

# MINNESOTA GOVERNOR'S ADVISORY COUNCIL ON CONNECTED & AUTOMATED VEHICLES

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## ANNUAL REPORT

March 2022



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This report was prepared by the Minnesota Department of Transportation's Office of Connected and Automated Vehicles (CAV-X), with acknowledgment to the Advisory Council on Connected and Automated Vehicles, CAV Innovation Alliance, and Interagency CAV Team members with special thanks to the CAV partners and stakeholders.

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# A NOTE FROM OUR CHAIRS

In 2021, the State of Minnesota continued its work to advance and prepare for Connected and Automated Vehicles (CAV) to become more available as a transportation option in our state – including demonstration and research projects, policy discussions, infrastructure investments, and guidance documents. In 2021, the council also focused on data privacy and ensuring appropriate data is shared and protected. Members also developed CAV Guiding Principles to align the state in creating a safe, equitable, and sustainable transportation system. Finally, we explored long-term transportation planning and infrastructure investments and mapped out how to effectively share CAV information with the public, stakeholders, and other audiences throughout the state.

A highlight was the September launch of the state’s first automated pilot project in Rochester. Two low-speed, driverless, electric, multi-passenger shuttles called “Med City Mover” are offering free rides in downtown Rochester and will operate through August 2022. This project provides valuable data on automated shuttles and how they operate on regular roads, during the challenges of Minnesota winter. We are also engaging directly with the community to gain insight on the user experience. These data will help inform our work in the future. And the future is bright, with many more projects planned in 2022.

Whether it’s improved access to transportation, improving the economy, or creating jobs, the work of CAV will have a lasting impact on the state. We plan to expand our work in the coming months to introduce CAV technology to different audiences including transportation professionals, elected officials, the public, and traditionally underserved communities and populations.

This annual report is intended to inform the Governor and the Minnesota Legislature of the work of the Governor’s Advisory Council in 2021.

**Margaret Anderson Kelliher and Phil Magney**

*Chair and Co-chair of the Governor’s Council on Connected and Automated Vehicles*

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# 1. COUNCIL'S VISION AND GOALS

## Background

Executive Order 19-18 established the Governor's Advisory Council in 2018, to understand how emerging technologies will impact Minnesota's transportation system and how to use CAV technologies to advance safer, more equitable, accessible, and sustainable transportation.

The 15-member Council represents various sectors, including freight, transit, mobility, accessibility, research, business, industry, tech start-ups, labor, local government, cybersecurity, and insurance. State agencies, tribal governments, counties, and cities are also represented. The Council is tasked with:

- Reviewing developments in CAV and emerging technologies
- Exploring partnership opportunities for the State to be prepared for the widespread adoption of new technologies
- Proposing policies to safely test and deploy CAVs
- Implementing recommendations from the 2018 Council
- Preparing an annual report to the Governor
- Engaging communities experiencing transportation barriers
- Advising the departments of Transportation and Public Safety on the safe testing and deployment of CAV

## Vision, Mission and Values

The Council's vision is to build a future transportation system that is safe, equitable, accessible, efficient, healthy and sustainable.

The Council's mission is to collaborate with stakeholders, partner with academic institutions and private industry, and engage communities to prepare for a future with emerging transportation technologies.

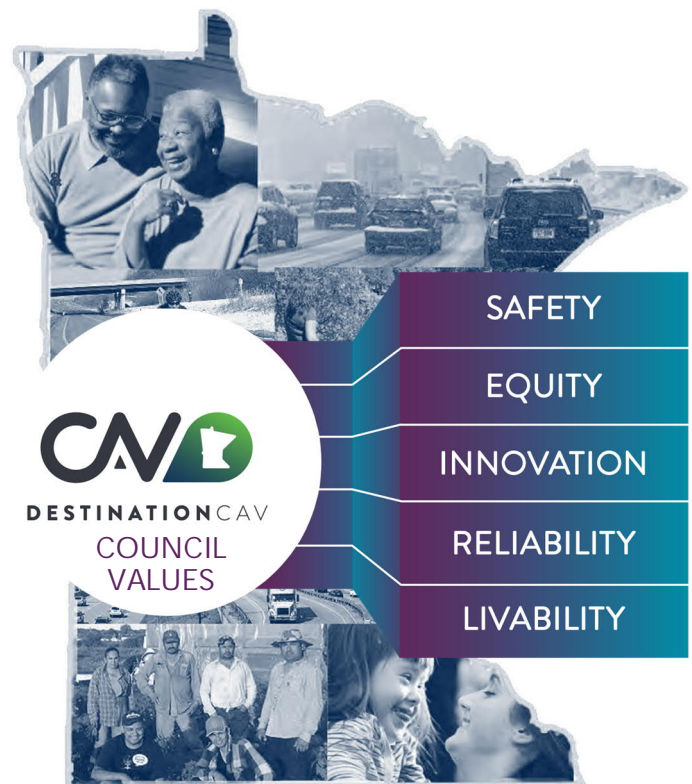


Figure 1: The council's values: safety, equity, innovation, reliability and livability

## Minnesota's CAV Goals



**Equity, Mobility and Accessibility**  
CAVs may reduce transportation barriers for people with disabilities, aging communities, low-income families, and could provide better access to jobs, health care, and other transportation modes.



**Economic Development and Small Business**  
Advancing CAV policy could grow Minnesota businesses, attract new ones, and expand opportunity for small businesses.



**Jobs and Workforce Development**  
CAVs present opportunities to reskill and upskill workers, attract new talent to the STEM field, and develop jobs of the future while protecting the jobs of today.



**Public Health and Sustainability**  
CAVs could help rethink the way we plan communities to maximize health and sustainable multimodal transportation. Since many CAVs are electric, they could reduce emissions to advance sustainability goals.



**Safety and Efficiency**  
Technology can eliminate some aspects of human error that contribute to the nearly 500 lives that were lost on Minnesota highways in 2021. CAVs could also reduce crashes and congestion.

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## Council Priorities and Strategies

The Council developed 10 priorities to accomplish by 2024.

1. Increase equity, mobility, accessibility, public health and environmental sustainability
2. Continue to advance industry and research partnerships
3. Conduct education, outreach, engagement, demonstrations, and pilots
4. Invest in infrastructure
5. Assess and recommend policies and laws for safe testing and deployment
6. Grow economic and workforce development
7. Address data privacy and cyber security
8. Review insurance and liability standards
9. Coordinate with regional and federal government partners
10. Conduct human factors research on the impacts of CAV on users





## 2. COUNCIL'S 2021 WORK

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### 2021 Council Meetings

The Council met five times in 2021, meeting the requirement of at least four meetings.

