information. Even if reported, validating and integrating these data into official systems would require significant staffing and oversight.	Very low feasibility due to lack of formal intake processes and the high staffing needs required to validate and integrate citizen inputs.	• Lack of dedicated communication channels and data verification challenges.
MnDOT Crowdsourcing App	MnDOT does not currently offer a crowdsourcing app, but the proposed concept could be a mobile or web-based tool that enables the public to report real-time issues affecting active transportation facilities. This app would function similar to Waze for active transportation users, designed specifically for MnDOT's transportation infrastructure, and would be integrated with CARS and 511.	Very low feasibility due to significant time and resources required to develop and maintain the crowdsourcing app.	• High resource requirements and limited alignment with MnDOT priorities.

5.2 Proposed System Concept

Building on the data sources identified and evaluated in Section 5.1, a system concept was developed to address current gaps in reporting and disseminating active transportation disruption data. Given the varied feasibility, readiness, and resource needs associated with different data sources, MnDOT proposes a phased implementation strategy to incrementally enhance its traveler information system. This phased approach ensures that foundational improvements are made first, while allowing time for policy development, technical upgrades, and stakeholder coordination needed for more complex enhancements.

The phased approach includes three phases:

- **Base Phase (1–2 years):** Focuses on enhancing the Work Zone Request System to support structured reporting of long-term active transportation closures, along with corresponding schema and API updates to improve data flow into MnDOT's 511 system and WZDx/CWZ feeds.
- **Growth Phase (3–4 years):** Expands the system to include short-term closure reporting through internal policy revisions to guide data reporting.
- **Mature Phase (5+ years):** Integrates CWZ Devices as a new data source and potentially leverages additional data sources such as Minnesota DNR trail conditions database and third-party platforms if they become available. This phase automates data entry and supports real-time reporting of active transportation facility closures.

A detailed description of each phase is presented below.

Base Phase (Years 1-2): Focus on Long-Term Disruption

In the Base Phase (1–2 years), MnDOT will implement foundational improvements focused on enhancing the reporting of long-term disruptions (i.e., those lasting more than 72 hours) that impact active transportation facilities. Figure 1 illustrates the concept of the proposed system during the Base Phase. Central to this system concept is the Work Zone Request System, which serves as the primary tool for collecting and managing disruption data. While not part of this phase, it is important to note that MnDOT is in the process of upgrading the 511 Statewide Road Work & Traffic Impact Form to the Work Zone Request System. This updated terminology is used throughout this section to reflect MnDOT's ongoing effort to modernize the form's role and functionality.

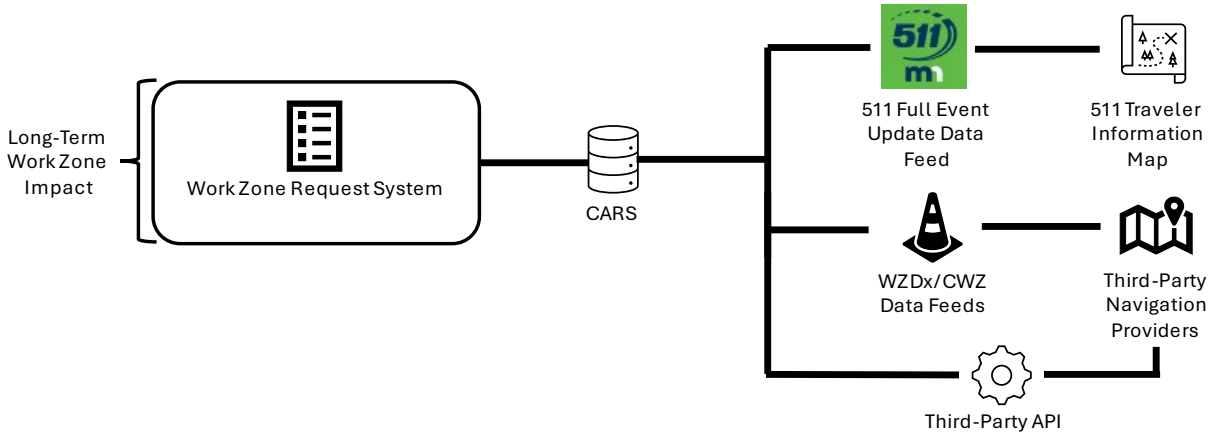

Figure 1. Base Phase System Architecture

During the Base Phase, the Work Zone Request System will be updated to add new fields for reporting disruptions affecting bike lanes, sidewalks, and shared-use paths. Entering data in those data fields is mandatory to ensure disruptions on active transportation facilities are captured and reported. Field entries will be standardized to reduce inconsistencies in data submissions, thereby streamlining the review process and minimizing time spent on validation. Example enhancements may include fields for facility type, disruption reasons, and detour route information for active transportation users. These additions are intended to address current data collection gaps and improve visibility into the impacts of work zones on active transportation users.

To promote interoperability, MnDOT will ensure that the new fields are aligned with the WZDx and CWZ feed specifications to the extent possible, supporting integration with external platforms. In parallel, supporting schema updates will be required across key backend systems, including the CARS database, WZDx/CWZ data feeds, and the 511 Full Event Update Feed, to accommodate the new active transportation data elements and ensure seamless data flow across MnDOT's information pipeline.

The 511 map will be enhanced to display disruptions affecting active transportation facilities through a dedicated, toggleable map layer. This active transportation facilities layer will allow users to view disruptions to bike lanes, sidewalks, and shared-use paths separately from motor vehicle disruptions, making the information more accessible and useful for the users of active transportation modes.

Lastly, third-party navigation providers will be able to access this information through either the WZDx/CWZ feeds or APIs created on their own to directly access the disruption data from CARS.

As these changes are implemented, MnDOT will establish a centralized documentation resource such as a version-controlled repository (e.g., GitHub) to track field-level updates, schema revisions, and API enhancements. This documentation will serve as a reference for internal teams, system integrators, and third-party data consumers, promoting transparency and continuity as the system evolves.

