Advancing Technology

DEPARTMENT OF TRANSPORTATION

MnDOT estimates $30-33 billion in available funding for the state highway system over the next 20 years. A minimum of $23.5 billion is needed to manage highest risks and meet legal requirements. This folio provides information on potential Advancing Technology investment strategies, funding levels, and outcomes for the estimated $7-9 billion of remaining investment.

1 | WHAT IS ADVANCING TECHNOLOGY?

Technology has radically transformed transportation behaviors over the past 200 years. The advent of the motor vehicle further transformed transportation and has shaped the American landscape radically to the one we live in today. Transportation is on the verge of a new transformation with the advent of connected and autonomous vehicles, but to best implement this new transformative technology, further investments are needed.

Advancing technology investments are focused on improving MnDOT's intelligent transportation system (ITS) infrastructure and Transportation System Management Operations (TSMO) which would prepare the state highway system for the widespread use and adoption of connected and autonomous vehicles. The Advancing Technology investment category will ensure MnDOT remains an innovative leader in transportation and the state of Minnesota is able to effectively harness and benefit from exciting new technological advances in transportation.

GOAL AND OBJECTIVES OF INVESTMENT

The goal of the Advancing Technology investment category is to strategically build out roadway technology to improve reliability, safety and support tomorrow's transportation system by being responsive to transformative technologies and building for tomorrow, today.

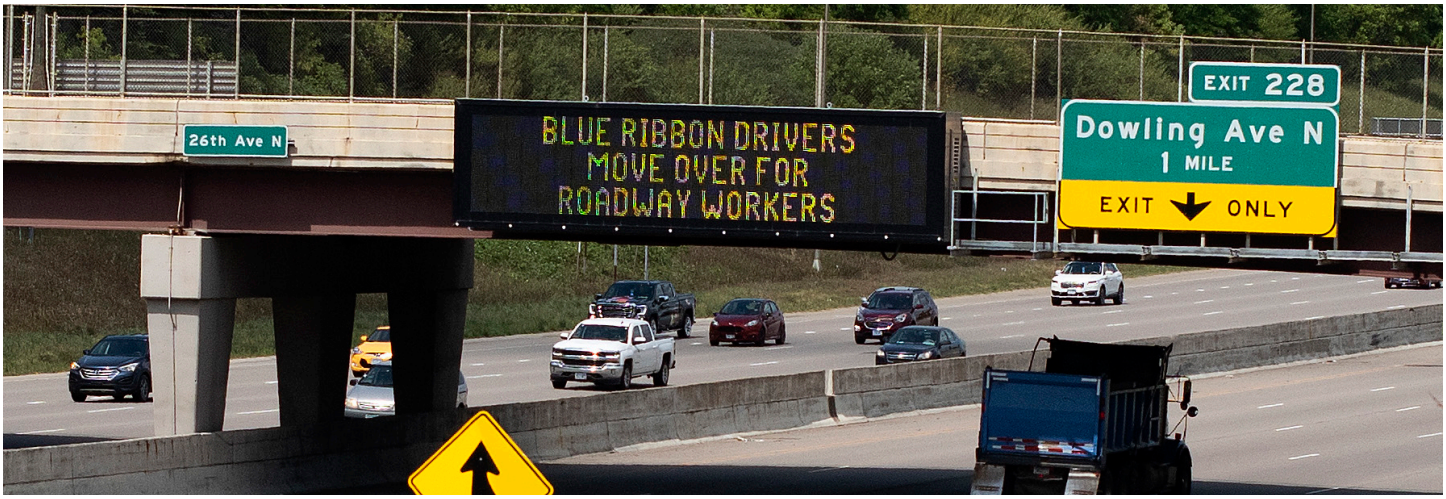
The objectives of the Advancing Technology investment category is to implement existing technology focused plans like the TSMO Business Plan, Statewide ITS Plan and the CAV Strategic plan, and prepare MnDOT to better understand the future needs of the transportation system.

TYPES OF IMPROVEMENTS

The Advancing Technology investment category focuses on enhancing Minnesota's transportation system by expanding the fiber network in MnDOT rights-of-way and ensuring the state's ITS infrastructure is maintained and expanded to ensure that the state is ready for transformative technology advancements in connected and autonomous vehicles.

HOW DOES MNDOT CURRENTLY SELECT ADVANCING TECHNOLOGY IMPROVEMENTS?

Current technology focused investments are primarily made through the ITS solicitation process, which funds projects in MnDOT's eight districts to maintain and improve ITS infrastructure on MnDOT state highways. MnDOT also utilizes funding from the CAV-X office to plan for and implement strategies and capital investments to prepare Minnesota's roadways for the widespread adoption of connected and autonomous vehicle technology.



2 | WHY IS INVESTING IN ADVANCING TECHNOLOGY IMPORTANT?

Advancing Technology investments directly support meeting the state transportation goal to "promote accountability through systematic management of the system performance and productivity through the utilization of technological advancements."

The Advancing Technology investment category was created to react directly to emerging trends occurring in the transportation and employment sectors which have the potential to change commuting and working patterns substantially. These trends include the adoption of connected and autonomous vehicles and the growth of work from home and online commerce. Both of these trends require enhanced fiber networks, especially in rural areas. Without investment in this category, Minnesota runs the risk of falling behind other parts of the country and becoming less economically competitive.

