West Central Minnesota I-94 Blowing and Drifting Snow Control Project

FY 2022/FY 2023 Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program

BASIC PROJECT INFORMATION

MINNESOTA DEPARTMENT OF TRANSPORTATION

Project Name: West Central Minnesota I-94 Blowing and Drifting Snow Control Project
Project Type: Resilience Improvements
Future Eligible Project Costs: $17.170 million
PROTECT Funds Requested: $13.736 million

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Supporting Information can be found at:
https://www.srfconsulting.com/mndot-i-94-snow-control/

DEPARTMENT OF TRANSPORTATION

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I. BASIC PROJECT INFORMATION

PROJECT DESCRIPTION

The Minnesota Department of Transportation is requesting $13.736 million of Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Grant funding for the construction of the West Central Minnesota I-94 Blowing and Drifting Snow Control Project. The project is a corridor-wide snow fence project addressing nearly 120 miles of Interstate 94 (I-94), along I-94, between the cities of Moorhead and Alexandria.

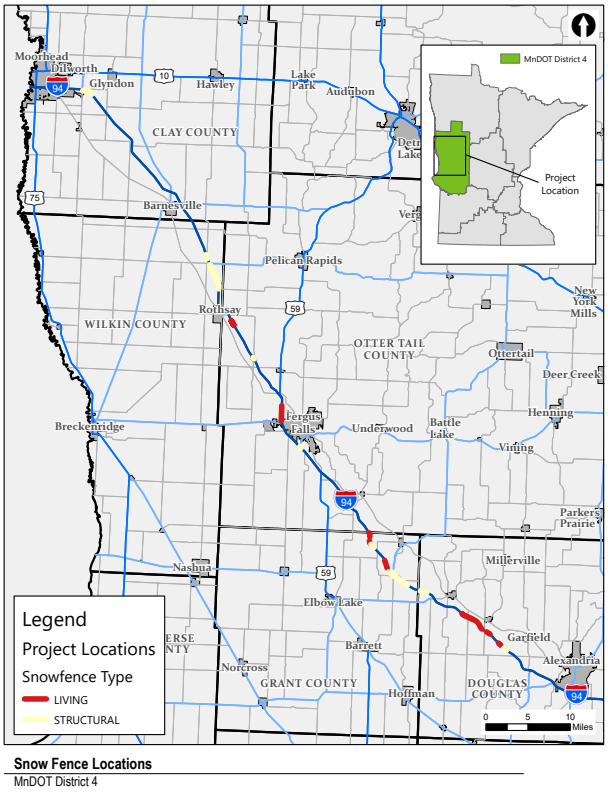
The project will install 24 total miles of snow fence across 38 sites, consisting of both structural and living snow fences. Snow fence sites are all along I-94 in Clay, Wilkin, Otter Tail, Grant, and Douglas Counties (see Figure 1). Of the 38 sites, 21 will be constructed using structural snow fences (11 miles) and 17 will be constructed using living snow fences (13 miles).

I-94 is one of the most important and heavily traveled roadways in the State of Minnesota, carrying up to 21,000 vehicles per day, including 5,500 trucks, along the project area. Acting as a freight and commuting corridor, I-94 is vitally important to the economic health of Minnesota and the region, supporting shipping, receiving, and commerce, and serving as a primary route for disadvantaged communities in the region to access goods, services, and employment opportunities. The interstate is an invaluable transportation asset for the interstate and intrastate movement of people and goods, serves as a major connector between the Fargo-Moorhead Metropolitan Area and the Twin Cities, and provides a key route for east west travel across the country.

What is a snow trap?

MnDOT defines snow traps as a section of roadway that experiences problems associated with blowing and drifting snow. These areas present problems for highway users by reducing visibility, creating snow drifts making the road impassable, and creating slippery conditions. Statewide MnDOT has identified more than 3,000 snow trap locations.

Figure 1 Project Location Map



This project will improve the system wide resiliency of Minnesota's transportation network by taking a comprehensive approach to snow fence installation and addressing blowing and drifting snow at the corridor level. It will mitigate the worst snow traps along the I-94 corridor, improving highway safety, reducing the need for wintertime maintenance, and enhancing operation of the interstate for local, statewide, and regional users. Project benefits include:

- Reducing snow drift and icy roads, improve roadway safety, reduce the occurrence of stranded motorists, and limit the need for emergency response. Snow fences also provide consistent driving conditions, reducing drifting snow and ice sporadically throughout the corridor. Installation of snow fences on a curve is shown to reduce crash severity by 40 percent.
- Reducing maintenance needs and costs during the winter months, which will allow MnDOT maintenance crews to focus efforts on other state highways providing network wide safety and operational benefits.

- Reducing environmental impacts to surface waters and air quality by decreasing chloride usage on the interstate for ice melt and reducing fuel consumption for snowplows.
- Improving the overall operation of I-94 throughout the winter months, enhancing community access to vital goods and services, improving emergency response during storm events, and reducing delays in freight movement and shipping.
- Reducing the occurrence of interstate closure and issuance of travel advisories.
- Reducing exposure of emergency response providers to severe weather conditions to provide services to crashes and stranded vehicles.

Benefit Cost Analysis (BCA):

MnDOT expects that this project will result in quantified benefits that significantly exceed costs. The projected benefit/cost ratio for this project is:

3.13

Project History

MnDOT snowplow crews, Minnesota State Patrol, and other emergency responders have long fought a continuous battle against the harsh Minnesota winters which can drop upwards of a foot of snow and ice, creating unsafe travel conditions and, on occasion, forcing the closure of I-94. Combined with high winds and wind chill temperatures as low as negative 40 degrees Fahrenheit, these winter conditions can prove not only cumbersome for travelers along the Interstate corridor but also tragically fatal.

As part of MnDOT's Toward Zero Deaths (TZD) Program, the Department began actively looking to mitigate more than 3,000 trouble spots or snow traps statewide. During the winter of 2018, MnDOT constructing snow fences structures along a two-mile stretch of I-94, east of the City of Moorhead. This location had been particularly troublesome in the past, seeing 27 crashes during the 2017-2018 winter. **With the construction of the fences, the number of crashes dropped to eight (less than 30 percent of the year prior), with only one resulting in an injury, during the 2018-2019 winter. MnDOT also saw $100,000 in operational and maintenance savings** due to the reduction of plowing needs and a 50 percent reduction in chloride use, which equates to 244 fewer tons of salt that needed to be applied to keep the road clear. Additionally, this will reduce the burden on emergency response resources to provide services to crashes and stranded vehicles.

In the years since the study, MnDOT has continued to build snow fences along the I-94 with the assistance of private landowners and farmers via its Snow Fence Program. This program allows MnDOT to work together with landowners to install structural, living (trees/shrubs), or vegetative (corn rows or hay bales) fences. From 2019 to 2023, MnDOT rented over 94 acres of snow fence in the form of standing corn rows (a cost of $187,856) and between 2018 and the

end of 2022, MnDOT installed just over seven miles (37,019 linear feet) of structural snow fence and over three miles (15,961 linear feet) of living snow fence along I-94:

- Beginning in 2018, through a series of Negotiated Maintenance and Construction Contracts (NMC), 2.38 miles (12,546 linear feet) of structural and 0.23 miles (1,224 linear feet) of living fence was installed in Clay County between Moorhead and Highway 336.
- Through a landowner agreement and West Otter Tail Soil and Water Conservation District (SWCD) 1.92 miles (102,256 linear feet) of living snow fence was installed along I-94 through Otter Tail County.
- 0.55 miles (2,896 linear feet) of structural fence was installed in Otter Tail County West of Fergus Falls.
- 1.28 miles (6,768 linear feet) of structural fence was installed in Douglas County near Alexandria.
- 1.34 miles (7,076 linear feet) of structural fence was installed in Clay County near Downer.
- 0.83 miles (4,393 linear feet) of living fence was installed in Otter Tail County West of Fergus Falls.
- 0.51 miles (2,712 linear feet) of structural and 1.28 miles (6,479 linear feet) of living fence installed in Otter Tail and Douglas Counties.
- 0.31 miles (1,620 linear feet) of structural fence between Highway 27 and the I-94 ramp east of Alexandria in Douglas County.
- 0.15 miles (800 linear feet) of living snow fence installed via NMC in 2018 between Highway 29 and the I-94 ramp south of Alexandria in Douglas County.

MnDOT has also a project programmed that would install approximately $2 million in snow fences along I-94 near the city of Rothsay.

Starting in 2022, MnDOT began analyzing locations along I-94 between the Minneapolis-St. Paul Metropolitan Area and the City of Moorhead with the goal developing a snow fence project which would address blowing and drifting snow at the worst locations along I-94. Those efforts led to the West Central Minnesota I-94 Blowing and Drifting Control Project, which will address the worst remaining snow trap locations on I-94. MnDOT is committed to delivery of this project and has previously incurred $252,492.22 in project development costs.

In 2000, MnDOT's Snow Fence Program won a Transportation Design National Award from the USDOT. In the award announcement, the committee stated: "A statewide code for "live" snow fence designs in Minnesota achieves a unique combination of maintenance reduction of snow removal, an attractive landscape, and a winter form of environmental art."

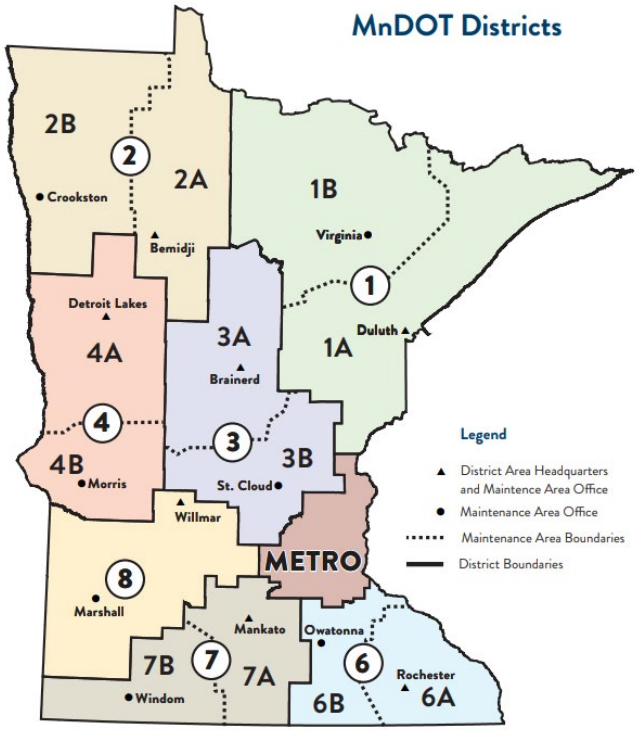
Negotiated Maintenance and Construction Contracts (NMC):

NMCs are an innovative form of project delivery that allows MnDOT to execute contracts that meet certain standards with a contractor without going through a competitive process. This can accelerate project delivery and helps to promote the use of new and small firms, including disadvantaged business enterprises (DBE), targeted group businesses, TGB, and veteran owned contractors

PROJECT LOCATION

This project is located at various sites along the I-94 corridor, between the cities or Moorhead, MN and Alexandria, MN – a 106–mile stretch of interstate in the northwestern/central portion of the Minnesota. The project is located in an rural area, outside of urbanized areas with a population of greater than 200,000 people The project will install a mix of living and structural snow fences in Clay, Wilkin, Otter Tail, Grant, and Douglas Counties (see Figure 1). This project is located in, being developed by, and will be delivered by MnDOT's District 4, located in the west central portion of the state (see Figure 2).