Growth Phase (Years 3-4): Integrating Short-Term Disruption Reporting

In the Growth Phase (3–4 years), the proposed system concept is built upon the Base Phase and expanded to capture and disseminate information of short-term disruptions on active transportation facilities. The porposed system concept for the Growth Phase is illustrated in Figure 2.

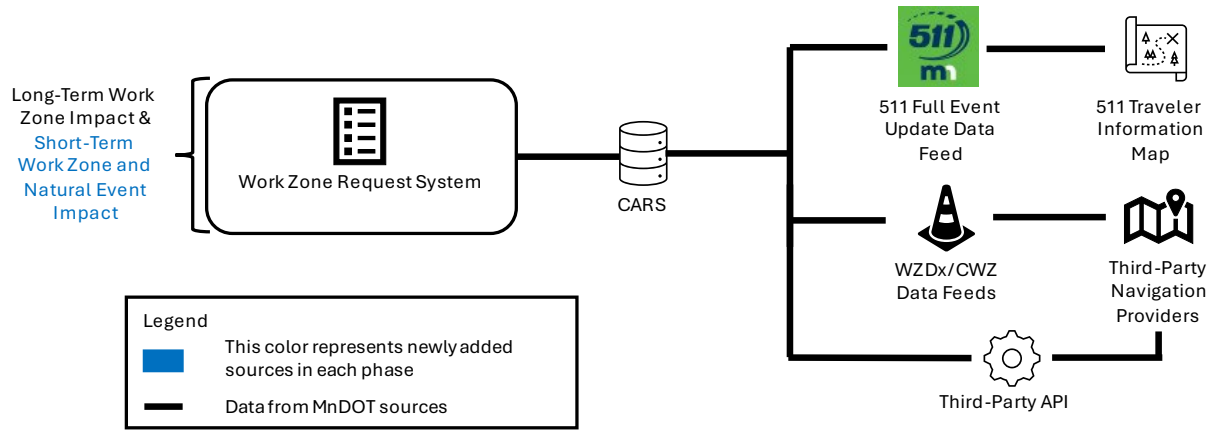

Figure 2. Growth Phase System Architecture

In this phase, MnDOT will expand the use of the Work Zone Request System to support the reporting of short-term disruptions (i.e., those lasting less than 72 hours). These types of closures, while often temporary, can significantly impact the mobility and safety of pedestrians, cyclists, and other non-motorized travelers. Building on the foundational updates made during the Base Phase, this phase focuses on extending the lane closure policies to support reporting of active transportation facility disruptions due to short-term construction and maintenance activities.

Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD) and MnDOT's Lane Closure Manuals provide policies and directions to assist construction staff and contractors in planning and scheduling lane and shoulder closures on MnDOT-owned and -operated roadways. They provide detailed guidance on when closures are permitted on each roadway, based on factors such as day of the week, time of day, and traffic volumes.

To support the reporting of short-term lane disruptions that fall outside these allowable criterion, MnDOT will establish updated internal policies. These policies should clearly define reporting timeframes, specify the types of activities that qualify as short-term closures (e.g., construction, maintenance, and natural events), identify responsible stakeholders for submitting closure information, and outline the review and approval process. Establishing this guidance is critical to ensure that short-term disruption reporting is both operationally feasible and consistently implemented across MnDOT districts and with external partners.

As with the Base Phase, these updates will require corresponding changes to MnDOT's backend systems. The CARS database schema and 511 Full Event Update Feed will be updated to accommodate short-term disruption data and support automated distribution of these data to the 511 traveler information map and WZDx/CWZ feed. All updates will be communicated in advance with the third-party navigation providers to allow them ample time to update their API request pipelines.

It is important to note that MnDOT is not involved in all trail-related construction and maintenance activities along state routes. The Minnesota DNR also performs construction and maintenance on state trails. DNR-led activities without MnDOT involvement are not currently captured in the Work Zone Request System. While it is required to apply for permits for work within the MnDOT right-of-way, permit information does not flow into the Work Zone Request System or CARS. As such, trail disruptions from DNR work is not reflected in MnDOT's traveler information platforms, creating a significant gap in disruption reporting.

To address this limitation, MnDOT would encourage the DNR to use the Work Zone Request System to report trail-related construction and maintenance disruptions along MnDOT-managed roadways. This would leverage existing systems with minimal technical development but require inter-agency coordination and training.

Mature Phase (Years 5+): Integrating Disruption Data from Connected Devices and External Sources

With the foundation built in the Growth Phase, the Mature Phase (5+ years) will focus on expanding the sources of disruption information through new technologies and potentially third-party data partnerships. In this phase, as shown in Figure 3, it is envisioned that the proposed system will be a modernized disruption reporting system capable of ingesting and disseminating multi-source data related to active transportation facility disruptions. Building upon the improvements made in earlier phases, this phase emphasizes further system integration and expanded comprehensive data collection.