#### January Meeting

The Council focused discussions on CAV data opportunities and challenges. Being there are no formal national cyber security standards for ITS or CAV, the responsibility of protecting data and privacy is placed on auto manufactures. Agencies can best secure transportation data by locking traffic signal cabinets, addressing more of the physical risk that could result in a cyber risk. The Connectivity and Data Committee presented Minnesota's CAV Data Privacy Principles to the Council and received support.

#### April Meeting

The convening of the Council focused on national CAV policy priorities by hearing from a number of industry partners. Industry partner recommendations included creating a new vehicle class for automated vehicles, coordinating state policies and traffic laws across boundaries, and promoting industry standards, educating the public about CAV technology, focusing on policy principles.

#### July Meeting

The Council reviewed and adopted the Minnesota CAV Guiding Policy Principles that were developed by

the Interagency CAV Team. The principles provide guidance on CAV policy, programs, and investments by asking the questions we want to address as a state. Upon the Council's adoption of the principles, they recommended that the Governor have all state and public agencies adopt and follow them.

#### September Meeting

The Council met to hear from an industry partner about designing the physical, digital, and operational infrastructure to accelerate CAV's presence on roadways. The vision presented created a safer, less congested, shared and sustainable roadway system by dedicating funding to support CAV infrastructure on specific corridors. The presentation generated good discussion about what Minnesota's future transportation system could look like.

#### December Meeting

The Council rounded out the year discussing CAV in long-range planning, as well as CAV messaging and engagement accomplishments for 2021 and plans for 2022. Minnesota conducted a state of the practice review to see how other states are including CAV in planning and found that Minnesota is one of the few to conduct scenario planning, most only include planning at a very high level, and no states have established CAV performance measures. Minnesota is working to develop CAV performance measures that align with CAV and Department goals. Minnesota's CAV messaging work in 2021 focused on

understanding people's perspective on CAV in Minnesota. People have positive feelings about CAV but not everyone is familiar with the terminology being used. The Education and Outreach Committee shared messaging guidance, programmatic strategic engagement recommendations, and case study examples of how CAV messaging can be coordinated in the state moving forward. The Committee also shared demonstration plans for 2022 that focus on specific audiences identified as priority by the Council, as well as plans of hosting a CAV Conference and Technology Showcase to highlight Minnesota's strong work in the industry. The Council shared support for the messaging and engagement work and look forward to helping implement recommendations in 2022.

## Implementing Advisory Council Recommendation Themes

In 2018, the Governor's Advisory Council on CAV collaborated with various transportation stakeholders to develop the council's key themes, as well as recommendations for the 2018 council to act on. Subsequent councils are required to review the 2018 recommendations and take actions to implement where appropriate.

### Modernize Policy

Most policies and laws in Minnesota and around the country do not address automated or connected vehicle technology and changes need to be made to appropriately reflect these changing technologies.

### Minnesota Platooning Law

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In 2019, the Minnesota Legislature authorized truck platooning by permit, requiring commercial vehicles to submit a plan to the departments of Public Safety and Transportation. In 2021, Minnesota received its first truck platooning permit application to use the connected vehicle technology on Minnesota roadways in summer 2022. MnDOT is working closely with the permit applicants to address all aspects of the law and ensure safe operations when deploying the technology next summer.

### Minnesota Personal Delivery Device Bill

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In the 2021 legislative session, a draft personal delivery device bill was introduced by Representative Steve Elkins. MnDOT's CAV-X staff met with representatives from other states with similar legislation to learn best practices and identify areas of opportunity and concern. It was immediately apparent that the local impact would be significant, if passed. In coordination with county and city engineers across the state, MnDOT established a working group and published a personal delivery device white paper to prepare for future legislation and ensure communities needs are heard and addressed.

### Equity

Minnesota has made its mark nationally by emphasizing the importance of ensuring that as transportation technologies advance, they must prioritize accessibility, equity, environmental sustainability, and public health. If we fail to act and proactively prepare for changes, technologies may only be beneficial for a select few, or we may increase existing or create new disparities for our communities.

### Minnesota CAV Guiding Principles

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In order to help stakeholders ask the right questions when developing CAV policy, programs, and projects, the Council adopted nine CAV guiding principles, as recommended by the Interagency CAV Team, that align with the Council's overall vision, mission, and goals. The principles include the following: Safety is Paramount, Advance Transportation Equity, Promote Public Health and Sustainability, Prioritize Shared Mobility and Accessibility, Innovation is Key, Agile Transportation Investment, Create People-Focused Policy, Increase Economic Prosperity & Quality of Life, and Develop System Resiliency through Data Access and Security.

Each of the principles has a general policy statement and is followed by key questions for policy makers, government, industry, and community to consider when developing new CAV programs, policies, or projects. Safety, equity, and innovation are reflected throughout each of the principles as programmatic and policy priorities. When the state, local partners, and other stakeholders commit to these principles, we believe we can advance a transportation system that is safe, equitable, accessible, efficient, healthy, and sustainable.



## Proactive Leadership and Public Engagement

Minnesota is active in regional and national discussions on how to best proactively prepare for the future of CAV.

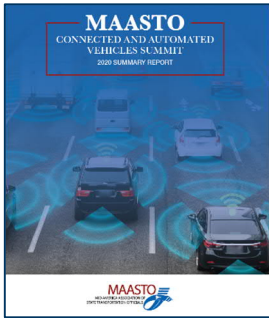


Figure 2: MAASTO Connected and Automated Vehicle Summit, 2020 Summary Report

### MAASTO CAV Committee

The Mid-America State Transportation Officials started to work on the 10 strategies identified as priorities for the committee to collaborate on and advance CAV planning and preparedness. In 2021, Minnesota was the lead for a number of the priorities including Equity, Access, and Engagement, DOT

Organization Readiness, Automated Vehicle Legislation and Engaging Policy Makers, AV Freight and Platooning, Research, Planning and Forecasting, and Local and Tribal Coordination. Minnesota is leading a number of the strategies for the region bringing in experts from MnDOT's CAV-X Office, Office of Freight and Commercial Vehicles, and Office of Transportation System Management focused on planning. Minnesota is leading the equity, access, and engagement strategy by sharing work related to strategic programmatic recommendations for engagement and the CAV messaging recommendations. Minnesota is leading the research strategy and establishing a baseline of what research is done throughout the region to identify gaps and opportunities to collaborate across state borders. Minnesota is also active on and leading other strategies and continues to be looked at as a CAV leader in the region.