Figure 2 MnDOT Districts



The City of Moorhead is along the Red River, which separates North Dakota from Minnesota, and is part of the Fargo-Moorhead Metropolitan Statistical Area. According to the 2020 Census, the total population for Moorhead was just over 43,000 people. Meanwhile, the City of Alexandria is located to the southeast and has a population of about 14,000 people. Between these two cities are other smaller population centers, the largest being Fergus Falls, a town of 14,000 61 miles southeast of Moorhead and 49 miles northwest of Alexandria. Many of the locations of the proposed snow fences are between Alexandria and Fergus Falls.

Transportation Disadvantaged Tracts

This project is not located within Census Tracts that are identified as Transportation Disadvantaged Census Tracts under the USDOT Transportation Disadvantaged Tracts tool. However, the project will improve a vital transportation corridor that serves areas that are identified as disadvantaged (see Figure 10).

Resilience Improvement Plan

The project is not included or prioritized in an applicable Resilience Improvement Plan (RIP). Minnesota does not have a RIP, however, MnDOT is developing a one to support PROTECT and resilience investment prioritization. A vulnerability assessment is underway with the RIP scheduled to be complete in early 2024. Once the vulnerability assessment is complete, MnDOT will develop risk management strategies and then outline categories, criteria, and a methodology for project scoring. Ultimately a prioritized list of projects where resilience enhancements can be incorporated will be included in the RIP.

Floodplain

Three fence locations are within 100-year floodplains. As such, one or more components of the State of Minnesota's Risk Mitigation Plan will be implemented in accordance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Development Patterns

The construction of the proposed snow fences is not anticipated to impact development patterns or demographics of the areas in which they will be located. This project will, however, affect how blowing snow is distributed along I-94, which will lead to safer traveling conditions for passenger vehicles and freight trucks. According to the Manufactures' Perspectives on Minnesota's Transportation System Study for District 4, published in 2015, there are more than 500 manufacturing and 400 trucking firms located within District 4. All of them depend on the highway and interstate system for the safe and efficient movement of goods. I-94 connects many businesses to Minneapolis/St. Paul and Chicago to the east and to Fargo, Billings, and Seattle to the west. Connections to major cities allow for access to urban and global markets by providing direct access to intermodal shipping. By keeping the interstate open and clear of blowing snow MnDOT ensures the area's manufacturing engine keeps running.

"Weather is by far our most consistent challenge," said one business owner who was interviewed for the report. "MnDOT's ability to quickly remove snow and ice makes a huge impact."

PARTIES INVOLVED

MnDOT is the lead applicant for the proposed project and will be responsible for the receipt and expenditure of PROTECT Grant funds. MnDOT has extensive experience with procuring and developing transportation improvement projects. With over 11,000 miles of trunk highway (including interstates) and 1,500 bridges under their ownership, MnDOT is experienced and committed to the maintenance and expansion of the roadway system. Within the last ten years, MnDOT and its partners have procured dozens of federal discretionary grants used to increase efficiency and safety on the MnDOT system.

MnDOT is committed to implementing timely investments in capital and preventative maintenance treatments to extend the service life of assets while reducing lifecycle costs. Ongoing operating and maintenance (O&M) costs on the state highway system are funded by taxes and fees from four main revenue sources:

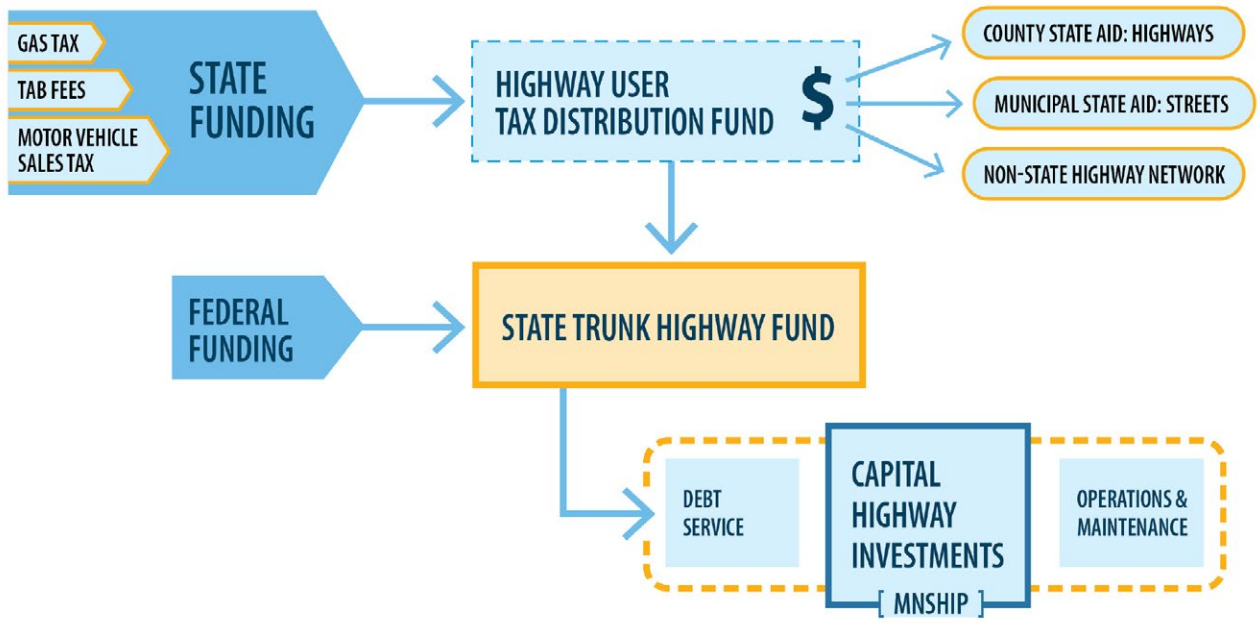
- State gas tax (motor fuel excise tax)
- State tab fees (motor vehicle registration tax)
- State motor vehicle sales tax
- Federal highway funds (highway user tax distributions, flexible highway account, and County State Aid Highway Fund)

MnDOT developed its first Transportation Asset Management Plan (TAMP) in accordance with the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21). TAMP was then extended beyond MAP-21's minimum requirements to include the entire state highway system and other infrastructure within the right-of-way corridor. MnDOT's TAMP was a national pilot project and serves as a guide for other states.

MnDOT applies the TAMP as a guide to analyze life-cycle costs, evaluate risks, develop mitigation strategies, establish asset condition performance measures and targets, and develop investment strategies. The TAMP will serve as a guide to ensure all necessary Project operation and maintenance is implemented.

While the project will be delivered by MnDOT, this project will be completed in collaboration with the Minnesota State Patrol, which has provided a letter of support for the project and will participate in project development and implementation. Additionally, MnDOT has long worked with the Department of Agriculture-Farm Service Agency (FSA) to implement their Living Snow Fences Project. The department has entered into a Memorandum of Understanding with the FSA to coordinate the development and maintenance of living snow fences throughout the state.

Figure 3 MnDOT Funding Flow Chart



II. GRANT FUNDS, SOURCES AND USES OF ALL PROJECT FUNDING

PROJECT BUDGET

Total Eligible Project Cost: $17,170,000 (cost estimate)

FY 2022/FY 2023 PROTECT Grant Request: $13,676,000 (80 percent of total eligible project cost)

The West Central Minnesota I-94 Blowing and Drifting Snow Control Project's primary purpose is to address resilience problems along the I-94 Corridor between Moorhead, MN and Alexandria, MN, which makes its full project costs (up to the federal maximum 80 percent) an eligible use of PROTECT funding. As can be seen in Table 1, below, MnDOT has committed to providing the full required match, including all funding for engineering and right-of-way acquisition.

MnDOT has committed to providing funding from one of the following two sources (funding commitment letter):

1. Out of a central pot of $216.4 million dollars set aside for providing non-federal match to IIJA grant recipients. This funding was provided to MnDOT in the most recent legislative session ending in May 2023 . The $216.4 million is available on a first come first serve basis to IIJA grant recipients.
2. If that central $216.4 million dollars fund is no longer available, the local match will be covered from the District 4 budget.