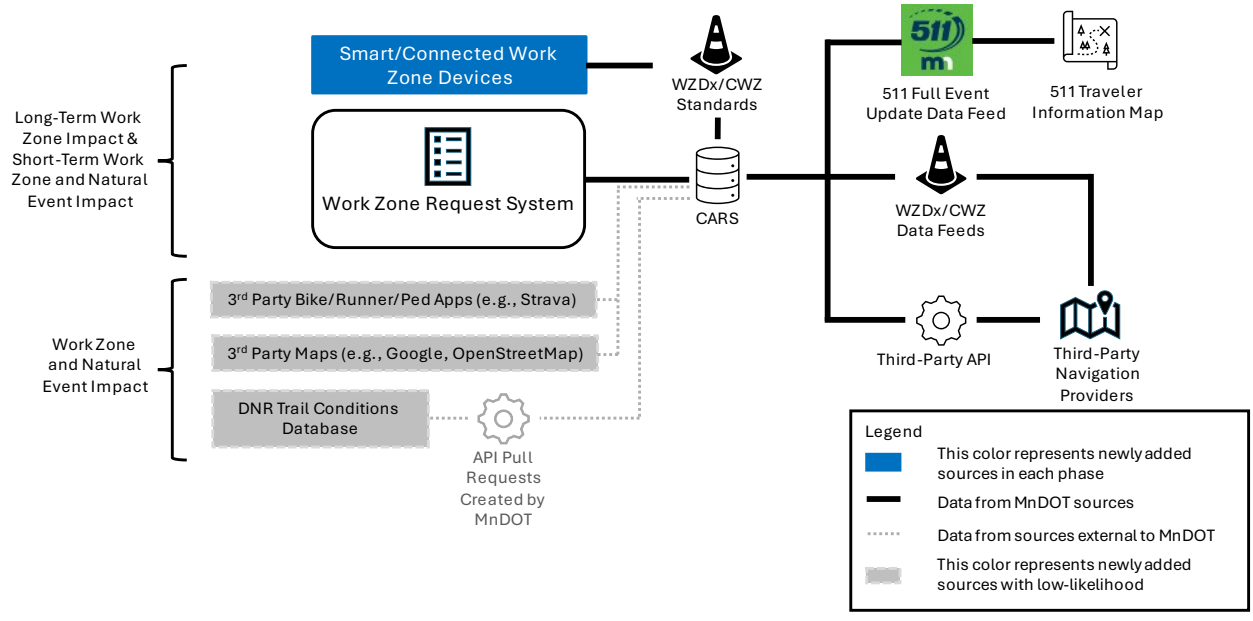

Figure 3. Mature Phase System Architecture

A critical enhancement in this phase is the integration of CWZ Device data. MnDOT will use CWZ devices, such as smart arrow boards, smart traffic control devices, and intelligent cones, for construction and maintenance activities. These devices can automatically detect and transmit dynamic information about the location and status of work zones to CARS. As technologies become mature and widely available, MnDOT will use those devices for work zones and automate work zone data entry through those smart devices, reducing the need for manual reporting. In addition, CWZ devices will use the WZDx/CWZ standards to transmit to CARS in a consistent format.

The Mature Phase may include third-party data integration as a potential enhancement to MnDOT's active transportation information strategy. While not guaranteed, MnDOT may explore opportunities to supplement its internal data sources with closure information from widely used platforms such as Strava, Garmin, Google Maps, and OpenStreetMap. This consideration is based on several assumptions that these platforms (1) will introduce user input or crowdsourcing capabilities, (2) provide structured data related to active transportation disruptions, and (3) offer data-sharing mechanisms such as APIs.

Given the broad adoption of these apps among active transportation users, MnDOT recognizes the potential value of the closure data they could provide—especially for disruptions that may otherwise go unreported. If these capabilities are realized, MnDOT may explore future partnerships, data-sharing agreements, and ingestion workflows to evaluate whether and how such third-party data could be integrated into existing systems like CARS and shared via 511 and WZDx/CWZ platforms. Further, these third-party providers can work to collect more comprehensive disruption data through their own API that pulls the data from CARS database.

In parallel, MnDOT may explore establishing a data pipeline to ingest trail condition and disruption information from the Minnesota DNR. This potential enhancement is based on the value of trail condition data already collected through DNR's existing processes and publicly available through the Trail Conditions and ParkFinder webpages. The proposed integration assumes that DNR will develop and maintain a centralized, structured database for these trail conditions in the future. If this assumption holds, MnDOT may develop an API to automate data pulls and feed this information into the CARS database—enabling relevant trail impacts to be displayed through MnDOT's traveler information platforms.

To support these advanced capabilities, MnDOT will implement schema and backend pipeline upgrades across the CARS database, the 511 Full Event Update Feed, the WZDx feed, and the CWZ feed. These enhancements will be designed not only to handle new data generated through the updated Work Zone Request System, but also to accommodate structured inputs from CWZ devices, Minnesota DNR database, and third-party platforms such as navigation and active transportation apps.

Additional Recommendation: Enhancing Public-Facing Communication on Active Transportation Impacts

To improve the visibility of active transportation facility closures on MnDOT's project webpages, it is recommended that MnDOT construction staff proactively share relevant information on work zone impacts, including those on active transportation facilities, with the Office of Communications and Public Engagement. This will enable the inclusion of work zone impact information for all modes on project webpages. This coordination will enhance public awareness and provide more complete information for motorized and non-motorized travelers.

6. User-Oriented Operational Description

This section describes how the proposed system for reporting active transportation disruptions operates from both a user and an organizational perspective. It outlines the key stakeholders, their roles and responsibilities, the workflows they follow, and the policies and constraints that govern those operations.

6.1 Stakeholders and Roles

Stakeholders are any individual, group of individuals, or agency that is involved in collecting, managing, disseminating, receiving, or using active transportation facility disruption information, managing work zone activities that impact active transportation facilities, performing construction, maintenance, or repairs on those facilities, and designing, implementing, operating, and maintaining the proposed system and its components. Stakeholders involved in the proposed system are listed below:

- MnDOT Construction and Maintenance
- MnDOT Construction Contractors
- MnDOT Communications
- MnDOT Metro District Work Zone Supervisor
- MnDOT Metro Maintenance Dispatch
- MnDOT RTMC
- MnDOT CARS Administrators
- MnDOT CAV-X Office
- MnDOT 511 Vendor
- Minnesota DNR
- Active Transportation Travelers
- Third-Party Navigation and Map Providers

The roles and responsibilities of these stakeholders are presented in Table 2.

