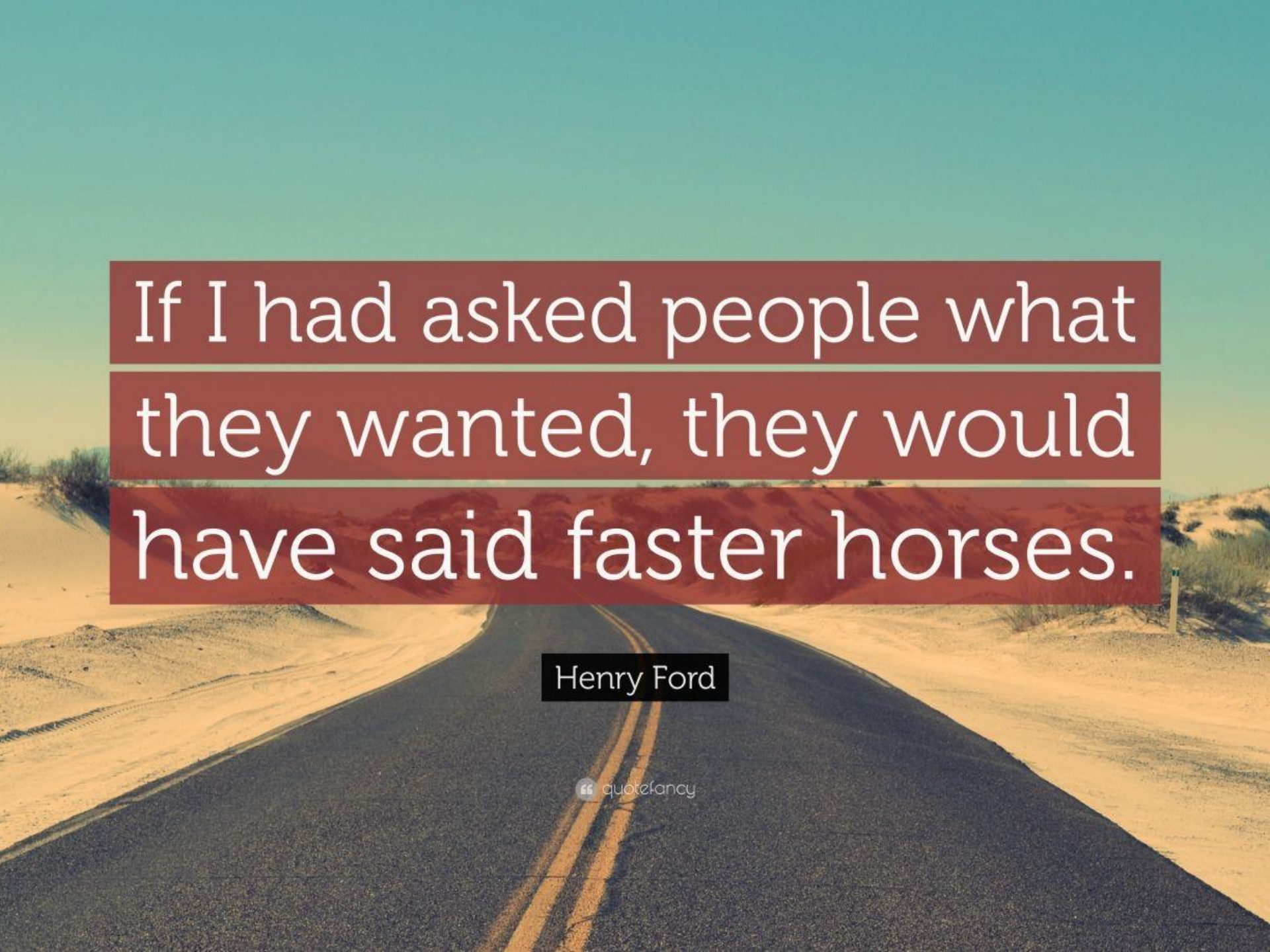


21st Century Transportation: *Transforming the Future of Mobility with CAV*

A photograph of a desert landscape. A paved road with two yellow lines runs from the bottom center towards the horizon. The road is flanked by sand dunes and sparse desert vegetation. The sky is a clear, light blue. Overlaid on the image are three horizontal red bars containing white text.