HOW DOES ADVANCING TECHNOLOGY SUPPORT EQUITABLE OUTCOMES?

As technology has progressed rapidly over the past 20 years, one of the benefits of that progression has been a general increase in the wealth of many Americans, whether they were early adopters to the tech boom or newly trained workers in the growing industry. These and other benefits of technology gains have not been accessible to all Americans equitably. This technological divide is one of geography as rural areas fall behind the metro regions, but also one felt in urban areas as well. By making more investments in technology on MnDOT right-of-way, including installing fiber and preparing our highways for connected and autonomous vehicles, MnDOT can help to bridge that technological divide, helping rural areas compete in a more technology rich economy. These investments also help to foster a safer transportation system, which would benefit lower income urban areas that experience higher rates of injuries and fatalities from traffic crashes.

HOW DOES MNDOT MEASURE PERFORMANCE, CONDITION, OR OUTCOMES?

MnDOT currently measures technology performance through the Statewide ITS Plan. The ITS Plan contains 12 performance measures spread over 6 categories - safety, mobility, fiscal responsibility and sustainability, operations and maintenance, asset management, and consistency. Additionally, the CAV-X office is currently developing performance measures centered upon connected and autonomous vehicle technology implementation.

Performance outcomes for advancing technology investments will focus on the number of projects MnDOT completes or infrastructure installed for each investment strategy.

3 | OPTIONS FOR INVESTING OVER THE NEXT 20 YEARS

Expand State Owned Fiber Network

The **minimum level** MnDOT would invest in expanding the state owned fiber network is **$0**. Fiber projects are typically done as part of other projects and no separate funding for fiber projects currently exists. This would result in limited to no expansion of the fiber network and less than 10% of vehicle miles traveled (VMT) covered by the fiber network.

LEVEL 1

Outcomes:
700 miles of new fiber installed
Less than 10% of VMT covered by fiber

LEVEL 2

Outcomes:
1,250 miles of new fiber installed
11% of VMT covered by fiber

$X.X Total cost of investment level

Portion of remaining $7-9 billion investment for level

Remaining investment available for other priorities

ITS Asset Expansion

The **minimum level** MnDOT would invest in expanding and upgrading ITS infrastructure is **$21 million**. Funding for the ITS solicitation would end after the STIP but approximately $1 million per year would be included with other projects. These investments would be focused on maintenance of the current system with limited traffic management system and TSMO improvements.

LEVEL 1

Outcomes:
Targeted improvements to the highest priority corridors for ITS, limited TMS and TSMO improvements across existing system

LEVEL 2

Outcomes:
200 to 250 miles of ITS corridor expansion

CAV Ready Investments

The **minimum level** MnDOT would invest in upgrading infrastructure and assets to be prepared for CAV adoption is **$4 million**. This would result in ending dedicated funding for CAV projects after the STIP.

LEVEL 1

Outcomes:
Limited amount of traffic signals upgraded. CAV investments only on highest priority corridors. CAV-X office funding lasts for 10 years.

LEVEL 2

Outcomes:
Limited amount of traffic signals upgraded. CAV investments only on highest priority corridors. CAV-X office funding lasts for 20 years.

LEVEL 3

Outcomes:
Upgrade traffic signals in Greater MN and support CAV for freight and transit. Improved pavement markings for CAV. Pilot 1-2 projects a year with work zone technology.

LEVEL 4

Outcomes:
Upgrade traffic signals, improve bike/ped awareness and support CAV for freight and transit. Improved pavement markings for CAV. Pilot 3-4 projects a year with work zone technology.

4 | ADVANCING TECHNOLOGY RISKS

WHAT ARE THE RISKS OF UNDERINVESTING?

As a part of developing performance levels for various programs and strategies, MnDOT also identified the risk to underinvesting in rest areas. Four risks were identified as low to high risk. The risks and their impacts are identified below.

MEDIUM RISKS

Risk: Inability to keep pace with shifts in technology
Impact: ITS and other technology assets could become obsolete before anticipated life-cycles which could negatively impact safety

Risk: Inadequate funding for maintaining technology assets
Impact: ITS and other technology assets could experience higher life-cycle costs, faster deterioration, and become unresponsive in winter weather which could negatively impact safety

Risk: Limited implementation and piloting of CAV technology
Impact: Minnesota could be at a disadvantage to other states as CAV technology becomes more widespread, and limits the state's ability to mitigate environmental pollution, advance traffic safety, and distribute technology more equitably

Risk: Lack of investments in technology on state highway system
Impact: Fatal and serious injury crashes could increase without additional technology investments

LOW RISKS

Risk: Lack of available funding leading to unequal technology investment across the state
Impact: Unequal access to technology investments could exacerbate inequitable transportation outcomes and increase the digital divide

WHAT LEVELS OF INVESTMENT REDUCES THE RISKS' SEVERITY?

The table below provides a summary of how risk levels changed with increased investment in Advancing Technology.

Risk Statement	Shift from Medium to low risk
Inability to keep pace with shifts in technology	Investment level 2
Inadequate funding for maintaining technology assets	Investment level 2
Limited implementation and piloting of CAV technology	Investment level 2
Lack of investments in technology on state highway system	Investment level 2
Lack of available funding leading to unequal technology investment across the state	Already low risk

To find out more details about Advancing Technology planning and projects, go to:
www.dot.state.mn.us/automated/
Project Selection:
www.dot.state.mn.us/projectselection/

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