### AASHTO CAV Policy Principles

The American Association of State Highway and Transportation Officials (AASHTO) developed CAV Policy Principles to articulate their position on and priorities for national CAV policy following experiences by states like Minnesota creating their own. Principles focus on the need for a national strategy, safety, sustainability, technology in the future, investments, equity, access, and quality of life, roles of state and federal government, unified national policy, federal leadership, and data sharing.

These principles will help guide the country in deploying connected and automated technology that improves safety, equity, and mobility by creating an interoperable and reliable transportation system.

### Public Education and Outreach

Building off of Minnesota's statewide CAV survey in 2020, we continued to solicit feedback from people in Minnesota on how to shape future projects and ensure we focus on all people's needs through additional surveys, community events, and demonstration projects.

### Public Demonstrations

With the launch of the Med City Mover, the state has engaged riders pre- and post-ride to better understand their familiarity, comfortability, excitement, and concerns about CAV technology. About 75% of respondents identify as not being familiar or knowing a little about CAV which supports the need to continue to reach people throughout the state with different technology demonstrations. Respondents tend to be excited about the technology but also have some concerns and see an opportunity for technology to improve our transportation system in a variety of ways.



Figure 3: Med City Mover shuttle at the Minnesota State Fair in St. Paul, MN

The Minnesota State Fair returned this year and the Med City Mover shuttle was brought to Saint Paul, MN for a static demonstration for attendees to see a vehicle for themselves. Fair attendees talked to CAV-X staff to learn about the demonstration project in Rochester but also about what the state is currently doing to prepare for CAV. Attendees at the fair also

were able to complete a survey and results were similar to those who have ridden the shuttle.

## Funding and Revenue

To date, Minnesota's CAV program and projects have been entirely state funded. With recently passed federal legislation, there are opportunities for our state to capitalize on new programs to extend the work we are already doing.

### Federal Infrastructure Investment and Jobs Act and Build Back Better Bill

In November 2021, President Biden signed the \$1.2 trillion Infrastructure Investment and Jobs Act into law, which reauthorizes legislation and creates new programs for transportation, water, broadband, and many other areas.

The legislation includes opportunities to deploy intelligent transportation technologies through several programs. Additionally, it establishes a U.S. Department of Transportation pilot program to conduct emerging technology research and has dedicated funding to study the impacts on roads from self-driving vehicles to identify potential policy change areas. Other new programs will be established that will focus on energy and carbon reduction, enhanced safety for cyclists, pedestrians, and other vulnerable road users, and workforce development which have CAV-related aspects and alignment.

There will be dedicated funding for new demonstration opportunities, CAV testing and research, broadband funding, education development to properly use vehicle technology, to increase awareness of career opportunities in CAV, and many other.

## Partnerships

Partnerships are key to Minnesota's success and continue to be a focus for the state. Collaboration continues to occur at varying levels of government, with academic partners, and private industry to share and learn from one another.

## Interagency CAV Team (I-CAV)



Figure 4: The I-CAV Team made of numerous public and research institutions

As required by Executive Order 19-18, the Interagency CAV (I-CAV) team represents Minnesota's public agencies and research institutions to help governments in Minnesota prepare for CAV. They ensure there is interagency coordination and collaboration to develop cross-agency policies and programs to advance CAV for the state. Representatives from state agencies, the University of Minnesota, Minnesota State Colleges and Universities, Met Council, the Federal Highway Administration and others collaborate and develop cross-agency policies and support the Advisory Council. I-CAV's mission is to advance CAV education and outreach, research, automated vehicle policy and standards for infrastructure and data.

In 2021, I-CAV helped develop the Minnesota CAV Guiding Principles to help ensure that CAV policies, programs, and projects help build a future transportation system that is safe, equitable, accessible, efficient, healthy and sustainable.

With the formation of the Innovation Alliance in 2020, I-CAV refocused the group's work on information sharing and addressing risks and opportunities related to CAV within Minnesota.

## Counties

The Minnesota County Engineers Association CAV Committee meets quarterly throughout the year with MnDOT's CAV-X Office. The CAV Committee is made up of county engineers from around the state, CAV-X staff, and MnDOT's State Aid for Local Transportation Office.

In 2021, the MCEA CAV Committee provided input on the Minnesota CAV Guiding Principles, discussed infrastructure investments that benefit human drivers as well as automated systems, and drafted preferences for future personal delivery device legislation.

The MCEA CAV Committee presented at the Annual Minnesota Counties Meeting to an audience of County Commissioners and invited CAV-X to share what Minnesota is doing to prepare for CAV, what local agencies are doing, and how we are and can continue to work together. The CAV Committee highlighted work from the Local Road Research Board project, "Preparing Local Agencies for the Future of CAV".



*Figure 5: Local Road Research Board's project "Preparing Local Agencies for the Future of CAV"*

Minnesota County Engineers participate on Innovation Alliance Committees, including Tracey VonBargen of Grant County on the Safety Committee and Mark Krebsbach of Dakota County and Wayne Sandberg of Washing County, both on the Outreach and Education Committee.

## Cities

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The League of Minnesota Cities includes representation from local elected officials and League staff on the Governor's Advisory Council and is involved with the Minnesota CAV Innovation Alliance on a number of committees to assist in moving forward CAV goals. Former Mayor Jason Gadd of Hopkins and Mel Reeder of the League of Minnesota Cities participate in the Connectivity and Data Committee, which is key to involving local city perspective as the state examines the impact of potential data collection and accompanying public policies. Councilmember Tina Folch of Hastings sits on the Outreach and Education Committee to ensure communities are engaged, and to help identify key messaging and information-sharing opportunities. Representatives from the city of Richfield and city of Apple Valley both sit on the Safety Committee to ensure all agency perspectives are represented and heard.



*Figure 6: Med City Mover and Shuttle Demonstration in Rochester, MN*

The city of Rochester is hosting the Med City Mover automated shuttles in their downtown area around the Mayo Clinic. Significant coordination has occurred around planning, installing, and maintaining signal infrastructure needed for the project, construction impacts, and coordination with local stakeholders. The city of Minneapolis has met with MnDOT to discuss curb space delineation and digitization, shared mobility, and personal delivery device impacts. They also worked with the Open Mobility Foundation to lead the development of a Curb Data Specification to standardize how cities communicate curbside uses to CAVs. The city of White Bear Lake hosted Minnesota's first CAV Career Pathways Camp that introduced students to a variety of career opportunities in the transportation technology industry.