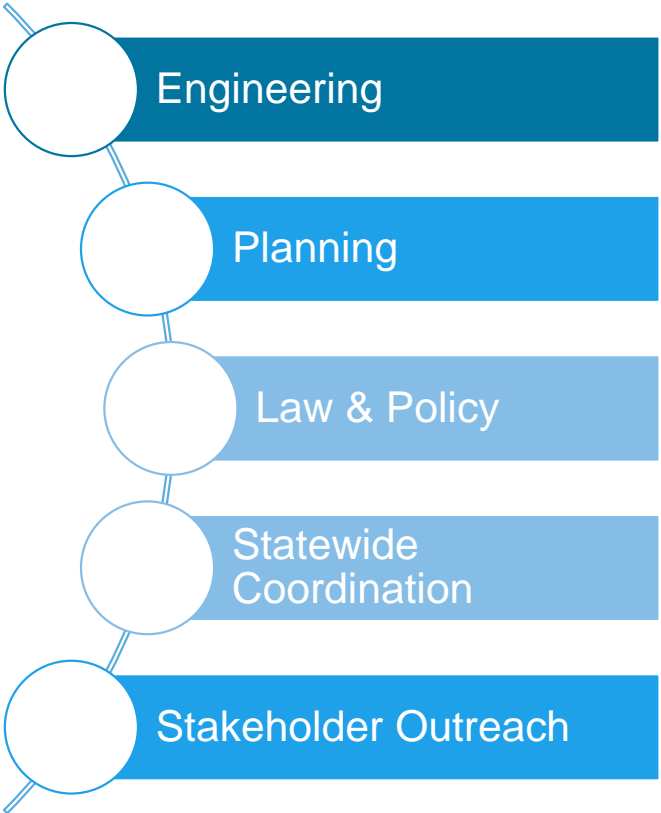
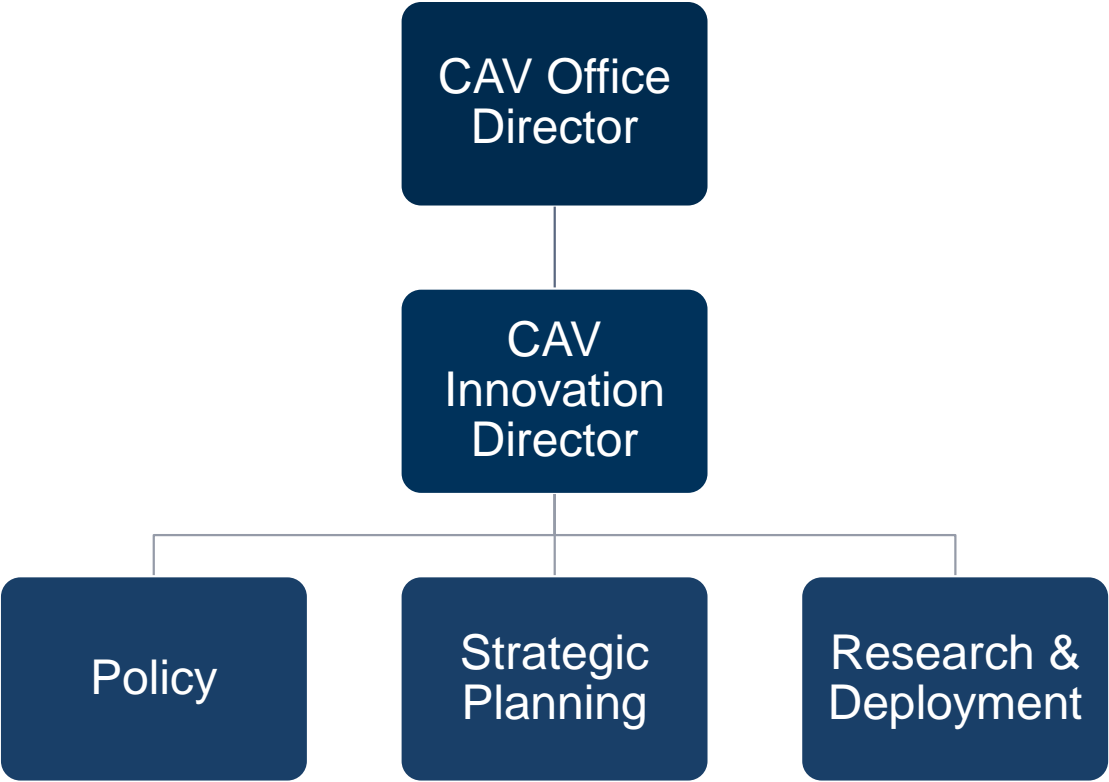
If I had asked people what they wanted, they would have said faster horses.