Table 1 Project Budget

Project Component	Federal - PROTECT Funding		Non-Federal - State of Minnesota Funding		Total Project	
	Amount ($)	Percent of Total Eligible	Amount ($)	Percent of Total Eligible	Amount ($)	Percent of Total Eligible
Construction Let Amount	13,000,000	76%	-	0%	13,000,000	76%
CO/Overruns	736,000	4%	34,000	0%	770,000	4%
Preliminary Engineering	-	0%	900,000	5%	900,000	5%
Construction Engineering	-	0%	600,000	3%	600,000	3%
Right-of-Way	-	0%	1,900,000	11%	1,900,000	11%
Project Total	**13,736,000**	**80%**	**3,434,000**	**20%**	**17,170,000**	100%

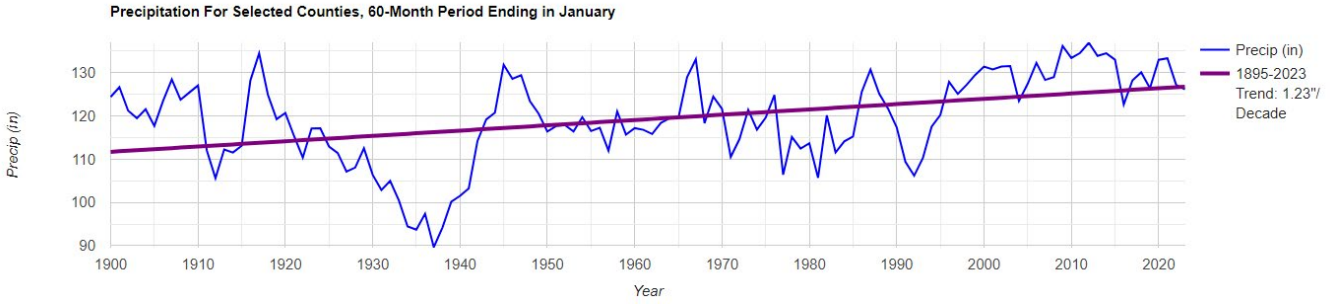
III. MERIT CRITERIA

CRITERION #1 VULNERABILITY AND RISK

Climate Change is already having sizable impacts on Minnesota's weather. The state is seeing increased precipitation, higher levels of wind, and heavy snow events. Daily average minimum temperatures during the winter (December to February) have increased 7.3 degrees from 1895 to 2021 in Northern Minnesota, 6 degrees in central Minnesota, and 4.9 degrees in southern Minnesota. Warmer days during the winter are leading to larger and more frequent precipitation events, resulting in more snow than ever before. Increased temperatures across the world are contributing to an increased volume of ocean water present

in the atmosphere, providing more fuel for passing weather systems to dump snow on the state. Seasonal heavy snow events, defined as calendar days with at least four inches of snow, have been increasing in frequency over time and annual rainfall has increased consistently since 1900 (see Figure 4).

Figure 4 Five-year precipitation in Clay, Wilkin, Otter Tail, Grant, and Douglas Counties since 1900.



These changes are resulting in more severe winter weather, creating additional maintenance needs, and more unsafe conditions for wintertime travel. **For District 4, this increase in snowfall equated to more than 88 inches of snow recorded during the 2022-2023 winter season.** To help track the severity of individual winter seasons, each MnDOT District calculates a Winter Severity Indexwthat compares maintenance and labor costs annually.

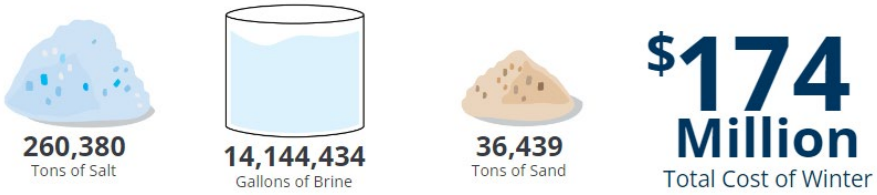
For MnDOT District 4 the Winter Severity Index for the 2022-23 season was 166 meaning the district had a more severe winter than five other MnDOT districts (see Table 2). The only districts with a higher severity index were Districts 1 and 3 in central and northeast Minnesota. According to MnDOT's annual Winter Maintenance Report this season was the most severe winter recorded in the district and the state over the past five years. As the prevalence of severe weather increases over time, MnDOT maintenance needs are expanded, safety issues are exacerbated, and the needs to apply salt, brine, and sand to roadway is increased.

Table 2 Winter Severity Index 2018-2023

Area	2018-19	2019-20	2020-21	2021-22	2022-23
Statewide	154	128	86	138	164
District 4	157	130	84	152	166

With larger snowfall events and more severe winter weather comes increased maintenance costs to keep I-94 and other roads open and results in additional greenhouse gas emissions from snowplows. During the 2022-23 winter season MnDOT District 4 work crews applied more than 16,400 tons of salt, 3,700 tons of sand, and 2.9 million gallons of brine on both I-94 and state highways. This accounted for approximately 6.3 percent of the state's overall salt usage during the season, about 14 percent of the state's sand usage, and 21 percent of the state's brine usage. Plow operators logged more than 850,000 regular and overtime hours clearing roads statewide, a 100,000-hour increase over the previous season. Snow and ice expenditures statewide were about 17.6 percent or $26 million more than the previous winter, with $174 million spent on materials, labor, and equipment – the most MnDOT has ever spent on plowing and snow operations.

Figure 5 MnDOT statewide salt, brine, and sand usage in the 2022-2023 winter.



[1]The MnDOT Winter Severity Index is based on several factors, including 1) dewpoint/relative humidity; 2) wind speed gusts and direction; 3) frost and black ice; 4) precipitation type and duration; 5) air temperature; 6) road temperature; 7) cloud cover; 8) blowing snow; and 9) surface pressure.

The 2022-23 winter season followed a concerning upward trend, as Minnesota has continued to experience more severe winter weather. While whiteout conditions are not unusual in western and northwest Minnesota, the 2021-22 winter season proved to be especially harsh. The months of December, January, and February were the windiest on record since 1989 with winds sometimes gusting up to 70 miles per hour creating ground blizzards with zero visibility events. **"I'd rather deal with 30 inches of snow falling straight down than have zero inches of snow blowing 70 mph at times"** said Kohl Skalin, District 4 Maintenance superintendent. "The intensity was just over the top and it never let up." It is expected that annual maintenance cost reductions will exceed $1 million annually.

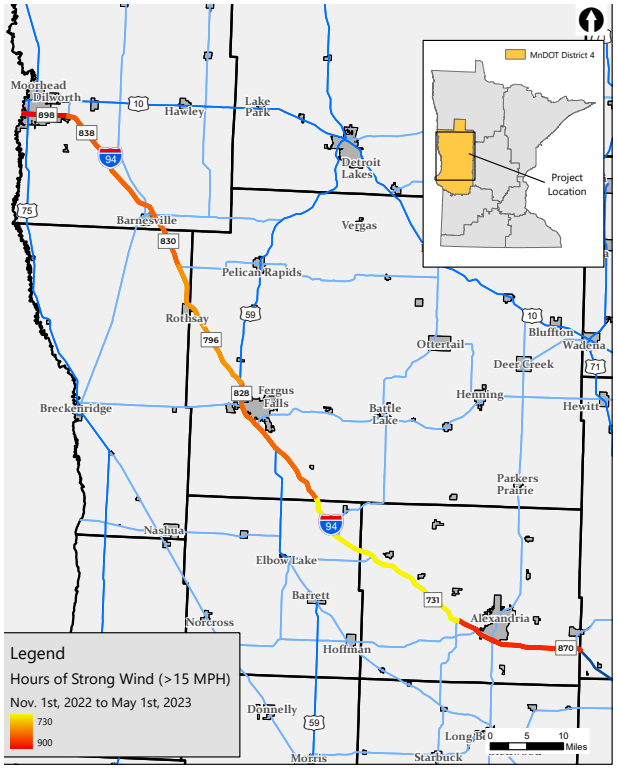
MnDOT has begun to track and analyze wind conditions during the winter months to understand the scale of the problem. According to this data, between November 1, 2022 and May 1, 2023, most sections of I-94 from Moorhead to Alexandria were met with over 800 hours (over 33 days) of wind exceeding 15 miles per hour and 400 hours (over 16 days) of potential blowing snow (see Figure 6).

Table 3 Vehicle Off Road and Jackknife events along I-94 as reported to the Minnesota State Patrol

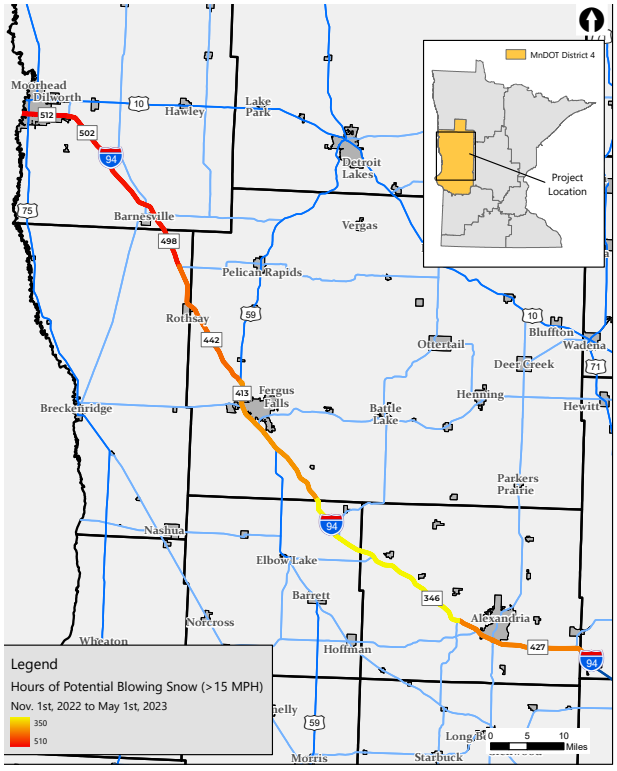
Winter	Jackknife	Vehicle Off Road (VOR)	Total Events
2022-2023	69	487	556
2021-2022	47	504	551
2020-2021	15	321	336
2019-2020	9	314	323
2018-2019	31	479	510

The types of conditions described above occur annually and lead to multiple crashes, injuries, travel advisories, including complete shutdowns of I-94 between Moorhead and Alexandria. Since 2018 there have been seven no travel advisories declared for this section of interstate with the entire stretch being forced to close at least three times. From 2018-2022, snow and ice crashed accounted for 32 percent of all statewide crashes with 16 percent resulting in serious injury or fatalities.

Figure 6 Hours of strong wind and potential blowing snow on I-94, Nov. 1, 2022 – May 1, 2023



Hours of Strong Wind (>15 MPH)
MnDOT District 4



Hours of Potential Blowing Snow (>15 MPH)
MnDOT District 4

In addition to serious injury and fatal crashes, there are numerous weather-related crashes, including vehicle off road (VOR) and jackknifes, annually that require response by the Minesota State Patrol. According to the Minnesota State Patrol they responded to 556 VOR and jackknife events along this portion of I-94 in the 2022-2023 winter[2] (see Table 3). Beyond the reported events, there are numerous occurrences of vehicles off road or stranded vehicles with passengers that are unreported or cannot be reached to high demand or limited mobility.

Many of these crash events result in damage to center median cable barriers. Since MnDOT's winter maintenance efforts are focused on snow and ice removal, median repair often cannot occur until the summer months. As a result, the effectiveness of the traffic safety device is reduced, which can create additional safety issues on the interstate. For example, after the very severe 2022-2023 winter, nearly 150 barrier locations needed repairs along the 55 miles of I-94 between Moorhead and Fergus Falls.