The City Engineers Association of Minnesota invited the CAV-X Office to speak 2022 Annual Meeting of the City Engineers Association of Minnesota to share updates on Minnesota's CAV Program and opportunities to get more involved.

## ITS Minnesota

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ITS Minnesota, a not-for-profit organization with members from public industry, private companies, and academia, continued efforts to educate and support the use of intelligent transportation technology in Minnesota. Over the last year, the group developed an equity statement and new goals for the upcoming years.



### 3. WHAT IS CAV

#### Connected Vehicles

Connected vehicles use technology to either communicate with each other, connect with traffic signals, signs, and other road items, or obtain data from a cloud. This information exchange will help with safety and improve traffic flow.

#### Automated Vehicles

Automated vehicles use technology to do driving tasks like steer, accelerate, and brake with little to no human input. Some vehicles still require a human to monitor the roadway, while other vehicles require no human intervention.

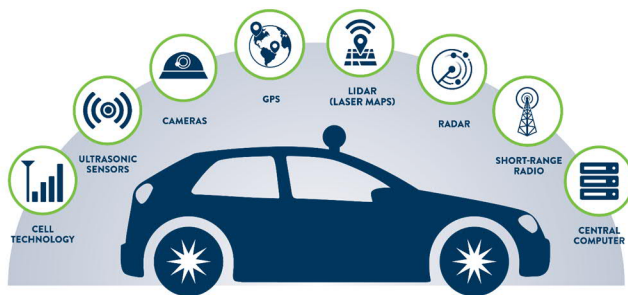


Figure 7: Example technologies used for automated vehicles

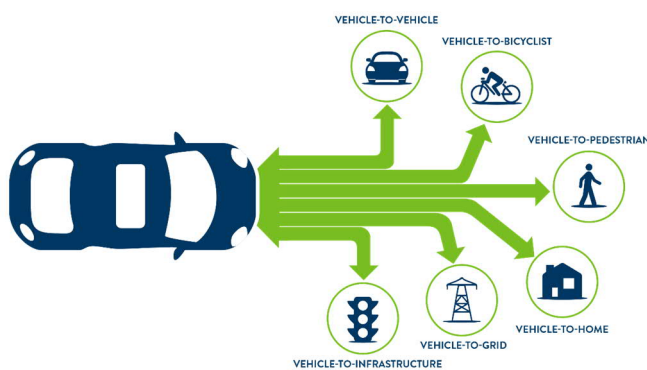


Figure 8: Example connections that connected vehicles can make

#### Examples of CAV today

*Truck Platooning* – uses CAV technology to allow trucks to travel together while connected by a computer system. The system communicates with platooning trucks to align speed, acceleration and braking. In Minnesota, a driver is required in truck platooning vehicles to steer, observe safe operations of the system, and take over control when necessary.

*Automated Shuttle Demonstration Pilots* – many pilot projects have been demonstrated around the country over the last few years showcasing CAV technologies for the general public to experience and observe. Minnesota has conducted demonstrations of automated shuttles in 2017 at MnROAD and in 2018 in downtown Minneapolis during the Super Bowl. Minnesota also launched its first demonstration pilot on a live multi-modal urban environment in downtown Rochester, MN with the Med City Mover. These pilot projects are beneficial to expose Minnesotans to CAV technology, educate about technology opportunities and limitations, test technology in the Minnesota environment, and ensure technologies meet all of Minnesota’s transportation needs, not just needs of a select few. Technology companies are great at advancing the capabilities of CAV but Minnesota believes it is the state’s role to ensure that technology is equitable, addressing real needs, not perpetuating existing disparities, and not creating new barriers.

*Automated Delivery Devices* – many states around the country have seen the introduction of automated delivery devices like self-driving robots. The devices are able to transport goods within a certain boundary which may have the ability to increase access to goods for people with current limitations. Companies are producing devices that range in sizes and speed of travel, some focused on similar weight and speeds to pedestrians and others of much greater weight and that can function on sidewalks and roadways.

## Defining Levels of Driving Automation

There are a many levels of automation that people experience today and it is important for people to understand the differences between the levels to understand the benefits and appropriate use.

The Society of Automotive Engineers (SAE) has clearly defined different levels of driving automation. The six SAE Levels of automation shown below clarifies when driver intervention is needed Level 0 shows no automation where the human is in control at all times and goes up to Level 5, which is full automation, requiring no human driving intervention in all conditions.

Currently, Level 1 and 2 vehicles are widely available for the public to purchase today and feature automated driving features that assist like lane keeping/centering, adaptive cruise control, and/or emergency breaking. A Level 1 vehicle is able to enable one driving assign feature at a time, where a Level 2 vehicle can enable two or more. There is a significant difference between Level 2 and Level 3 vehicles, as Level 3 vehicles are able to use automated driving features to control a vehicle in limited conditions but will still require the driver to take over control when conditions aren't met. Level 4 vehicles do not require drivers to take over control and are able to operate in specific conditions. Level 5 vehicles are considered fully automated vehicles where no driver intervention is needed and the vehicles can operate under all conditions. To date, there are no Levels 3, 4 nor 5 vehicles available for public consumption at this time but many companies are working on the technologies in research and demonstration testing.