Henry Ford



Who we are

MnDOT CAV-X Office



Interagency Team

- Policy position papers
- Branding
- Testing & Deployment
- Partnerships



Duties of the Advisory Council

Consult with government, stakeholders, auto & tech industry, business, labor, advocacy groups, universities, communities experiencing transportation barriers



Prepare and submit a report to the Governor and Legislature by December 1, 2018



Advise and support government to support testing and deployment of CAV

Governor's Advisory Council on CAV

Advisory Council

Interagency CAV Team

Transportation
Infrastructure
& Investment

Cyber Security
& Data Privacy

Vehicle
Registration,
Driving
Training,
Licensing

Insurance and
Liability

Traffic
Regulations &
Safety

Economic &
Workforce
Development,
Business
Opportunities

Accessibility
and Equity

Land Use &
Planning

Stakeholders

Stakeholders

Stakeholders

Stakeholders

Stakeholders

Stakeholders

Stakeholders

Stakeholders

Advisory Council Goals

1. **Brand** Minnesota as a place to test and deploy CAV
2. **Engage the public**
3. **Educate** the general public
4. **Develop actionable recommendations** to facilitate the adoption of CAV in a manner that enhances our quality of life, while providing flexibility to account for evolving technology
5. **Recommend mobility strategies**

Equitable Mobility



“Consult with communities experiencing transportation barriers”



What we're doing

Connected Vehicles



LOCATION



SPEED



DIRECTION



TRAFFIC

Up to 980 Ft (300 Meters)



Connected vehicles **“talk” to infrastructure**, including roads, traffic signals, and other vehicles electronically.

Automated Vehicles



Automated vehicles can **take control** of some or all aspects of **driving tasks**.



0

No Automation

Zero autonomy; the driver performs all driving tasks.

1

Driver Assistance

Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.

2

Partial Automation

Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.

3

Conditional Automation

Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.

4

High Automation

The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.

5

Full Automation

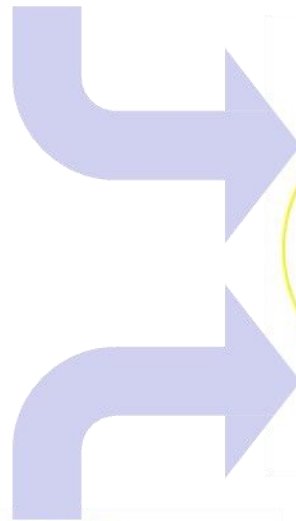
The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