Snow fencing will reduce the occurrence of these events, increase the safety of I-94 during winter storm and blowing snow events and allow emergency responders to focus resources on other portions of the state. Further, closures to I-94 often forces travelers off of the interstate and onto other state or county roads, which frequently leads to them being stranding in locations where emergency responders cannot easily access. In total, the projected crash savings as a result of this project exceed $13 million over the 20 years evaluated for the benefit-cost analysis.

"Part of the mission of the Minnesota State Patrol is to help provide for safe, efficient movement of traffic on Minnesota roadways...Winter weather in this area is one of the biggest challenges we face. Our past coordinated work with MNDOT has allowed for improvements in segments of the roadway with the utilization of snow fences. These areas have seen a significant safety improvement not only for the public that uses it, but also for the troopers and other emergency responders that have to respond to incidents in that area."

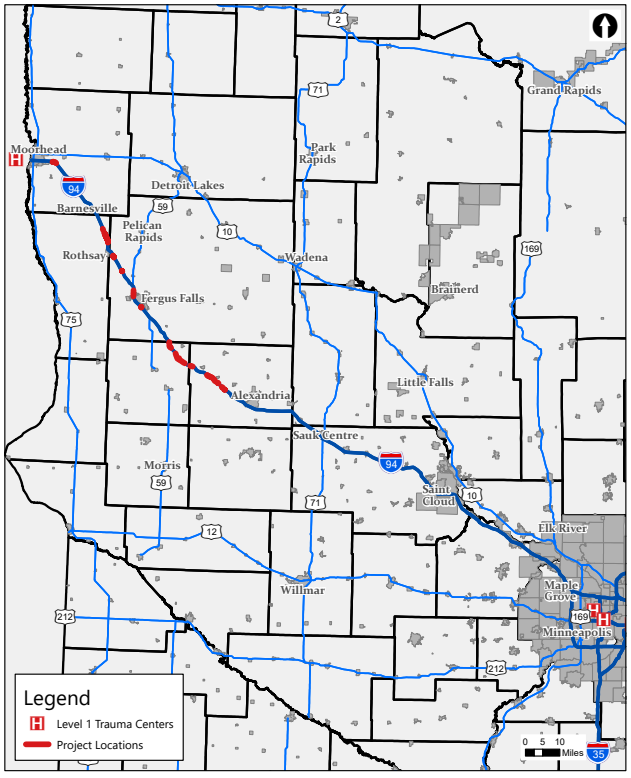
Captain Brian Cheney, District Commander-Detroit Lakes, MN State Patrol

[2]This data is commonly underreported due to trooper backlog, local agencies responding, or those involved in the incident not filing a report.

CRITERION #2 CRITICALITY TO COMMUNITY

I-94 is a critical piece of transportation infrastructure for the State of Minnesota and the region. Not only does the interstate connect cities and towns in the western portion of the state to the economic hub of the Twin Cities and beyond, it provides continued access to vital medical facilities, job opportunities, and other necessary goods and services. Additionally, the interstate serves as key shipping and receiving corridor for many industries in the region.

Figure 7 Location of Level 1 Trauma Centers in Western Minnesota.



Providing Access to Medical Facilities

According to a study titled Ambulance Deserts: Geographic Disparities in the Provision of Ambulance Services (2023), by the Maine Rural Health Research Center and the Rural Health Research Centers, nearly 4.5 million people across the U.S. live in an "ambulance desert" – 25 minutes or more from an ambulance station – and more than half of those are residents of rural counties. During an emergency every minute counts, this can lead to fatalities and long-term injuries that may have been prevented if the individual was closer to emergency services. In Minnesota, about 46,702 people live in Ambulance Deserts, with 71.1 percent of those living in rural areas.

The Sanford Health Medical Center located in Fargo, North Dakota is the only Level 1 Trauma Center between Minneapolis, Seattle, Denver, and Omaha (see Figure 7), and plays a vital role in the medical care of people across the region with approximately 60 percent of patients coming from outside the Fargo-Moorhead Metropolitan Area. This Level 1 designation is the highest level of trauma care for a medical facility in the United States and means that the facility has a full range of specialists and equipment available 24 hours a day. Commonly, medical airlift services are used to transport patients in need of critical, lifesaving assistance. However, during winter blizzards emergency medical airlift services are unavailable making ambulances traveling along the interstate as the only way of transporting critical patients. I-94 serves as the primary route for these patients to Fargo. This project will improve operation of I-94 during these severe winter storm and blowing snow events, allowing continued use by emergency responders.

A Critical Freight Route

According to MnDOT's Traffic Forecasting & Analysis Office, the Average Annual Daily Traffic (AADT) on I-94 between Alexandria and Moorhead ranges from a low of 10,500 AADT along the more remote stretches of the interstate to highs of more than 18,000 and 25,000 AADT for areas near Moorhead and Alexandria, respectively. Varying based on location in proximity to transportation hubs and rail lines, freight traffic is steady with between 3,000-6,000+ heavy commercial vehicles traveling the corridor daily (see Figure 8). Over one quarter of tracked truck trips within the region begin in one of four areas: 1) The I-94 / US-59 interchange near Fergus Falls; 2) The Rothsay truck stop on I-94; 3) US-10 between Perham and Wadena; or 4) I-94 in western Alexandria.

The MnDOT District 4 Freight Plan identifies I-94 as the heaviest traveled freight route in the area, with many businesses dependent on hauling being located on I-94 between Fergus Falls and Alexandria. Freight-related businesses make up about 37 percent of the workforce in MnDOT's District 4. Most of the freight being transported within the I-94 corridor are either manufactured goods or agricultural products. Cereal grains make up 48 percent of District 4's truck tonnage, which is larger than the statewide

share of 22.5 percent. The Federal Highway Administration estimates that Minnesota will see a continued increase in truck-carried tonnage of cereal grains and animal feed.

> "In particular, animal feed tonnages are expected to increase by 94 percent between 2017 and 2050, while agricultural products are expected to increase by 12 percent," the FHA wrote in its 2022 Freight Analysis Framework. These goods are among the top commodities moving within District 4's transportation network so it is likely that truck tonnages on I-94 will also increase.

Manufacturers' Perspective

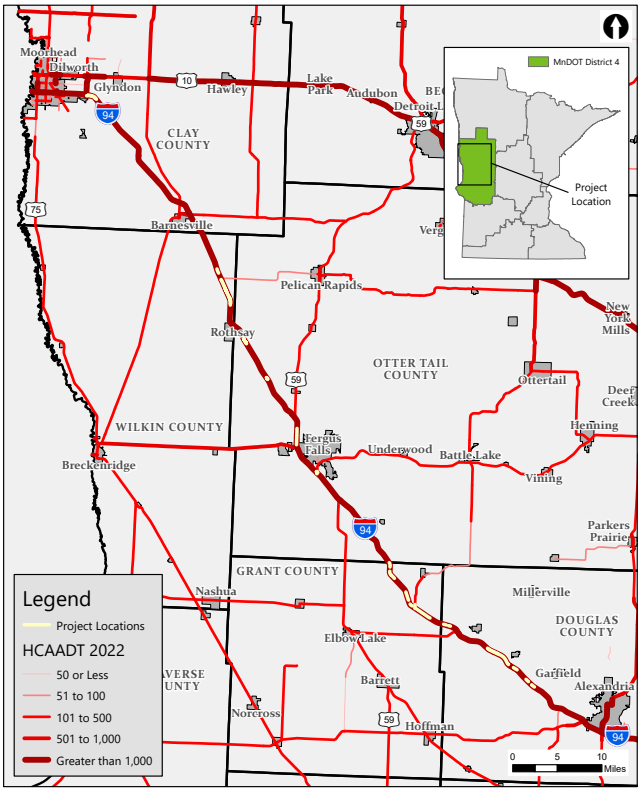
In 2015, MnDOT published a report titled Manufactures' Perspectives on Minnesota's Transportation System for District 4, that sought to gather the perspectives from manufacturers regarding the highway network. 103 businesses in the region were interviewed, including 82 manufacturers, 15 carriers, and six other businesses that served tourists, such as hotels and casinos. Nearly all (92) of them shipped products to a state that borders Minnesota, 61 businesses shipped nationally and 31 shipped internationally. The primary transportation concerns of the businesses centered on issues like signage, pavement quality, and snow and ice removal.

Though reporting mostly positive opinions about snow and ice removal in Minnesota, respondents requested more prompt response to winter storm events on secondary state roads, especially during shift changes when employees are commuting, and in the early morning. While the I-94 snow fence project was not discussed or in the works at the time, the responses of the businesses surveyed indicate that more resources are needed for snow removal on secondary highways and roads within the district. By completing the proposed I-94 snow fence project, MnDOT will be able to divert resources to these at-need areas during snow events that would normally be used to keep the interstate clear.

Access to Jobs

In addition to being a key freight route, I-94 serves as a vital transportation corridor connecting people to jobs and economic opportunities. The majority of the project area between Moorhead and Alexandria is identified as Economic Development Region 4 – West Central (EDR4) by the Minnesota Department of Employment and Economic Development (DEED). This region covers the counties of Becker, Clay, Douglas, Grant, Otter Tail, Pope, Stevens, Traverse, and Wilkin.

Figure 8 Heavy Commercial Average Annual Daily Traffic in west central Minnesota.

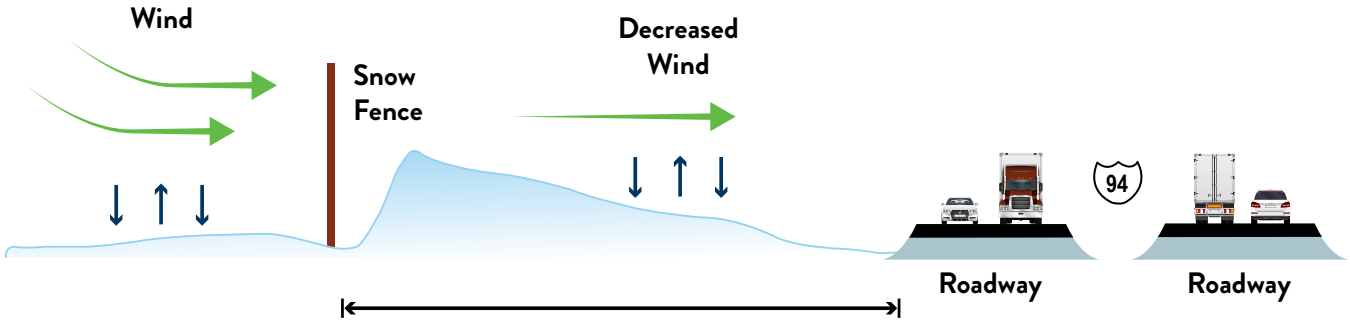


Due to having fewer jobs than available workers and its rural nature, EDR4 is a net exporter of labor. In 2019, 41,857 workers commuted to locations outside of the region for work while another 23,639 workers commuted into the region. I-94 serves as the key corridor for commuters, with nearly 28 percent of the region's workers being employed by businesses located in the Fargo-Moorhead Metropolitan Statistical Area, which is easily accessible via I-94.