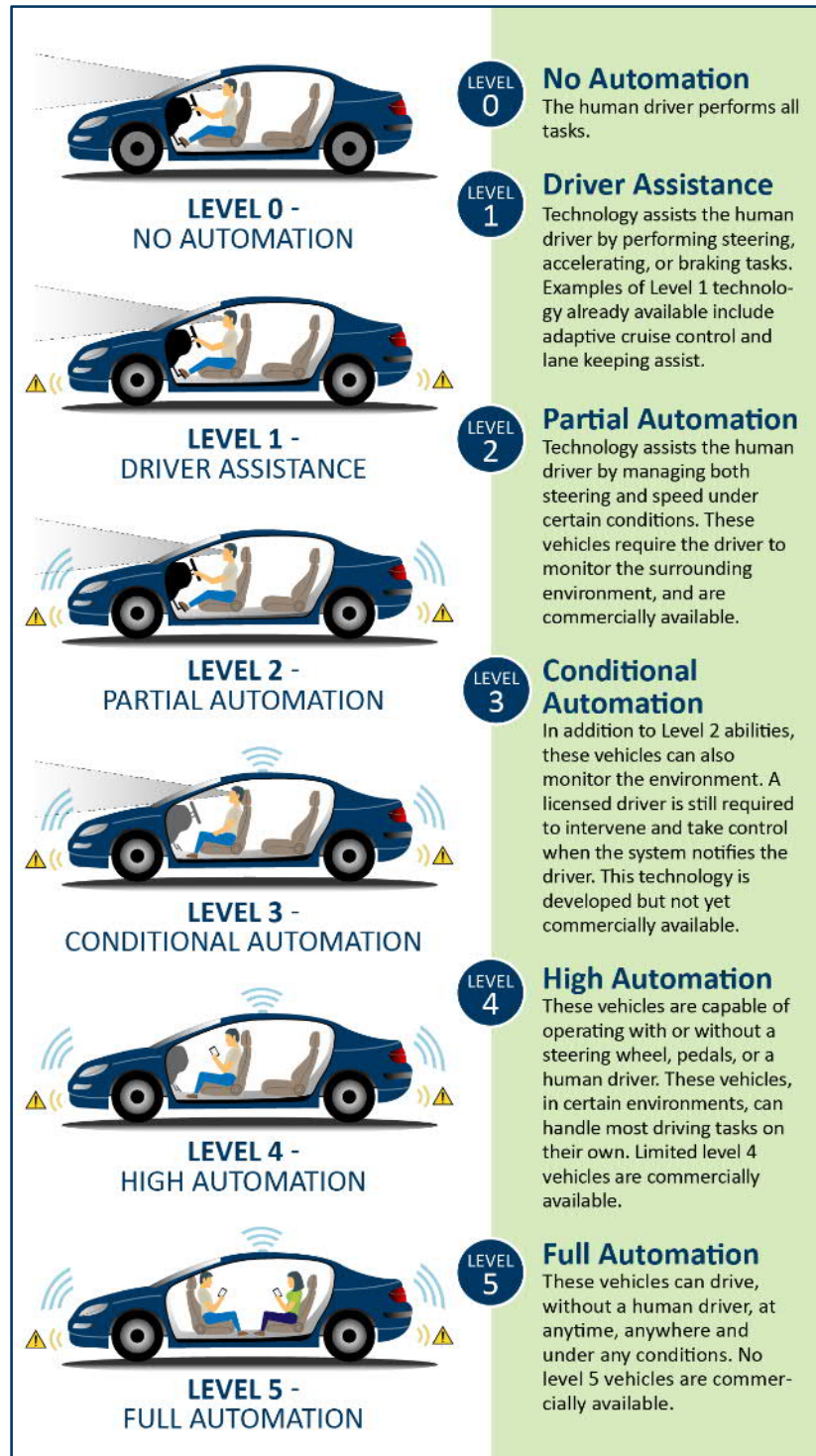


Figure 9: Society of Automotive Engineers International Levels of Driving Automation ([www.sae.org](http://www.sae.org))



## 4. HOW MINNESOTA IS PREPARING FOR CAV

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Minnesota continues to prepare for connected and automated vehicles and transportation technologies by observing trends and advancement in vehicle automation, connected vehicle technology, and other emerging areas.

### Testing and Research

- **CAV Traveler Alert System information:** The state and researchers integrated CAV technology into snowplows to alert drivers when they are approaching snowplows along the highway. Providing advance notice that large maintenance vehicles may be ahead has the ability to help avoid crashes and to be aware of snowplows in extremely snowy conditions. The technology has been successfully used on digital message signs along Minnesota highways, and the team is looking at expanding notifications through use of a mobile phone application in 2022.
- **Snow Plow Lane Assist research:** Minnesota continues to test connected vehicle technology with University of Minnesota Professor Max Donath in order to provide guidance to snowplow drivers to stay in lanes during snowstorms and whiteout conditions. Currently, each of the eight MnDOT districts and one local partner have snowplows with equipped technology.
- **Med City Mover Automated Shuttle:** Minnesota launched its first driverless shuttle project in a live, multi-modal traffic, urban environment in fall 2021 with the Med City Mover in Rochester, Minn. The shuttle will run for one year and test the technology in the Rochester environment, helping the state learn about infrastructure needs, technology limitations, interactions between automated shuttles and other roadway users, impact of winter weather on technology, and more.
- **Limitations and Capabilities of AVs:** University of Minnesota Professor Rajesh Rajamani is working to characterize the limitations and capabilities of state-of-the-art autonomous vehicles, including their ability to operate in winter road environments. Utilizing the MnCAV Ecosystem vehicle, the project will look at performance in rural and urban settings and under different weather conditions.
- **Lane-departure detection and warning through smartphone application:** University of Minnesota Duluth Professor Imran Hayee and his team are developing a smartphone application based on an innovative lane-departure detection and warning algorithm which can also provide an advance curve-speed warning using standard GPS technology. This technology is being designed to be more robust and less expensive than the current technology offered on vehicles today.
- **Equity impacts of Shared Automated Vehicle systems:** A team led by University of Minnesota Professor Yingling Fan completed work on a project that explored equity concerns and considerations around the rollout and regularized use of a hypothetical Shared Automated Vehicle (SAV) system in the Twin Cities metropolitan area. The team conducted a literature review, qualitative interviews, and a series of stated preference surveys to draw their conclusions and offer recommendations. The final report for the project will be published in early 2022.
- **Autonomous Snow Plow Competition:** The 11<sup>th</sup> Annual Autonomous Snow Plow Competition was held in April of 2021 at Dunwoody College of Technology in Minneapolis, MN. Thirteen teams from different colleges and universities from the United States and Canada competed by designing and building an unmanned snow plow vehicle that removes snow autonomously on a pre-defined path using skills in science, technology, engineering, and math. The team from Université Laval in Quebec City, Canada took first place in 2021 competition.

### Planning

- **Corridor planning:** MnDOT, along with other state and local partners, completed the state's first CAV corridor planning effort with communities along Highway 52 from Rochester to

St. Paul. The project team worked with various stakeholders and recommended specific CAV applications to advance safety, equity, sustainability, mobility, and access along this corridor.

## Engagement

- **CAV Messaging and Engagement:** Based on data gathered over the last two years, MnDOT developed messaging guidance to help build knowledge of CAV technology through Minnesota, to develop two-way lasting relationships with communities, organizations, and entities around the state, and to integrate CAV messaging into transportation plans and projects across the state. This work is essential to ensure that Minnesotans can help shape the future of transportation in the state by being well-informed and a part of conversation.