Table 2. Stakeholder Roles and Responsibilities

Stakeholder	Responsibilities with the Proposed System
MnDOT Construction and Maintenance	• Submit long- and short-term active transportation disruptions using the Work Zone Request System. Provide accurate location, closure, impact, duration, and detour details. • Deploy and manage CWZ devices. • Notify MnDOT Communications Staff about the upcoming and ongoing disruptions.
MnDOT Construction Contractors	• Report both long-term and short-term closures impacting active transportation facilities using Work Zone Request System. Provide accurate location, closure, impact, duration, and detour details. • Regularly update MnDOT Construction staff on project schedule and status.
MnDOT Communications	• Update construction project webpages with current active transportation disruption information.
MnDOT Metro District Work Zone Supervisor	• Conduct preliminary review and subsequent approval of active transportation facility closure requests within the Metro District.

Stakeholder	Responsibilities with the Proposed System
MnDOT Metro Maintenance Dispatch	• Review approved (motorized and active transportation) lane closure requests for Metro District. Look for conflicts or issues. • Coordinate with project contact in case of conflicts. • Enter verified closure requests into CARS.
MnDOT RTMC	• Update and maintain the Work Zone Request System as needed. • Review submitted data and request the responsible MnDOT construction staff and contractors to correct errors. • Enter both motorized and active transportation lane closures into CARS.
MnDOT CARS Administrators	• Configure CARS processes and schema to support inclusion of active transportation closure information. • Integrate CWZ device and third-party data. • Manage WZDx and CWZ feed outputs.
MnDOT CAV-X Office	• Guide the development of CWZ devices and applications.
MnDOT 511 Vendor	• Create an active transportation-specific layer on the 511 map. • Maintain the public interface and backend environment required to gather disruption data and present it on the 511 map.
Minnesota DNR	• Use the Work Zone Request System to report disruptions on trails along MnDOT-managed roadway. • Create and maintain a structured trail condition database. • Observe trail conditions and log trail closure data consistently. • Notify RTMC staff of database or schema changes for CARS database integration.
Active Transportation Travelers	• Use MnDOT 511 and third-party apps to access disruption data on active transportation facilities.
Third-Party Navigation and Map Providers	• Receive motorized and active transportation disruption data via WZDx/CWZ feeds. • Alternatively, develop own API feed to access and download disruption data from CARS directly. • Share crowdsourced/user-reported active transportation closure data with MnDOT via API or equivalent.

6.2 Operational Workflow

This section describes the enhanced operational workflow for gathering and disseminating active transportation disruption data through two primary sources: the updated Work Zone Request System and CWZ devices.

Work Zone Request System Operational Workflow: With the proposed system, the Work Zone Request System will be updated to require MnDOT staff and construction contractors to provide information on active transportation facility impacts when submitting requests. The workflow of the proposed system will build on the current workflow for motorized lane disruptions by incorporating additional checks and minor policy updates to accommodate active transportation impacts. Figure 4 presents the steps involved in the operational workflow.

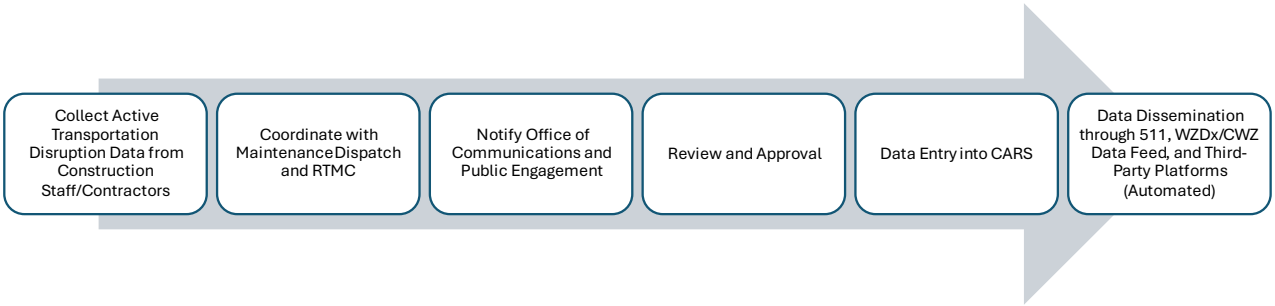

Figure 4. Enhanced Operational Workflow for Updated Work Zone Request System

Table 3 below outlines a proposed workflow using the Work Zone Request System, highlighting how active transportation disruption data can be integrated into established reporting, review, and dissemination processes.

Table 3. Proposed Workflow of Reporting Disruptions Using Updated Work Zone Request System

Process Step	Enhanced Workflow
1. Collect Active Transportation Disruption Data	Disruption data are gathered through submissions by MnDOT construction staff and contractors, and DNR via the updated Work Zone Request System. Note: While MnDOT districts follow established timelines for reporting long-term disruptions, updated internal policies may be needed to define clear submission guidelines for short-term disruptions.
2. Coordinate with Maintenance Dispatch and RTMC	MnDOT construction staff and contractors use existing protocols to submit requests to Metro Maintenance Dispatch and RTMC staff.
3. Notify Office of Communications and Public Engagement	MnDOT construction staff use existing protocols to notify Office of Communications and Public Engagement staff about the active transportation disruptions. Office of Communications staff update the construction project webpages.
4. Review and Approval	RTMC and Metro Maintenance Dispatch staff review submitted disruption requests for accuracy and completeness. Metro Dispatch is responsible for reviewing information submitted for the Metro District, and RTMC staff is responsible for reviewing information submitted for the Greater Minnesota Districts. Only approved entries proceed for entry into CARS database. Note: MnDOT may need to revise procedures to guide reviewers on how to review and validate active transportation-specific fields.
5. Data Entry into CARS	Once approved, RTMC staff enter the disruption data into the CARS database. This includes standardized information on closure type, location, timing, impact, and detour details for active transportation facilities. This process can be streamlined over time by adding automated validation checks for standardized fields.
6. Data Dissemination	Enriched data are distributed via 511, WZDx, and/or CWZ feeds. Third parties can also develop their own APIs to access data from CARS.