CRITERION #3 DESIGN ELEMENTS

Snow fences in the United States have been widely used to mitigate blowing and drifting snow since the 1990s although the first recorded use of them in the U.S. can be tracked back to the construction of the Transcontinental Railroad in 1868-69. Fences come in different forms, including structural (man-made), living, and standing corn rows. This project will consist of a combination of structural (21 sites, 10.5 miles) and living fences (17 sites, 12.9 miles).

Figure 9 Snow fence functionality



Snow fences are effective in improving roadway safety because they minimize the amount of snowdrift that reaches roadways. In general, both structural and living fences provide a wind/snow block, with room for snow storage between the fence and the roadway. Due to having to move through or around the fence, blowing snow loses speed and energy and is deposited behind and in front of the snow fence. When designed properly, the height of the fence and the angle and position of slats will direct snow into accumulation and storage areas that do not impact the safety of drivers on the road (see Figure 9).

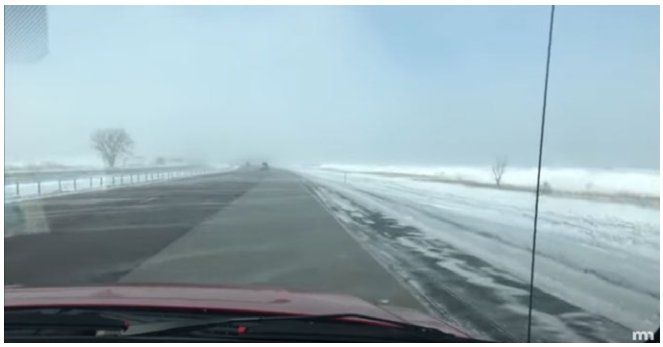
There are two types of permanent snow fences in use today – structural and living. Structural fences are usually constructed of wood, metal, a combination of plastics, or composite polymer/fiber while living snow fences are groups of bushes or trees and other vegetation placed in such a way as to act in a comparable manner to that of a structural fence. Both structural and living fences can be arranged in a variety of different patterns to better accommodate the curvature of the road they are protecting and the direction of the wind.

STRUCTURAL SNOW FENCES

Typically constructed of wood, metal, a combination of plastics, or composite polymer/fiber. As can be seen in the picture (above), fences are constructed with slanted spacings so that snow is able to move "through" the fence and be deposited between the structure and the roadway. The snow fence pictured is an example of structural snow fencing located along I-94 outside Moorhead.

LIVING SNOW FENCES

Made up of groups/rows of trees, shrubs, native grasses, and wildflowers, located along farmland. They are typically located about 100-200 feet away from the highway, which provides adequate room for drift formation and snow storage. The snow fence pictured is an example of living snow fencing located along I-94 east of Rothsay.



Dash cam footage (above) showing the difference in roadway conditions between a portion of I-94 near Moorhead with (left) and without (right) standing corn row snow fences, during the same blowing snow event with winds of 30 miles per hour (January 29, 2019). During this event, one foot snow drifts formed rapidly on roadways that were not protected by snow fencing.

Construction of the 38 snow fences will be based on the best design and construction practices. For the project, a mix of living and structural snow fences will be constructed in either a herringbone or parallel fence patterns depending on the needs of the selected location. The angle of blowing snow the fence, the curvature of the section of interstate, the Right of Way (ROW) available to MnDOT, and the ROW that is available to be acquired all impact snow fence design. In developing the specific design for each fence location, MnDOT will utilize climate data provided through the University of Minnesota's Drift-Free Roads Design Tool.

As discussed above, MnDOT has seen significant success through its Snow Fencing Program. Prior to the 2018-2019 winter, MnDOT installed snow fencing across a two-mile stretch of I-94 east of Moorhead to test their effectiveness. As a result, MnDOT saw $100,000 in operational and maintenance savings due to the reduction of plowing needs and a 50 percent reduction in chloride use. Additionally, **crashes were reduced from 27 in the 2017-2018 winter to only eight in the 2018-2019 winter** (despite seeing a relatively severe winter, winter severity index of 157 in District 4).

Outside of MnDOT's efforts, the Federal Highway Administration (FHWA) has published numerous studies and case studies demonstrating the effectiveness of snow fencing. For example, after installing snow fencing along I-80, the Wyoming DOT saw snow removal costs drop almost 50 percent and saw a reduction in crash rate by nearly 70 percent during winter storm events. Additionally, according to a 2003 report for the National Cooperative Highway Research Program Transportation Research Board of the National Academies written by Ronald D. Tabler who pioneered research on snow fences in the U.S., snow fences can:

- Eliminate snow drifts
- Improve visibility
- Dramatically reduce ice formation
- Reduce expenditures on staffing, equipment, and maintenance operations
- Reduce crashes and injuries
- Prevent road closures
- Reduce traffic delays

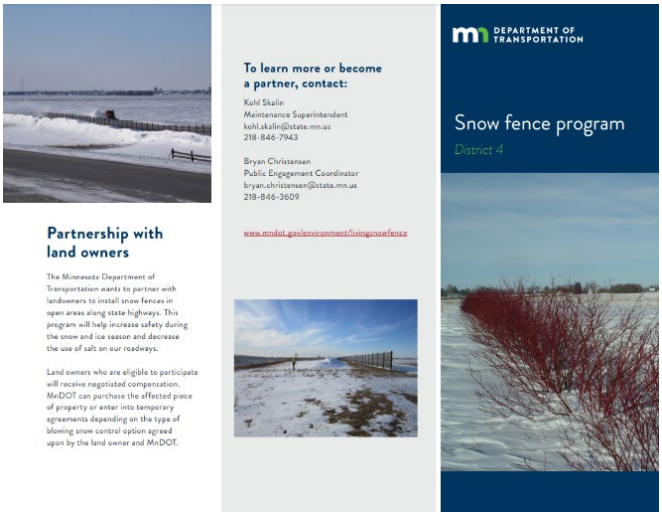
Structural snow fence instillation

Eight foot snow drift behind a structural snow fence.

CRITERION #4 PUBLIC ENGAGEMENT, PARTNERSHIPS, AND COLLABORATION

Since the establishment of MnDOT's snow fencing program in the early 2000s, MnDOT has completed ongoing and consistent engagement with the public about the benefits that snow fences provide. As a part of these efforts, MnDOT has worked directly with landowners and farmers to keep standing corn as a fencing technique. Throughout their work, standing corn rows have served as a gateway to installation of permanent fencing.

More generally, MnDOT, as an agency, is committed to completing thorough and effective public engagement for all projects, which is essential to the department's commitment to offering opportunities for meaningful input and to advance equity in transportation.



MnDOT employees are expected to operate in an inclusive and transparent manner throughout the planning, program development and project delivery process by keeping the public informed, listening to and acknowledging concerns and aspirations, and incorporating public feedback into decisions and outcomes. To guide public engagement and to provide a standard set of engagement expectations, MnDOT follows requirements as published in the department's Public Engagement Policy and Public Engagement Guidance Documents, and has issued MnDOT Policy #OE008 to serve as the foundation for the department's commitment to engagement activities.

As a part of all projects, MnDOT provides engagement opportunities and encourages the public to:

- **Engage early and often;**
- **Assist in identifying transportation challenges and solutions; and**
- **Participate in decision-making processes.**

MnDOT has consistently communicated the benefits and opportunities that snow bring to local communities and property owners. MnDOT District 4's Snow Fence Program webpage is a repository for information related to its snow fences program, including:

- Details about its partnerships with landowners;
- The monetary compensation it offers for those participating in the snow fence program;
- The beneficial impacts of snow fences on commerce and safety; and
- The locations of current and future snow fence projects.

MnDOT also has live cameras showing snow fence locations, has published a YouTube video showing the difference in driving conditions with and without snow fencing, and has posted time-lapse videos showing how snow fences function during the winter. In addition to directing interested members of the public to this website, MnDOT has also created a brochure which includes similar information and which has been handed out and mailed to property owners in the past. Beyond past engagement efforts, below are MnDOT's responses to questions from the NOFO about the agency's preliminary public engagement plan for the Project:

As a part of engagement efforts, MnDOT shared the *video above* illustrating the benefit of snow fences along I-94 and other state highways

Question #1: *How will public engagement be conducted demonstrating engagement of diverse input such as community-based organizations during project planning and how will this input be considered during the project decision-making process?*

A: MnDOT will work with local city governments and townships to communicate the proposed snow fence locations to the general public. This communication will take place via public meetings, flyers, mailings, social media posts and landowner meetings. Members of the public will be able to submit questions and comments on the project directly to MnDOT where they will be answered in a timely fashion.

Question #2: *Describe partnerships and collaboration with community stakeholders.*

A: For this project MnDOT officials will be contacting meetings with local property owners along the corridor. MnDOT will also work with some of these landowners regarding the potential planting of certain crops and vegetation to act as natural/living snow fences. These landowners will receive monetary compensation for catching snow and storing it on their property as well as compensation for any easements or right-of-way that will be necessary for the construction of the snow fences.

Question #3: *Describe partnerships and collaboration with other agencies (e.g., State, local, regional, Federal).*

A: MnDOT regularly works with local city governments and townships, as well as local soil and water conservation districts, on snow fence projects. For this project, MnDOT has had both informal conversations and well as official meetings with these agencies to discuss the proposed location of each snow fence as well as any location-specific challenges that may be present near the location, such as unstable soil, retention ponds/ditches that may be affected, and right-of-way needed. Additionally, MnDOT has collaborated with the Minnesota State Patrol, local sheriff offices, and other emergency response agencies in the development of this project. As the project progresses, MnDOT will continue to engage with these agencies to get feedback about the project as well as to update them on the project's progress. Many of these agencies, including the Minnesota State Patrol, Clay County Sheriff's Office, Otter Tail County Sheriff's Office, Wilkin County Sheriff's Office, Rothsay Fire and Rescue, and Sanford Ambulance and AirMed have submitted letters of support for the project.