## Partnerships

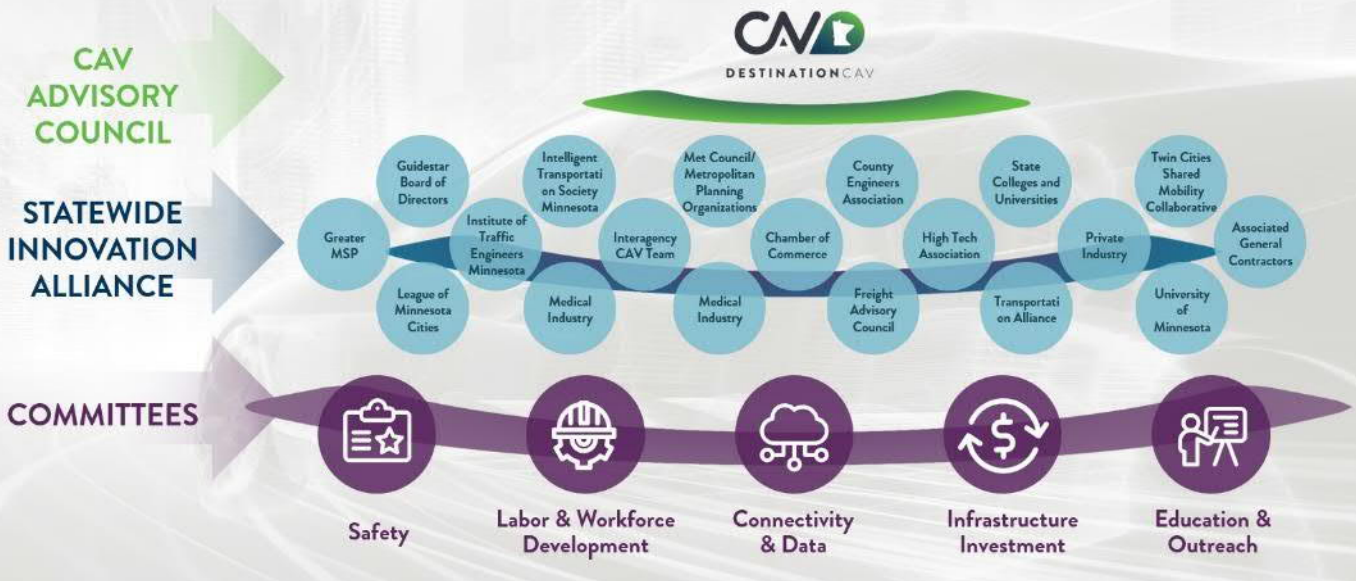
- **CAV Challenge:** MnDOT continues to administer the CAV Challenge program that allows partners to propose innovative solutions to address transportation challenges of today and of tomorrow in our state. The program won two awards in 2021, a regional winner and national finalists for the *Transportation Innovation* and *America's Transportation Awards* and winner of the *WTS Minnesota Innovative Transportation Solutions Award*. The CAV Challenge continues to bring new partners to the state.
- **National committees and working groups:** MnDOT continues to represent Minnesota on key regional and national committees and conferences to advance CAV research and policy.
- **CAV Career Pathways High School Camp:** The City of White Bear Lake, University of Minnesota's Center for Transportation Studies, and MnDOT partnered to host a CAV Career Pathways Summer Camp for 16 students from the Twin Cities Metropolitan Area. The weeklong day camp was hosted in August 2021 at White Bear Lake High

School. Students were able to meet with the White Bear Lake Autonomous Shuttle project team and ride the shuttle on school grounds. Throughout the week of camp, students learned about CAV technologies and gained career insights from several industry and agency partners. In addition to the shuttle, CAV technology demonstrations were provided by Subaru of White Bear Lake, Tesla, DART Transit, and MnDOT.



Figure 10: Students participating at the CAV Career Pathways High School Camp

- **ADAS 101 Curriculum:** Minnesota State Transportation Center of Excellence, in collaboration with partners from across the country created and adopted education training for high schools and colleges to educate on advanced driver-assistance systems currently available in vehicles.
- **National Science Foundation Grant for Innovative, Semi-Autonomous Trucks and Off-highway Powered Equipment:** Minnesota State Transportation Center for Excellence partnered with industry to complete a curriculum map for the basics in CAV in heavy trucks and off-highway equipment for technicians and drivers/operators career pathways.



## 5. MINNESOTA'S CAV INNOVATION ALLIANCE

### A Statewide Coalition

The Council launched the CAV Innovation Alliance in 2020 with five committees focusing on Safety, Labor and Workforce Development, Connectivity and Data, Infrastructure Investment, and Education and Outreach. The Alliance is intended to be a broad statewide network to coordinate CAV work across Minnesota and serves as a “one stop shop” for CAV in the state.

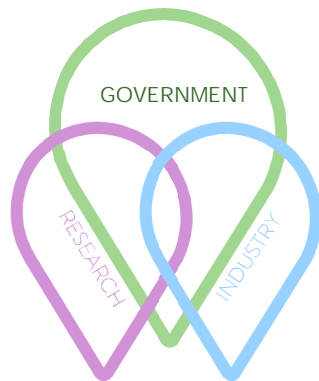


Figure 11: CAV Innovation Alliance three pillars; government, research, and industry

The goals of the CAV Innovation Alliance are to:

1. Create a network of local, regional, and state organizations that share a commitment to planning and preparing for CAV and emerging technologies
2. Coordinate CAV activities across the state to develop a unified program and avoid redundant research
3. Implement Governor’s Advisory Council recommendations to advance the Council’s priorities

4. Develop priorities for public-private research, pilots, and projects
5. Meet regularly to discuss CAV project and research updates, share lessons learned, and best practices
6. Convene an annual conference to share lessons learned and develop priorities for the Alliance

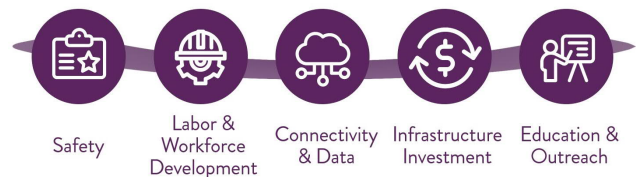


Figure 12: CAV Innovation Alliance’s five committees

### Committees

The Alliance reports to the Governor’s Advisory Council and provides strategic recommendations on each of the committee focus areas. MnDOT provides staff and administrative support for each of these committees. Each committee has two co-chairs, from both the public and private sectors, with deep technical expertise in each respective committee topic. Annually, each committee reports to the Council on their activities, hosting educational panels, and showcasing key deliverables to the state’s CAV leaders to advance Council goals.