CWZ Devices Operational Workflow: The operational workflow for collecting active transportation disruption data from CWZ devices is designed to be fully automated (Figure 5), ensuring high efficiency and minimal manual intervention. The process begins with CWZ devices automatically detecting and transmitting data about disruptions that impact sidewalks, bike lanes, and shared-use lanes in a format that is compliant with WZDx and CWZ specifications. Once collected, the data undergo an automated

validation process to check for accuracy and completeness. Validated data are then automatically entered into MnDOT's CARS, eliminating the need for manual data entry and reducing the risk of error.

Following entry into CARS, the disruption information is disseminated through multiple channels, including the 511 Full Event Update Feed to display on the 511 map, the WZDx or CWZ feed to the third-party platforms, and APIs developed by third-party platforms to their applications. This automated pipeline enables near real-time reporting and distribution of critical active transportation disruption information to users and navigation tools across Minnesota.

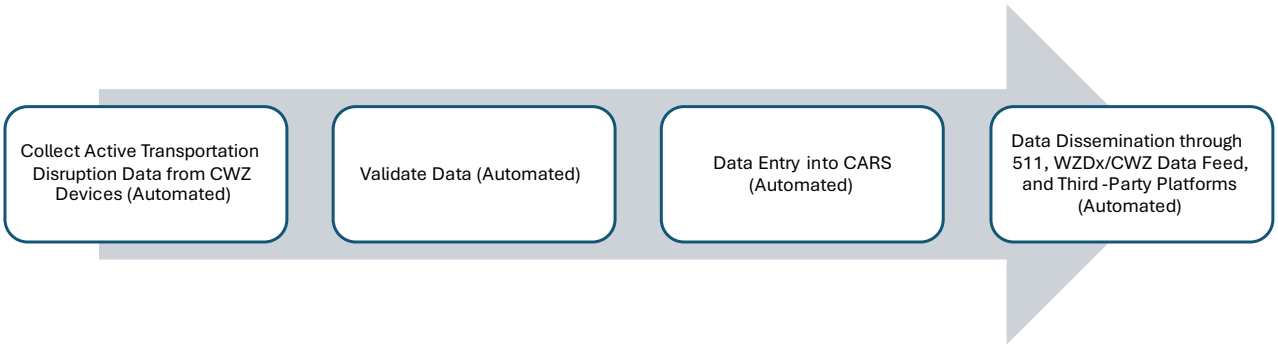

Figure 5. Enhanced Operational Workflow for CWZ Devices

6.3 Organizational Interactions and Coordination

The proposed system will rely on several coordination pathways among internal staff and support teams. These interactions ensure that reported closure information is accurate, reviewed, and communicated effectively:

- **MnDOT Construction and Office of Communications and Public Engagement:** MnDOT Construction Staff will notify Office of Communications and Public Engagement to ensure active transportation disruption information is updated on project websites in a timely and consistent manner.
- **MnDOT Construction/Contractors and Metro Maintenance Dispatch/RTMC:** Construction staff and contractors will coordinate with the Metro Maintenance Dispatch (for Metro-area closures) or the Statewide Operations Dispatch (for Greater Minnesota District closures) to notify them of the start and end of planned work zones. If there are questions or clarifications needed about submitted closure entries, Metro Maintenance Dispatch or RTMC staff coordinate directly with the reporting project personnel.

These coordination workflows are consistent with the current lane closure request workflows and will remain in place under the proposed system, but their scope will expand to include both long- and short-term closures affecting active transportation facilities such as bike lanes, sidewalks, and shared-use paths.

In addition, the proposed system introduces new coordination needs due to the integration of external data sources and automation technologies. These include:

- **CARS Administrators and 511 Vendor:** CARS administrators will communicate any planned schema updates resulting from the integration of new data sources to the 511 vendor. This

coordination ensures that the vendor can make the necessary adjustments to the data pipeline from the CARS database to the 511 Event Feed.

- **RTMC and CWZ Device Providers:** RTMC staff will coordinate with technology vendors and system integrators to resolve questions or issues related to data generated from intelligent cones, smart arrow boards, and other CWZ devices.
- **CARS Administrators and Minnesota DNR:** Establishing and maintaining an automated data pipeline between DNR's trail condition database and MnDOT's CARS database will require technical coordination and data governance alignment.
- **MnDOT and Third-Party Providers:** Two-way coordination will be necessary between MnDOT and third-party navigation and map providers. This includes setting up data sharing protocols and establishing mechanisms to ingest user-generated or app-observed disruption data, while also ensuring MnDOT-sourced data are made available to end users through those platforms.

As MnDOT evolves toward a more integrated and responsive closure reporting system, these expanded coordination pathways will play a critical role in ensuring the accuracy, timeliness, and completeness of active transportation facility information delivered to the public.

7. Operational Needs

This section outlines the vision, goals, objectives, and unmet operational needs that drive the requirement for a more inclusive and capable work zone and natural event closure reporting system at MnDOT. These needs reflect the agency's growing commitment to ensuring that Minnesota's multimodal travelers—particularly those using active transportation modes—receive the same level of timely, accurate, and accessible information as motor vehicle users.

7.1 Vision

MnDOT envisions a traveler information ecosystem that promotes equitable access to closure and detour data for all users, including cyclists, pedestrians, wheelchair users, and micromobility riders. As more Minnesotans choose active transportation for commuting and recreation, the need to extend 511 system capabilities to cover non-motorized facilities becomes increasingly urgent. Recognizing this critical information gap, MnDOT is exploring opportunities to collect, manage, and disseminate closure data for active transportation facilities to improve safety, mobility, and equitable access to traveler information.

7.2 Goals

The project is driven by several interrelated goals:

- **Promote equitable access** to traveler information by ensuring that cyclists, pedestrians, wheelchair users, and micromobility riders have the same quality of closure and detour data as motorized travelers—regardless of ability or mode of travel.
- **Enhance safety and protect users** by preventing unsafe entries into closed or restricted bike lanes, sidewalks, and shared-use paths through timely and visible alerts.
- **Ensure reliability and accessibility** of route information for non-motorized users, adding transparency and reinforcing public trust in MnDOT's traveler information systems.