This project also supports the Minnesota Toward Zero Deaths initiative, by drastically improving roadway safety during winter storm and blowing snow events.

Question #4: *Describe partnerships and collaboration across relevant sectors (e.g., emergency management, environmental, planning, floodplain management, health, housing and development, private sector).*

A: MnDOT has been in communication with the Minnesota State Patrol as well as District 4 snowplow operators and snow removal teams to collaborate on the selection of the locations for snow fences for this project. Interviews and reports with/from MnDOT snowplow operators were vital to the preliminary selection of locations for snow fences and crash data provided by the Minnesota State Patrol has been integral to confirming the selection of said locations. MnDOT plans to continue to interact with these groups going forward to update them on the construction of the snow fences and to receive feedback after construction is completed to assist in measuring the impact of the fences.

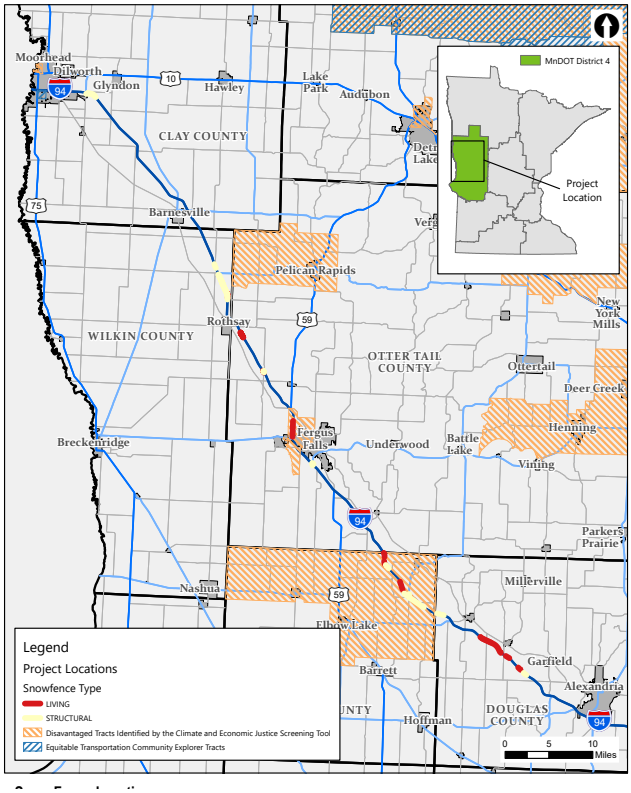
Question #5: *For (1) through (4) above, as applicable, describe the roles of these entities in the planning, design, construction, and operation of the project.*

A: Due to the nature and type of project being proposed, the beforementioned stakeholders will have little to no input on the design, construction, and operation of the snow fences but these stakeholders will be able to communicate with MnDOT regarding the locations of the fences and fence type selection (living vs. structural) for each fencing site.

CRITERION #5 EQUITY AND JUSTICE40

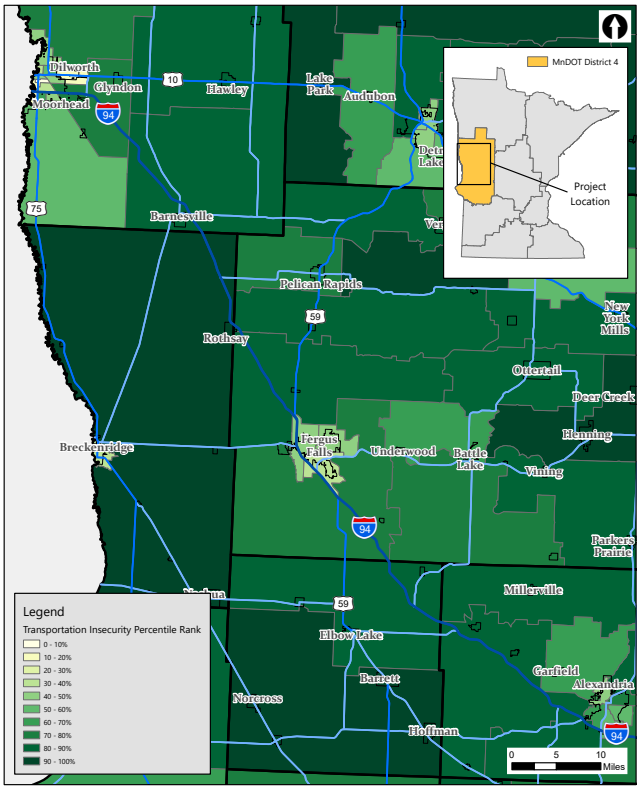
As discussed above, I-94 serves a wide range of the community and provides vital transportation options for communities along and outside the project area. The highway's reach as a transportation asset helps to ensure that a minimum of 40 percent of project benefits flow to underserved communities. Specifically, the targeted section of I-94 for this project runs through five counties. In total, there are eight snow fence sites that fall within census tracts identified by the Climate and Economic Justice Screening Tool (CEJST) as disadvantaged (see Figure 10). No sites fall within census tracts identified as being historically disadvantaged under the USDOT Transportation Disadvantaged Tract Tool, however, six of the 11 Census Tracts that touch I-94 between Moorhead and Alexandria, a transportation disadvantage indicator and four have a health disadvantage indicator.

Figure 10 CEJST and Transportation Disadvantaged Tracts



Additionally, under the USDOT Equitable Transportation Community Explorer, the project area, and its immediate proximity show very high levels of transportation insecurity, with most tracts falling into the 80th or higher percentile relative to the rest of the nation (see Figure 11). As will be explored in detail below, this project directly addresses transportation insecurity by improving the operation of I-94 during the worst winter weather events, allowing continued use for personal, transit, and emergency vehicles.

Figure 11 Transportation Insecurity from the Equitable Transportation Community Explorer



Tracts identified as being disadvantaged by CEJST are classified as such due to lack of green space, proximity to risk management plan facilities, share of adults whose high school education is less than a high school diploma, and the share of households where income is less than or equal to twice the federal poverty level. Due to the nature and location of the snow fence project, MnDOT assesses that there will be no adverse impacts to disadvantaged communities and that the resulting benefits of blowing snow protections along I-94 will allow these communities to continue to persevere and access high quality jobs and healthcare services. Project benefits will apply to the disadvantaged communities in the following ways:

1. **Reducing the impacts of emergency events** – As discussed above, there are numerous crashes on I-94 each winter. These crashes not only lead to fatalities and injuries, but also require the closure of lanes and sometimes the rerouting of traffic. These closures and detours can lead to disruptions in work commutes, the delay of emergency medical care, and increased emissions – all issues which can have disproportionate impacts on disadvantaged communities. By improving blowing snow protection along the interstate, MnDOT will be able to reduce the number of emergency events which can cause these adverse impacts and disruptions to everyday life. Further, this Project will improve the operation of the interstate during the winter months, which will help emergency response, increase safe and comfortable travel speeds and reduce the time when I-94 cannot be safely traversed, even during winter storm events.

2. **Improving access to critical community services** – As mentioned previously, I-94 is the main route that rural Minnesotans in this region use to access Sanford Medical Center in Fargo, ND – the only Level 1 Trauma Center in the region. It is also a vital lifeline to the larger cities of Alexandria, Fergus Falls, and Moorhead which are home to grocery stores, libraries, and other medical services not typically available in small towns in rural Minnesota.

3. **Connecting Minnesotans to good-paying jobs** – A key benefit provided by this project is maintaining a connection between Minnesotans and good-paying jobs. As is the case in many rural areas, many communities along I-94 depend on their access to larger urban areas for employment opportunities. I-94 is vital for those communities to maintain that connection. According to the Economic Development Region 4 report, published by the Minnesota Department of Employment and Economic Development (DEED), Black or African American and Hispanic or Latino groups had the highest participation rates in the region. Despite having higher labor force participation rates, every other racial group had lower income than white households. In particular, Black or African American households had the highest poverty rate among racial groups, at 48.4 percent, much higher than statewide average.

As explored previously, the I-94 corridor between Moorhead and Alexandria provides access to well-paying jobs and other economic opportunities. While closures, delays, and dangerous traveling conditions during wintertime impact all workers who use the interstate, based on the economic discrepancies explored above, the impact on disadvantaged groups is much more profound. By constructing snow fences across the corridor, MnDOT will be able to keep the interstate open and safe for all Minnesotans who rely on it for their livelihoods.

4. **Reducing current or potential burdens** – Unsafe driving conditions on I-94 in MnDOT District 4 can affect residents of all backgrounds. Closures of the interstate can limit access to jobs and healthcare as well as cut off families from each other during the busy winter holiday season. Snow fences along the targeted section of I-94 will limit the occurrences of these events and provide safer, more consistent driving conditions for all community members. They will also allow MnDOT to focus their resources on state highways off the interstate, providing safer driving conditions across the entire transportation system.

5. **Improving access to resources and quality of life** – The I-94 corridor provides rural Minnesotans and Minnesotans of diverse backgrounds access to urban resources such as libraries, trauma centers, medical services, including primary care, mental health, vision, and dental, grocery stores, places of worship, and retail/entertainment options. Many small and rural communities do not have these types of services available locally, so residents are forced to travel for access to everyday goods and services. For example, a Minnesotan with Somali heritage working at local manufacturing plant and living in Dalton, MN – a small town of 215 people with a gas station as the only place in town to acquire groceries and other items – is dependent on I-94 to access the following:

- The nearest Target: located in Alexandria about 39 miles (a 37-minute drive)
- The nearest movie theater: located in Fergus Falls about 16.5 miles (a 20-minute drive)
- The nearest library: located in Fergus Falls about 14 miles (a 16-minute drive)
- The nearest international airport: located in Fargo, ND about 76 miles (a 1 hour and 8-minute drive)
- The nearest mosque: located in St. Cloud about 108 miles (a 1 hour and 41-minute drive)

In total, it is expected that this project will result in travel time savings of $17.4 million throughout the life of the project. By

protecting the targeted sections of I-94 from the effects of blowing and drifting snow, MnDOT is able to protect access to these quality-of-life resources for all Minnesotans.