Safety Committee	Labor & Workforce Development	Connectivity & Data Committee	Infrastructure Investment Committee	Education and Outreach Committee
<b>CHAIRS</b>				
Mike Hanson, Department of Public Safety	Chris Hadfield, MnSCU Technology Center of Excellence	Frank Douma, University of Minnesota	Jay Hietpas, MnDOT	Gina Baas, University of Minnesota
Amber Dallman, MnDOT	Patrick Weldon, Polaris	Damien Riehl, Fastcase	Bret Weiss, WSB	Katie Caskey, HDR

Each committee identified several key goals and top priorities.

<b>GOALS</b>				
<ul style="list-style-type: none"> <li>Define 'CAV safety'</li> <li>Develop safety principles</li> <li>Advance multi-modal safety research focused on human-centered design</li> <li>Educate CAV safety benefits</li> </ul>	<ul style="list-style-type: none"> <li>Develop CAV STEM curriculum</li> <li>Create baseline CAV workforce occupational data</li> <li>Apply for grants to pilot a CAV workforce upskilling program</li> </ul>	<ul style="list-style-type: none"> <li>Define CAV data privacy principles</li> <li>Create a CAV data privacy policy framework</li> <li>Identify the CAV data the state needs</li> <li>Develop a public-private CAV data pilot</li> </ul>	<ul style="list-style-type: none"> <li>Provide expertise on infrastructure standards</li> <li>Advise on what CAV investments to make</li> <li>Develop partnerships to fund CAV infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Increase awareness of CAV in the state</li> <li>Convene stakeholders in conferences and events</li> <li>Develop messaging and outreach materials</li> <li>Host technology demonstrations</li> </ul>



### Safety Committee

The Committee focuses on how CAV technology can advance the state's goals to eliminate deaths and injuries on roads (known as *Toward Zero Deaths or TZD*). Priorities include ensuring the state promotes walking and biking and providing transportation for all communities. The transportation system must be designed for all road users, not just CAV technologies, so this committee uses a human-centered design and multi-modal approach to help the state identify its CAV safety principles and promote the goals in the *Strategic Highway Safety Plan*.

The Committee has focused its work on quantitative and qualitative safety with an emphasis on educating people in Minnesota about different CAV technologies, defining CAV safety and developing CAV safety principles and best practices, and advancing CAV safety research with a multi-modal perspective and human-centered design approach.



### Labor & Workforce Development Committee

In addition to co-chair leadership, this committee has strong support from the state's Department of Employment and Economic Development, workforce advocates, University of Minnesota Center for Transportation Studies, and leaders from the state's Auto Dealers and Trucking Associations.

The Committee launched Minnesota's first CAV Career Pathways Camp for high school students in the summer of 2021. The week-long camp was held at White Bear Lake High School and hosted 16 students free of charge. The camp introduced students to CAV technology and CAV-related career opportunities. Topics focused on an automated shuttle demonstration, vehicle sensors, agricultural technology, and scenario planning, and risk and benefits assessment.

The Committee also conducted a CAV curriculum assessment identifying opportunities to develop a modular curriculum for high school students, entry-level curriculum for first and second-year college



students, and to explore a partnership with Project Lead the Way for middle-school curriculum.



### Connectivity & Data Committee

This committee helps the state understand what to do with CAV data and how Minnesota can responsibly manage CAV data. The Committee reviewed over a dozen state and international data policies to develop the *Minnesota CAV Data Privacy Principles*, a framework to understand how the state should address the challenges of managing complex information and responsibly sharing information with the appropriate entities.

The Committee, with leadership from Minnesota IT Services (MnIT), is also developing the state's *Security by Design Framework* to identify how systems can be developed to prevent cyberattacks and other security concerns.

The Committee is leading the Alliance in using an equity lens framework when creating these new policies, asking how CAV policies may unintentionally impact Minnesota communities and ensuring the state engages all communities.



### Infrastructure Investment Committee

Committee priorities include advising cities, counties and the state on what strategic investments should be made to support CAV.

The Committee is assessing opportunities to invest in fiber, traffic signals, pavement marking and signing and how to manage CAV assets. Cities are looking into digital curbside mapping and curb management. This and other data – like work zone, signal timing and traffic data – is critical for CAVs and traditional vehicles to operate safely. Members are also looking into policies that support testing on public road, winter weather testing and autonomous freight research.



### Education and Outreach Committee

With education and outreach being one of the state's number one priorities, this committee supports the Council and all Alliance committees to

develop a collaborative approach to CAV education, outreach and awareness.

This committee is co-chaired by Gina Bass, Associate Director of Engagement and Education at the Center of Transportation Studies at the University of Minnesota Center for Transportation Studies and Katie Caskey, Strategic Communications Manager at HDR, this committee focuses on increasing awareness of CAV technology, sharing regular updates on Minnesota's CAV program and activities, and convening stakeholders and communities to learn about CAV, collaborate on policy and share best practices.

The Committee includes a diverse group of stakeholders with backgrounds in accessibility and mobility advocacy, planning, community engagement, public outreach, communications, and other fields.

Committee priorities include:

1. Developing CAV presentation materials and talking points
2. Creating a regular CAV newsletter
3. Developing a statewide CAV website
4. Hosting technology demonstrations
5. Convening an annual CAV conference
6. Surveys to gauge public awareness of CAV

This committee supports the implementation of the MnDOT CAV Strategic Plan, the state's *Strategic CAV Communications and Engagement Plan*, and the outreach and education work of all Alliance and Council priorities. Surveys show that when the public has an opportunity to see the technology in person, ask questions, and participate in demos, two-thirds of Americans support investments and planning for CAV. Without engaging communities, however, Americans are hesitating to adopt CAV technology.

The Alliance will help Minnesotans understand what a future with CAV looks like. The pandemic and renewed demands for racial justice have sparked conversations in how we build trust, develop meaningful relationships, and collaborate across Minnesota.



## CAV Innovation Alliance Membership

The Innovation Alliance is intended to be a broad partnership that includes representatives from universities and technical colleges, private industry, nonprofits, government, and communities. In its first six months the Alliance has grown significantly, but still seeks opportunities to include diverse voices from across the state. As the state seeks more members, current members are listed below.