- **Support multimodal trip planning** by providing closure and detour data through multiple channels (e.g., 511 system, third-party navigation apps), enabling users to make informed route choices.
- **Improve user experience** by delivering consistent, accurate, and user-friendly updates on active transportation impacts, supporting a safer and more inclusive travel environment across Minnesota.

7.3 Objectives

To fulfill these goals, MnDOT has identified the following actionable objectives:

- **Develop a concept** for integrating active transportation facility information into Minnesota's 511 traveler information system.
- **Investigate opportunities** to collect more robust data on the condition and accessibility of active transportation facilities.
- **Improve data coverage and reliability** for all key active transportation facilities, including bike lanes, shared-use paths, and sidewalks.
- **Leverage existing systems**, namely Work Zone Request System, WZDx specification, and CARS, to disseminate enriched closure and detour information via 511 traveler information system and third-party platforms, reaching users through the apps and tools they already use.

7.4 Key Performance Indicators

As the system evolves, MnDOT will measure success using a combination of quantitative and qualitative indicators. These may include:

- The percentage of planned active transportation facility closures reported and validated in the system.
- The average time required for data cleaning and transfer from submission to public display.
- The number of third-party platforms successfully integrating MnDOT's active transportation closure data via WZDx/CWZ data feed or own APIs.

7.5 Project Needs

The proposed system is intended to meet the project needs and support the project goals and objectives. A variety of project needs have been identified based on the current system's capabilities and limitations, as well as insights gathered through discussions with stakeholders. The project needs include:

- Provide timely, accurate, and accessible information about active transportation disruptions to users.
- A method to report disruptions to active transportation facilities.
- Enable field staff and contractors with tools and procedures for consistent and complete data entries.
- Develop tools and establish processes to help verify data accuracy efficiently.
- Develop a way to report dynamic, short-duration disruptions.
- Integrate active transportation facility disruptions data into CARS and 511.
- Make active transportation facility disruptions data available for third-party traveler information providers.

8. System Overview

The proposed system enhances MnDOT's existing traveler information ecosystem by expanding the types of data it collects, manages, and disseminates to include closures affecting active transportation facilities such as bike lanes, sidewalks, and trails. At the heart of this modernization is the enhanced Work Zone Request System, which will function as the primary intake for multimodal disruption data.

8.1 Scope of the System

The system supports the full lifecycle of closure data reporting related to active transportation facilities on or adjacent to MnDOT-managed roadways. It enables MnDOT to:

- Collect active transportation closure and detour information from multiple data sources.
- Review, validate, and integrate that data into MnDOT's internal systems.
- Disseminate structured, accurate, and timely information to the public via 511 and third-party platforms.

To accommodate varying levels of technical readiness and data maturity, the system is designed for phased implementation across agencies and sources.

8.2 Data Lifecycle and System Flow

The system operates across four primary stages of data handling, with specific actors, interfaces, and tools supporting each phase.

1. Data Collection (Input Stage)

Data are collected from a diverse set of providers:

- **Work Zone Request System**: Used by construction staff and contractors to submit both planned and unplanned disruption data.
- **CWZ Devices**: Provide automated, sensor-based updates on dynamic work zone activity affecting active transportation facilities, feeding disruption data directly into CARS.
- **Minnesota DNR**: May input trail disruption data into the Work Zone Request System. May provide trail condition and disruption data to CARS through a MnDOT-developed API.
- **Third-Party Platforms**: MnDOT may collect user-submitted or crowdsourced active transportation disruption data from applications such as Google Maps and Strava using their APIs.

2. Review and Validation (Processing Stage)

All incoming data undergoes internal review to ensure accuracy and consistency:

- **MnDOT Construction, Metro Maintenance Dispatch, and RTMC**: Conduct initial validation and internal coordination.
- **CARS Administrators**: Review, clean, and standardize incoming data before inputting it into MnDOT's central database, CARS.

3. Integration and Hosting (Back-End Architecture)

The system infrastructure supports data consolidation and dissemination:

- **CARS Database**: Central repository for all validated disruption data. Enables structured, programmatic access to disruption information. This serves as the distribution point for all data consumers including 511, WZDx/CWZ feeds, and third-party applications.
- **Internal Hosting**: All backend systems—including the CARS Database, 511 Full Event Update Feed, and WZDx/CWZ feeds—are hosted within MnDOT's secure information technology (IT) environment.

4. Dissemination (Output Stage)

Validated data are distributed to a range of public and private systems:

- **511 Full Event Update Feed**: Pulls updated disruption data from CARS and powers MnDOT's public-facing 511 traveler information map.
- **WZDx Feed**: Publishes standardized work zone data (including pedestrian and bicycle impacts) for use by external consumers.
- **CWZ Feed**: In addition to standardized work zone data, may publish dynamic disruption data collected from CWZ devices in the field in a standardized format.
- **Third-Party Navigation and Mapping Applications**: Platforms such as Apple Maps, OpenStreetMap, Cadence, and Strava access the data from CARS via WZDx/CWZ feed or through their own APIs.

9. Operational Environment

The enhanced traveler information system will be built on MnDOT's existing infrastructure, including the Work Zone Request System, the CARS, and related data feeds such as WZDx and 511 Full Event Update Feed. These foundational systems provide a robust and familiar framework for data entry, processing, and dissemination. No new hardware (e.g., servers, workstations, communications infrastructure) investments will be required, allowing MnDOT to focus resources on optimizing current tools and workflows.

To support the inclusion of new data types such as short-term active transportation disruptions and inputs from external sources, schema updates and backend adjustments may need to be made to the CARS database and associated data feeds. These updates will also accommodate integration with CWZ Devices, structured trail closure data from the Minnesota DNR database, and potential third-party applications that share or consume closure data.