CRITERION #6 CLIMATE CHANGE AND SUSTAINABILITY

As is demonstrated by many studies, installation of snow fencing has significant benefits to maintenance costs and chloride application. This project will directly reduce the amount of blowing and drifting snow that is deposited on I-94. As a result, MnDOT will not only improve driving conditions, it will also be able to protect the environment from the harmful effects from increased usage of road salt and emissions from snowplows.

Protecting Minnesota's Drinking Water

According to the Environmental Protection Agency (EPA), road salt, otherwise known as Sodium Chloride, can contaminate drinking water, kill or endanger wildlife, increase soil erosion, and damage private and public property. The concentration of road salt can lead to a phenomenon called freshwater salinization syndrome (FSS). This phenomenon is due to the direct and indirect effects of salts that cause other pollutants in soil, groundwater, surface water, and water pipes to become more concentrated and mobile. Further, salts can increase the rate of metals mobilizing from soils and pipes and can cause radioactive materials such as radium in soils "to become more concentrated in groundwater and surface water."

Excess nutrients in the soil like nitrate-nitrogen can also be mobilized by high salinity, thereby exacerbating nutrient pollution, which contributes to harmful algal blooms and low dissolved oxygen levels in lakes and rivers. **When road salt seeps into the surrounding environment it can mix with heavy metals and other chemicals to create "chemical cocktails" which are mixtures of chemicals that "can have synergistic toxic effects that may be difficult to treat and remove."**

According to a study titled the Condition of Minnesota's Groundwater, 2007-2011, conducted by the Minnesota Pollution Control Agency (MPCA), chloride concentrations were found to have increased by about 100 mg/L in studied wells over the last 15-20 years. Two of the wells studied in rural, undeveloped areas showed contamination, which was attributed to the presence of de-icing chemicals that had seeped into the surrounding soil. Over 30 percent of the analyzed wells had significant increases in chloride concentrations and 11 of the 35 wells had a statistically significant upward trend in chloride concentrations. "If these trends continue, the water from more wells likely will have concentrations that exceed drinking water and water-quality standards in the future," the authors of the study write.

MnDOT estimates that the construction of snow fences along the I-94 corridor between Moorhead and Alexandria will contribute to the reduction of 10,755 tons of chloride leading to a societal benefit that will protect the health of Minnesotans and the wellbeing of the environment for years to come..

Reducing Harmful Emissions

Installation of snow fencing also provided beneficial benefits when it comes to air emissions. There are two primary ways that snow fencing can reduce carbon and other air toxics emissions:

1. Reducing carbon emissions from snow and ice removal; and
2. Providing carbon sequestration.

During the 2022-2023 winter season snow and removal services for MnDOT equated to 650,234 regular labor hours worked, an increase of 14.6 percent from the previous year. Overtime winter labor hours were estimated to be 203,268 hours (about 23 years) or 34.5 percent more than the amount of overtime labor hours worked in the previous winter. As snow events continue to increase in severity, more hours spent on snow removal efforts will be required. These increases in maintenance needs will result in an increase in amount of emissions released by MnDOT snowplows and snow removal crews. While MnDOT greenhouse gas

emissions from facilities decreased between 2005 and 2021, greenhouse gas emissions from fleet vehicles increased. In 2021, the most recent year for which there is data available, mobile combustion accounted for 40,239 of 63,017 of the agency's metric tons of carbon dioxide equivalent (mtCo2e) emissions released.

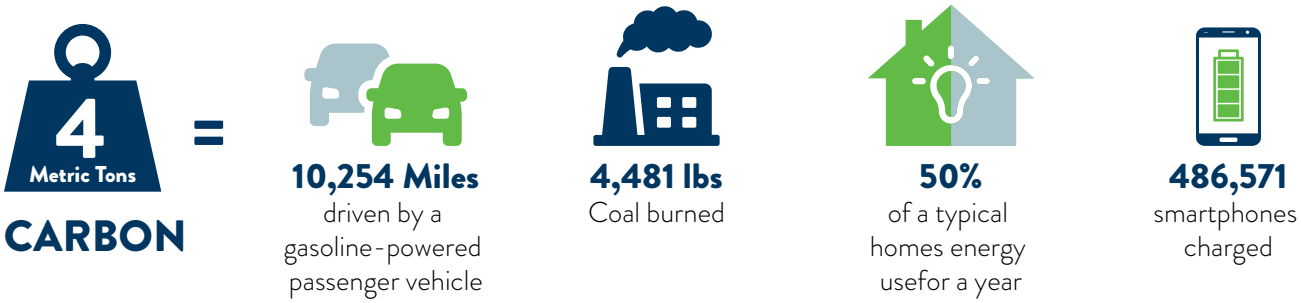
By completing this project along I-94, MnDOT estimates a reduction of 1,003,641 personnel hours (about 114 and a half years) and a carbon savings of 17,860 tons mtCo2e.

Beyond emissions reductions from maintenance needs, living snow fencing plays a role in carbon sequestration. According to research published by the MnDOT Office of Policy Analysis, Research and Innovation in a study titled "Economic and Environmental Costs and Benefits of Living Snow Fences: Safety, Mobility, and Transportation Authority Benefits, Farmer Costs, and Carbon Impacts ", living snow fences generally replace agricultural land. **The net carbon sequestration benefit from the change is four tons per acre (see Figure 12).**

CRITERION #7 SCHEDULE AND BUDGET

This project was initially initiated in 2011, and has steadily progressed since that point. These efforts began through a partnership with the West Ottertail Soil and Water Conservation District. Starting in 2018, MnDOT installed snow fencing along I-94 east of the City of Moorhead to test the effectiveness of both living and structural snow fencing. Since that time, MnDOT has sustained efforts to identify, develop, and implement additional snow fence projects across the west central portions of the state. In an effort to address snow traps at a corridor level, rather than on a site-by-site basis, MnDOT began developing this project.

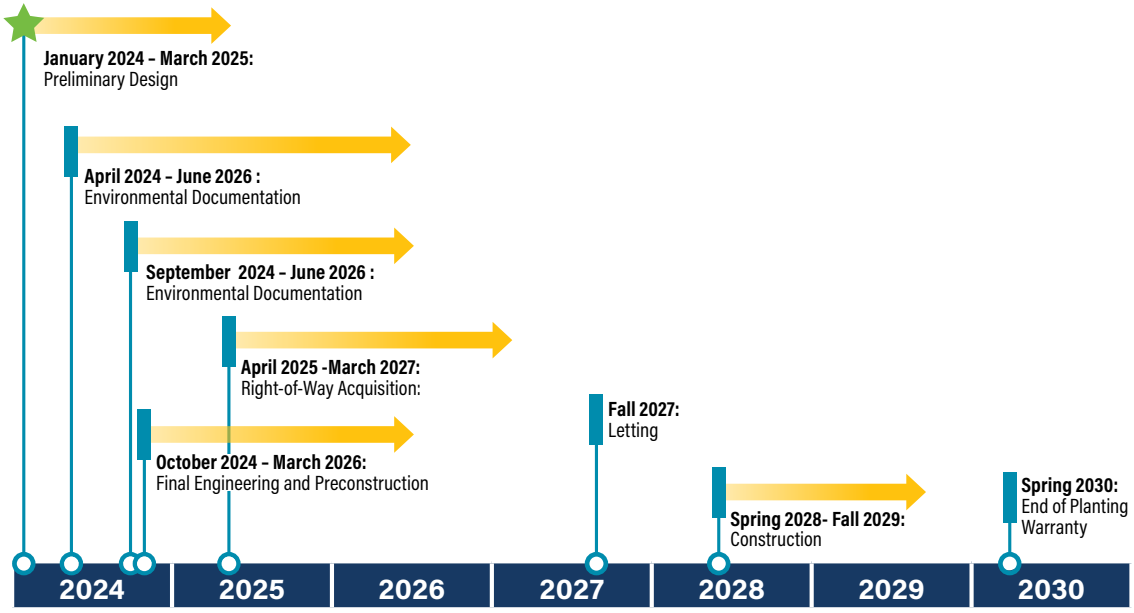
Figure 12 Living Snow Fence Carbon Sequestration



Schedule

MnDOT guarantees that all necessary activities will be completed to allow FY 2022 or FY 2023 PROTECT funds to be obligated sufficiently in advance of the statutory deadline (September 30, 2025 for FFY 2022 funds and September 30, 2026 for FFY 2023 funds). As can be seen in the schedule below (Figure 13), construction is anticipated to begin in Spring of 2028 and end in the Fall of 2029. With living snow fences, a mandatory warranty period will extend two years beyond planting, where watering, weeding, and other maintenance activities will take place.

Figure 13 Project Schedule



Project Budget

The primary purpose of this project is to improve the resilience of the transportation system. As such, the project is eligible to be fully funded (up to the 80 percent maximum federal share) through PROTECT dollars. Table 4 below, also included in the Project Budget section above, outlines the total project cost, including the amount requested from the PROTECT Discretionary Grant Program and all other funding sources and amounts. It is inflated to the year of construction (2028) and includes contingencies for potential overruns. The detailed total project cost estimate is available for review here.

Table 4 Project Budget

Project Component	Federal - PROTECT Funding		Non-Federal - State of Minnesota Funding		Total Project	
	Amount ($)	Percent of Total Eligible	Amount ($)	Percent of Total Eligible	Amount ($)	Percent of Total Eligible
Construction Let Amount	13,000,000	76%	-	0%	13,000,000	76%
CO/Overruns	736,000	4%	34,000	0%	770,000	4%
Preliminary Engineering	-	0%	900,000	5%	900,000	5%
Construction Engineering	-	0%	600,000	3%	600,000	3%
Right-of-Way	-	0%	1,900,000	11%	1,900,000	11%
Project Total	**13,736,000**	**80%**	**3,434,000**	**20%**	**17,170,000**	100%

MnDOT is requesting $13.736 million (80 percent of eligible project costs), to help deliver this important transportation resilience project. While MnDOT has committed time and funding to develop and grow its snow fencing program statewide, the program has primarily been held back due to lack of funding. While this initiative is important to MnDOT, the Department's primary role is to maintain the existing road system before investing in specialty projects. On a statewide basis, there are more forecasted roadway needs than funding available. The PROTECT program provides a unique opportunity for MnDOT to continue and expand investments into the snow fencing program by implementing this corridor wide project.

Another unique aspect of this project is that due to the separate nature of each of the 38 sites, the work can be scaled based on the availability of funding and other resources. MnDOT could seek additional funding and return later to complete the remaining portions of the corridor.