- 3M
- AECOM
- American Family Insurance
- American Trucking Research Institute
- Association of Minnesota Counties
- Blue Cross/Blue Shield
- Bolton & Menk
- Cam Creek Consulting
- City of Apple Valley
- City of Eden Prairie
- City of Hopkins
- City of Hastings
- City of Richfield
- City of Roseville
- Dakota County
- Fastcase
- Federal Highway Administration
- Freedom Lines
- Governor's Advisory Council on CAV
- Grant County
- HDR
- House of Representatives
- HumanFIRST Lab
- Ideate Consulting
- Intelligent Transportation Society (ITS) Minnesota
- Interagency CAV Team
- League of Minnesota Cities
- Maslon LLP
- Met Council
- Minnesota Automobile Dealers Association
- Minnesota 360
- Minnesota Council on Disabilities
- Minnesota Department of Administration
- Minnesota Department of Employment and Economic Development
- Minnesota Department of Human Services
- Minnesota Department of Public Safety
- Minnesota Department of Transportation
- Minnesota Trucking Association
- Mobility Mania
- NewPublica
- County Engineers Association
- State Colleges and Universities
- Minnesota Transportation Alliance
- Minnesota Safety Council
- Minnesota Toward Zero Deaths
- Minnesota Safe Routes to Schools
- MnSCU - Transportation Center of Excellence
- MnSCU – Northland College
- MnIT
- Polaris Industries
- Rochester Public Schools
- Safety Signs
- Scott County
- State Patrol
- Split Rock Partners
- SRF
- Stantec
- The Plum Catalyst
- Twin Cities Shared Mobility Collaborative
- University of Minnesota
- VSI Labs
- Willshire Consulting
- Washington County
- WSB

## 6. COUNCIL'S PLANS FOR 2022

### WHAT IS PLANNED FOR CAV IN MINNESOTA IN 2022?



**Public Engagement, Outreach and Demonstrations:** The state will work to implement strategic programmatic recommendations identified as part of

the Statewide CAV Messaging and Engagement Plan, including: Building a new Minnesota CAV website, updating Destination CAV Newsletter, creating a CAV messaging resources library for partners, and prioritizing CAV technology demonstrations.

For CAV demonstration plans, the state is partnering with the University of Minnesota to kick-off the new initiatives of DriveMN, LearnMN, and ShapeMN. These focus on increasing public exposure to CAV technology and increasing knowledge and understanding of CAV, with the goal of creating policy guidance, infrastructure investment recommendations and considerations, and discovering unique community transportation needs and concerns.

The state will be hosting a CAV Conference and Technology Showcase to share the CAV initiatives and research taking place in Minnesota, provide updates from regional and national CAV partners, and showcase Minnesota companies and academic institutions conducting CAV-related work.



**Autonomous Shuttle Pilots:** Minnesota will continue collaborative public-private partnerships to understand how the state should

prepare for CAV. The Rochester Med City Mover autonomous pilot will continue through summer 2022 and two other autonomous shuttle pilots that use different CAV technology are expected to launch in 2022.



**Connectivity & Work Zone Safety:** MnDOT is building upon current software to improve work zone safety by publishing and sharing real-time

information about work zones using a new common, national, standardized data format. This work will allow more notifications, including "Workers Present" as well as automating and improving reporting capabilities.



**Data Privacy and Cybersecurity:**

Minnesota will conduct a cybersecurity gap analysis and develop security recommendations for Council review, adoption, and implementation.



**Workforce Development:** The state's CAV program continues to plan to partner with Twin Cities Start Up Week and looks to expand the CAV

Career Pathways Camp for high school students in 2022.



**Infrastructure Readiness Assessment:**

The state will be partnering with VSI through DriveMN to deliver tangible insights to Minnesota on the

readiness of our roadways for the new technologies. VSI's AV Readiness Survey is designed to examine the compatibility of public roadways against new and emerging technologies associated with Advanced Driver Assistance Systems (ADAS) and Automated Driving (AD) systems. The insights derived from this survey will identify areas of interests where the ADAS/AD systems responded in an unpredictable way that could jeopardize safety. Likewise, the survey also will highlight areas of outstanding performance that serve as examples of what works well with today's infrastructure.

## 7. CAV ADVISORY COUNCIL MEMBERSHIP AND LEADERSHIP

ADVISORY COUNCIL MEMBERS	ORGANIZATION
COMMISSIONER MARGARET ANDERSON KELLIHER, CO-CHAIR	Minnesota Department of Transportation
AMBER BACKHAUS	Automobile Dealers Association
DAN CHEN	3M
RYAN DANIEL	St. Cloud Metropolitan Transit
DANIELLE ELKINS	City of Minneapolis
MICHAEL GORMAN	Split Rock Partners
JOHN HAUSLAUDEN	Minnesota Trucking Association
PHIL MAGNEY, CO-CHAIR	VSI Labs
KYLE SHELTON	University of Minnesota Center for Transportation Studies
MYRNA PETERSON	Mobility Mania
EDWARD REYNOSO	Teamsters Joint Council
DAMIEN RIEHL	Fastcase Legal Research Platform
VICKY RIZZOLO	American Family Insurance
PATRICK WELDON	Polaris
BRET WEISS	WSB

EX-OFFICIO MEMBERS	ORGANIZATION
MAYOR JASON GADD	League of Minnesota Cities
COUNCIL MEMBER TINA FOLCH	City of Hastings, League of Minnesota Cities Representative
COMMISSIONER ALICE ROBERTS-DAVIS	Department of Administration
COMMISSIONER THOM PETERSON	Department of Agriculture
COMMISSIONER GRACE ARNOLD	Department of Commerce
COMMISSIONER STEVE GROVE	Department of Employment and Economic Development
COMMISSIONER JAN MALCOLM (REPRESENTED BY EMILY SMOAK)	Department of Health
COMMISSIONER JODI HARPSTEAD (REPRESENTED BY COURTNEY WHITED)	Department of Human Services
COMMISSIONER MARK PHILLIPS	Iron Range Resources and Rehabilitation Department
COMMISSIONER JOHN HARRINGTON	Department of Public Safety
COMMISSIONER ROBERT DOTY	Department of Revenue
COMMISSIONER TAREK TOMES	Minnesota IT Services
COMMISSIONER LAURA BISHOP (REPRESENTED BY TODD BIEWEN)	Minnesota Pollution Control Agency
WAYNE SANDBERG	County Representative, Association of Minnesota Counties
DAVID DIVELY	Interim Executive Director, Minnesota Council on Disability
REP. CONNIE BERNARDY	Majority Party Representative, Minnesota House of Representatives
REP. STEVE ELKINS	Minnesota House of Representative
SEN. SCOTT NEWMAN	Majority Party Representative, Minnesota Senate
SEN. SCOTT DIBBLE	Minnesota Senate
SEN. JIM CARLSON	Minority Party Representative for Minnesota Senate
CHAIRWOMAN CATHY CHAVERS	Boise Fort Tribe, Minnesota Indian Affairs Council
CHARLIE ZELLE	Chair, Met Council