If the DNR Trail Conditions Database becomes a reality, MnDOT will need to develop a dedicated API to access and download trail disruptions data from the database. In addition, if the third-party providers collect facility disruption information from their users, MnDOT will need to engage discussions with them, investigate the value of ingesting their data, and explore options to access the data if deemed beneficial and feasible. If obtaining and ingesting third-party crowdsourced data are desired, MnDOT will need to coordinate with third-party providers to either develop APIs or use APIs provided by the providers to download the data. It is anticipated that these data streams would be automatically ingested into CARS, without adding significant manual workload.

The 511 Traveler Information Map will be updated to include a new, togglable map layer for active transportation disruptions. Since the current map already presents motorized lane closures using data collected and vetted through the Work Zone Request System, the same mechanism can be extended to display active transportation facility closures submitted through the same process. This layer can also support data from DNR and third-party providers, using existing integration capabilities that have previously been applied to sources like Waze. These enhancements require only minor configuration and styling adjustments to the current map interface, making them low-impact but high-value improvements for public users.

The system's backend services, including data storage, API management, and public feeds, will be hosted within MnDOT's IT infrastructure. This environment includes both physical and cloud-based systems managed by MnDOT's technical teams, who provide support, security oversight, and ongoing maintenance.

From a staffing perspective, a modest increase in personnel hours will be required to manage the enhanced system. Tasks will include additional data entry, cleaning, and validation, as well as ensuring proper map display of closure data. These responsibilities will be incorporated into existing roles, with minimal disruption to current operations.

Overall, the operational environment builds on MnDOT's existing platforms and staffing structure, requiring incremental adjustments to support greater data accuracy, accessibility, and multimodal information sharing to the public.

10. Support Environment

To ensure the enhanced traveler information system operates effectively and can evolve over time, MnDOT will need to implement the following support-related improvements:

- **Policy & Procedure Updates:** Revisions to internal policies and procedures will be required to support the reporting of both long- and short-term active transportation disruptions through the Work Zone Request System. This includes establishing clear guidelines on when and how active transportation disruptions should be reported, who is responsible for submitting them, and what review protocols must be followed. These updates will help promote consistency across districts and improve the overall quality of reported data without the need for extensive training.
- **Standards Alignment:** MnDOT needs to ensure continued alignment with the WZDx and CWZ specifications. This will enable the seamless sharing of structured active transportation closure data with third-party platforms and navigation providers, ensuring that end users receive timely and accurate information across multiple systems.
- **Centralized Documentation:** To support long-term system sustainability, MnDOT needs to establish and maintain a centralized, version-controlled repository—such as a GitHub page—for technical documentation. This repository should include schema definitions, field-level updates, API configurations, and data integration procedures. By maintaining up-to-date documentation, MnDOT can reduce onboarding time for new team members, simplify external collaboration, and ensure system transparency for both internal and external stakeholders.

11. Operational Scenarios

The following scenarios illustrate how the enhanced traveler information system will function during its mature operational phase. Each scenario highlights a different use case for reporting, managing, and disseminating active transportation closure data across a variety of real-world situations. Together, they demonstrate the flexibility of the system to support both planned and unplanned events, leverage automated and manual inputs, and integrate data from MnDOT personnel, external agencies, connected devices, and third-party platforms. These examples provide a practical view of how the system supports timely, accurate, and accessible information for pedestrians, cyclists, and other multimodal users.

Scenario 1: Long-Term Construction Impacts on Trails and Sidewalks During Base Phase

MnDOT begins a multi-month roadway reconstruction project in District 7. The project affects the roadway, sidewalks, and a shared-use trail. After months of planning, design, and development of a traffic management plan, the construction schedule is set. Three weeks prior to the start of construction, MnDOT construction staff submit work zone impact and lane closure information using the Work Zone Request System. The Work Zone Request System submission includes information on the impacted roadway segment, specific closures on lanes, sidewalks, and trails, start and end dates, and detour plans.

MnDOT RTMC staff review the submission, verify details, approve the request, and enter the construction and closure information into CARS. The roadway lane closure information along with details on routes impacted, start and end dates of the impacts, and the natural extent of the impacts appears as the Road Reports layer on the 511 Traveler Information Map. Information on the impacts to the sidewalks and shared-use trail is displayed on the layer for active transportation users on the 511 map.

Third-party traveler information providers access the closure information in CARS via APIs that are developed by the providers. Providers who subscribe to the MnDOT WZDx/CWZ Data Feed receive the information pushed from CARS automatically. Third-party traveler information providers make the information available to their users. The public also accesses the MnDOT 511 Traveler Information System to obtain information.

MnDOT construction staff and contractors continue monitoring the project progress and submit additional requests to reflect changes to road/lane, sidewalk, and trail impacts based on the construction progress and staging. Updates to the information disseminated on the 511 Traveler Information System and to the third-party traveler information providers are made once the requests are received, reviewed, verified, approved, and entered into CARS.

Once the closures expire, information on roadway, sidewalk, and/or trail disruptions is automatically removed from the 511 Traveler Information System. Information is also made available to the third-party traveler information providers so they can update the information on their apps and services.

Scenario 2: Short-Term Closures Due to Roadway Maintenance

MnDOT plans to perform maintenance work on a short roadway segment in the Metro District that requires temporary closures of a bike lane and a sidewalk. A MnDOT maintenance supervisor or inspector enters the closure into the Work Zone Request System as a short-term event. The entry is flagged as maintenance-related and includes an estimated completion time. MnDOT Metro Maintenance Dispatch reviews the request, verifies its accuracy, and enters the information into CARS. The information then appears on the 511 map under the active transportation layer. If the maintenance

completion time deviates from the anticipated time in the initial request, MnDOT maintenance informs the Metro Maintenance Dispatch to update the information. Metro Maintenance Dispatch receives updated information and updates the data in CARS. The information in the 511 Traveler Information System is then updated. The initial information and subsequent updates are also shared with third-party apps and map providers for public consumption.