CRITERION #8 INNOVATION

This project incorporates an innovative approach to project delivery, uses nature-based solutions wherever feasible, and is the result of coordination and collaboration between MnDOT and a variety of agencies, including the Minnesota State Patrol, the USDA, local soil and water conservation districts, and local governments.

Corridor Wide Approach to Project Delivery

Historically, in Minnesota and around the country, snow traps are addressed through snow fencing on a site-by-site basis, typically as a part of other highway projects. This project is taking a different, more holistic approach, by addressing these issues at all of the worst locations across the corridor as a part of the same project. Once completed, this project will serve as a model for other key corridors in Minnesota (e.g. I-90 and I-35) and across the United States. Individual snow fence sites have seen significant benefits, of which will only be multiplied when the entire corridor is addressed. By addressing the worst 38 snow trap locations across the corridor, this project will provide consistent driving conditions between Moorhead and Alexandria, greatly improving highway operation, reducing maintenance costs, and improving safety.

Nature-Based Solutions

As has been discussed in detail above, snow fencing comes in two main forms, structural (man-made) and living. By using targeted planting of trees, shrubs, and other vegetation, living snow fences make use of natural solutions to achieve similar results to structural fences. While living fences are not the best approach for all locations, this project looks to incorporate them wherever feasible. In total, the project will construct living snow fences at 17 of the 38 sites (42 percent), which accounts for 12.9 of the total 23.5 miles (55 percent). For each of these sites, contractors will remain under contract for a warranty period of two years, where they will complete routine maintenance, such as watering, mowing, and weed control, to ensure successful plant growth.

Living snow fencing with berm with snow catch points.

Beyond blowing snow benefits, living snow fences provide other benefits, including, but not limited to, natural soil erosion control, creation of natural habitat for grassland nesting birds and pollinators, and reducing spring flooding by keeping soil sentiment out of ditches to maintain proper drainage.

In addition to the use of living snow fencing, this project also provides opportunities for MnDOT to restore portions of right-of-way, between fencing and the roadway, back to its natural state by introducing native plantings. Like living snow fences, native vegetation provides flooding, soil erosion control, and habitat benefits.

Purchase Land in Easement

Historically, MnDOT has worked with landowners, in partnership with the USDA, to create snow fencing outside

of the ROW, leaving the maintenance onus on the property owner. In most cases, these fences have come in the form of standing corn rows. While this has been a successful approach to introducing snow fencing as a beneficial improvement and provided short term benefits, the West Central Minnesota I-94 Blowing and Drifting Snow Control Project will result in permanent benefits throughout the I-94 corridor. By purchasing the necessary land in easements, MnDOT will take on the responsibility of ownership, upkeep, and maintenance of both the living and structural snow fences. This will help to ensure that all fences are maintained in good condition and guarantee that fence benefits extend into the future.

IV. ECONOMIC ANALYSIS

The benefit-cost analysis provides an indication of the economic desirability of a scenario, but results must be weighed by decision-makers along with the assessment of other effects and impacts. Projects are considered cost-effective if the benefit-cost ratio is greater than 1.0.

A summary of results of the benefit-cost analysis are included in Table 5 and the full BCA technical memorandum and workbook are available as an attachment to this application.

Table 5 Benefit-Cost Analysis

	Initial Capital Cost (2021 dollars)	Project Benefits (2021 dollars)	Benefit-Cost Ratio (7% Discount Rate)	Net Present Value (2021 dollars)
No Build vs. Build	$11.7 million	$36.5 million	3.13	$24.8 million

V. FHWA FY 2022 AND FY2023 PRIORITY CONSIDERATIONS

1. EXCEPTIONAL BENEFITS UNDER MERIT CRITERIA #5 EQUITY AND JUSTICE 40

As discussed in detail under Criterion #5 Equity and Justice40, this project serves a very wide range of the west central Minnesota population. According to the CEJST, eight of the proposed snow fence sites are located in areas that are identified as disadvantaged (see Figure 10). Additionally, the majority of the project area is experiencing very high levels of transportation disadvantage and transportation insecurity. In research published by the University of Michigan Poverty Solutions, they stated that "a lack of reliable transportation can exacerbate symptoms of poverty and in some cases even cause poverty by making it difficult to secure employment or access services." Exposure to severe winter weather conditions plays a role in that insecurity and can directly impact people's ability to move out of poverty.

Further, many of these transportation insecure communities are dependent on their ability to move around to access vital goods and services, including emergency medical care, everyday medical care, healthy food, pharmacy services, and recreation. In this part of Minnesota, these services are spread out, or located in one of the few urban areas. Additionally, access to good paying jobs typically requires traveling to one of the urban or metropolitan areas (Fargo-Moorhead, Alexandria, or Minneapolis-St. Paul). As has been shown, severe winter storms or blowing snow events make traveling even short distances difficult and dangerous. Snow fencing provides significant benefits, allowing continued interstate operation and allowing for safer travel conditions throughout the winter.

2. WORKFORCE DEVELOPMENT, JOB QUALITY, AND WEALTH CREATION

MnDOT has proactively developed a strong portfolio of Equity and Inclusion Programs in its appropriations process such as Disadvantaged Business Enterprise (DBE), Targeted Group Business (TGB), and its Equal Employment Opportunity (EEO) Program. MnDOT encourages and awards private business contracts to both minority-owned and women-owned businesses, and over the past five years, has awarded more than $173 million in prime contracts and goods purchases to under-utilized businesses, increasing from $19 million in FY16 to over $38 million FY20. The Department has two snow fence contractors on its approved/qualified products list who meet Build America, Buy America standards. One of these businesses is a woman-owned contractor.

Additionally, MnDOT is committed to Minnesota's affirmative action efforts and works to ensure that the agency is providing equal opportunity to all employees and applicants in accordance with state and federal affirmative action laws along with the agency's designated plan. Additionally, MnDOT provides reasonable accommodations to qualified individuals with disabilities when such accommodations are related to performing essential functions of the job, applying or competing for a job, or enjoying the benefits of and privileges of employment.

MnDOT's Office of Equity and Diversity also offers several Diversity, Equity, and Inclusion training programs to its employees. In accordance with 23 CFR Part 200.9(b)(11), MnDOT prepares a Title VI and Nondiscrimination Implementation Plan on an annual basis for the Federal Highway Administration and every three years for the Federal Transit Administration in accordance with FTA Circular 4702.1B. The Minnesota Human Rights Act also prohibits discrimination in the provision of public services on the basis of race, color, creed, religion, national origin, sex, marital status, disability, gender identity, sexual orientation, and status with regard to public assistance. Public services are defined to include any department or agency managed by the State of Minnesota.

Certain businesses contracting with the State of Minnesota, cities, counties, and the University of Minnesota are required to have a Workforce Certificate. Workforce Certificates require contractors to actively work to hire, train, promote, and retain people of color, Indigenous people, women, and/or people with disabilities to ensure that Minnesota's workforce reflects Minnesota's demographics. When agencies sign a contract with a contractor, under the Minnesota Human Rights

Act and Minnesota Administrative Rules 5000.3400 through 5000.3600 (Rules), the bid-award entities are required to:

- Provide each bidder and contractor with documentation describing the Minnesota Human Rights Act and Rules.
- Send a list of prospective bidders to the Minnesota Department of Human Rights (MDHR) before a bid opens.
- Include in each contract the affirmative action clause stating the intention of the bid-award entity to carry out its responsibility for requiring affirmative action by its contractors and the consequences for failure to implement affirmative action.
- Include in each contract the contractor's obligations under the Minnesota Human Rights Act and Minnesota Administrative Rules.
- Provide information to MDHR with information or assistance deemed necessary to seek compliance with the Minnesota Human Rights Act and Minnesota Administrative Rules.
- Provide information to MDHR indicating that a business or firm is not in compliance with the Minnesota Human Rights Act and Minnesota Administrative Rules.
- Cooperate with the Commissioner of the MDHR in implementing the Minnesota Human Rights Ace and Minnesota Administrative Rules.

MDHR maintains a list of contractors that have current Workforce Certificates and Equal Pay Certificates, and contractors that have had their certificate expired, surrendered, suspended, or revoked. MDHR also posts workforce participation rates on large state construction projects on a regular basis because of the impact these projects have on employment opportunities in Minnesota for people of color, Indigenous people, and/or women.

3. CONSTRUCTION READINESS

MnDOT is prepared to deliver the project in accordance with the project schedule and the department assesses minimal project delivery risks for the following reasons:

- MnDOT is substantially through the Project's preliminary engineering phase. Design work done to-date lowers uncertainty around scope, impact, and cost. MnDOT anticipates having preliminary engineering completed Spring of 2025, which allows the environmental and right-of-way acquisition processes to be completed prior to a Fall letting in 2027. This project requires substantial right-of-way acquisitions, however, due to the segmented nature of the project, project delivery will not be delayed by the acquisition process.
- Project limits are established. The Project's footprint is substantially within state ROW, landowner engagement and discussions have already begun, and negotiations with impacted landowners will begin soon.
- The Project is noncontroversial and is supported by Project partners. MnDOT has maintained ongoing coordination with federal, state, and local agencies such as the FHWA, the Minnesota State Patrol, the City of Alexandria, the City of Moorhead, and the City of Fergus Falls, and other project partners. The public has seen the benefit from the recently installed snow fences in the area and understand the value they bring in improving winter driving conditions. As such, the public has been pushing MnDOT to continue the work throughout the entire corridor.
- MnDOT has secured funding sufficient to cover 20 percent of project costs. The Minnesota Legislature passed a bill in 2023 to provide $216 million from the state's General Fund to match federal funding associated with both competitive and formula grant opportunities available through the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA).

4. FUNDING NEEDS

As discussed above, the MnDOT snow fences program has made significant progress over the last 20 plus years. The primary item that has held the program back is a lack of funding. While snow fencing continues to be a priority for MnDOT, often times the need for funding to maintain the system outweighs specialty projects, such as this one. As good stewards of the statewide transportation system, MnDOT first focuses on maintaining existing assets in good condition. However, there are consistently more forecasted needs statewide than there is funding available, so money is directed towards maintaining the existing system.

The PROTECT Program provides a unique opportunity for MnDOT to push forward this innovative approach to addressing snow traps at a corridor level rather than site-by-site. Without this award, MnDOT will be unable to move forward with this project and will have to continue to install snow fencing one at a time.

VI. SUPPORTING DOCUMENTATION

All supporting documents and the PROTECT grant application narrative are also available to view at the following webpage:

https://www.srfconsulting.com/mndot-i-94-snow-control/