Scenario 3: Dynamically Changing Closures Detected by CWZ Devices

In a metro-area construction zone with rolling sidewalk closures, MnDOT has deployed CWZ Devices that detect pedestrian access limitations using geofenced sensors and automated status updates. As the contractor shifts work activity along the corridor, CWZ Devices are placed appropriately in and around the work zone. The CWZ Devices detect that a sidewalk section is closed and feed these data directly into CARS in near real-time following the WZDx/CWZ Standard. No manual entry is required. The closure appears on the 511 map and is reflected in data feeds to the third-party app and map providers. This allows app and map users to receive up-to-date sidewalk access conditions as they change throughout the day. This automation reduces the burden on staff while ensuring that accurate, timely information reaches the public.

Scenario 4: Trail Closures Due to Natural Events (DNR Data)

Following a severe storm, the Minnesota DNR field personnel reports fallen debris blocking a state trail adjacent to a MnDOT roadway in District 1, resulting in a temporary closure of the trail. DNR staff posts the trail closure information on the DNR trail webpages and logs the data in the trail conditions database that the DNR recently developed. Recognizing that the new DNR trail conditions database can be valuable sources of trail conditions and closure data, MnDOT coordinates with the DNR for making the data accessible by MnDOT for sharing with the public and the third-party traveler information providers. With the mutual understanding and agreement between MnDOT and DNR, MnDOT develops an API to retrieve data from this database at regular intervals. The data are automatically pulled, structured, and ingested into the CARS database. The closure then appears on the active transportation layer of the 511 Traveler Information Map. The information is also made accessible to the third-party traveler information providers. MnDOT continues to pull the data from the DNR database and ingests the data into CARS. Changes to the trail conditions and closure information are automatically updated in CARS and the 511 Traveler Information System. Alternatively, DNR staff enters the temporary trail closure information into the Work Zone Request System, which gets pulled into CARS, displayed on the 511 traveler map, and shared with the third-party traveler information providers.

Scenario 5: Crowdsourced Closure Reports via Third-Party Platforms

A group of cyclists observes a blocked bike lane due to short-term utility work that the contractor does not report using the Work Zone Request System nor through use of CWZ Devices. Cyclists report the disruption using a third-party app that has a feature for users to report conditions on bike lanes. The app organizes user reports and makes the information available to the app users. The app developer has an agreement with MnDOT which allows for two-way sharing of information. MnDOT allows the app developer to access CARS to obtain information that has a value to the app, and in turn MnDOT gains access to the crowdsourced data provided by the app users. MnDOT, via an API, obtains bike lane disruption information which is tagged with location and type of disruption. While the information is flagged as "unverified," MnDOT RTMC staff verifies the information using available resources such as

nearby traffic cameras, field staff reports, traffic speed data, or public reports. Once confirmed, MnDOT RTMC staff approves ingesting the data into CARS and for publishing on the 511 map and sharing with third-party traveler information providers via WZDx/CWZ data feeds or APIs.

12. Summary of Impacts

The enhanced traveler information system brings several benefits to MnDOT and its partners, while introducing minimal disruption to existing operations. For MnDOT construction staff and contractors, the primary change is the use of an updated Work Zone Request Form, which now includes fields for active transportation disruptions. These updates are straightforward and supported by basic guidance, ensuring that data entry remains a quick and familiar process.

For Dispatch, RTMC, and CARS staff, the enhancements provide improved tools for reviewing and managing a wider range of disruption data. While there is a slight increase in data volume and variety, the review and validation processes remain largely unchanged. Staff will now have access to more complete information, enabling better support for active transportation users. The system may also reduce the need for manual entry through integrations with CWZ devices and DNR, streamlining internal workflows over time.

External partners such as the Minnesota DNR benefit from a more automated and visible pathway for sharing trail closure information with the public. Similarly, third-party mapping platforms can receive and contribute active transportation data through established data feeds and newly generated APIs, strengthening public access to timely, multimodal travel updates.

There are no major system infrastructure changes required—existing platforms like the CARS database and 511 Traveler Information Map are leveraged and enhanced. The proposed system includes the possibility of using the DNR trail conditions database as an option. A key technical dependency of this option is the development and maintenance of an API to connect with the DNR's database if it becomes available. Constraints may include the readiness of partner systems, internal staffing for API development, and coordination timelines.

To assess performance, MnDOT may track metrics such as the number of active transportation disruptions reported, average time from data submission to public availability, WZDx/CWZ Data Feed usage by third-party apps, API pull requests from CARS database, and user feedback on the 511 map's new features. These indicators will help evaluate system reliability, accuracy, and public value.

A key consideration is the limited geographic coverage of the proposed system. The proposed concept focuses on reporting and disseminating disruption information of active transportation facilities along or adjacent to MnDOT-managed roadways. These facilities represent only a fraction of Minnesota's total active transportation network. The value of the system that may capture disruptions on a small segment of an active transportation user's overall trip needs to be further investigated.

Despite the limited coverage, the information provided by the system may still deliver significant value for active transportation users. Disruptions at key points, such as bridge or river crossings, can disproportionately impact a user's ability to complete their journey safely or efficiently. For example, a closed river crossing may only represent 10% of a user's total route, but without prior knowledge of that closure, the user may be forced into a lengthy and unfamiliar detour, potentially on unsafe or unaccommodating roads.

By publishing these critical disruptions, even if only along portions of a route, the system can help active transportation users make more informed decisions, avoid unsafe conditions, and adjust travel plans accordingly. Furthermore, building the foundation for reporting active transportation impacts along MnDOT roadways also opens the door to future partnerships and data-sharing opportunities with local agencies and third-party platforms, thereby extending the reach and utility of this information over time.