Society of Automotive Engineers (SAE) Levels of Automation

Connected & Automated Vehicles

Autonomous Vehicle

Operates in isolation from other vehicles using internal sensors



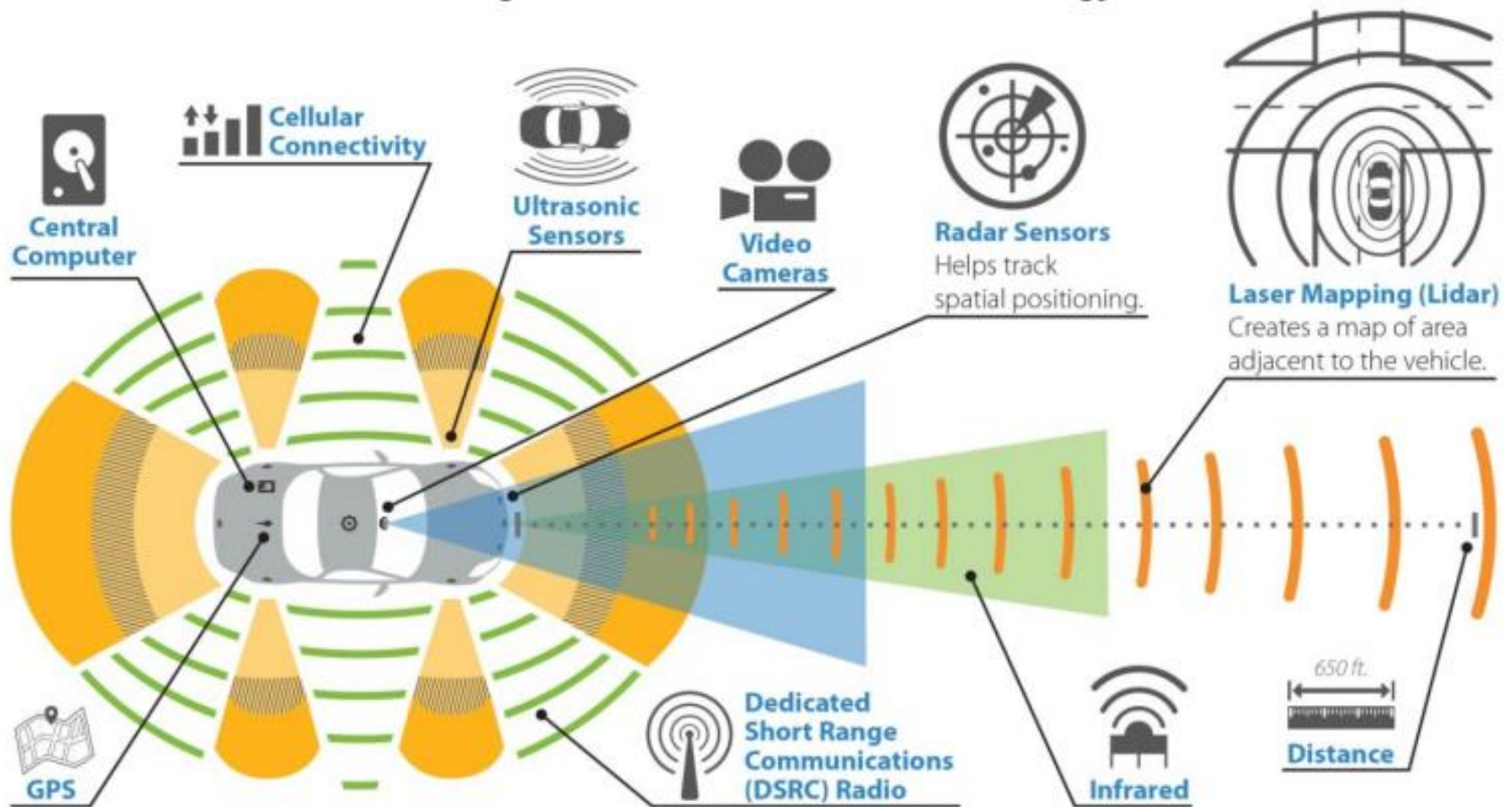
Connected Automated Vehicle
Leverages autonomous and connected vehicle capabilities

Connected Vehicle

Communicates with nearby vehicles and infrastructure



How does it work?



Electric Vehicles



Majority of CAV being developed on **battery, solar, or electric-generator** platforms.

Shared Mobility

CAV allows
**more accessible
transportation**

- car sharing
- bike sharing
- micro transit
- para transit
- TNCs
- SAVs



Shared Mobility

**1 account to access, plan,
and pay** for
private and public
transportation options



Alternative Automation



Truck Platooning



Automated Delivery














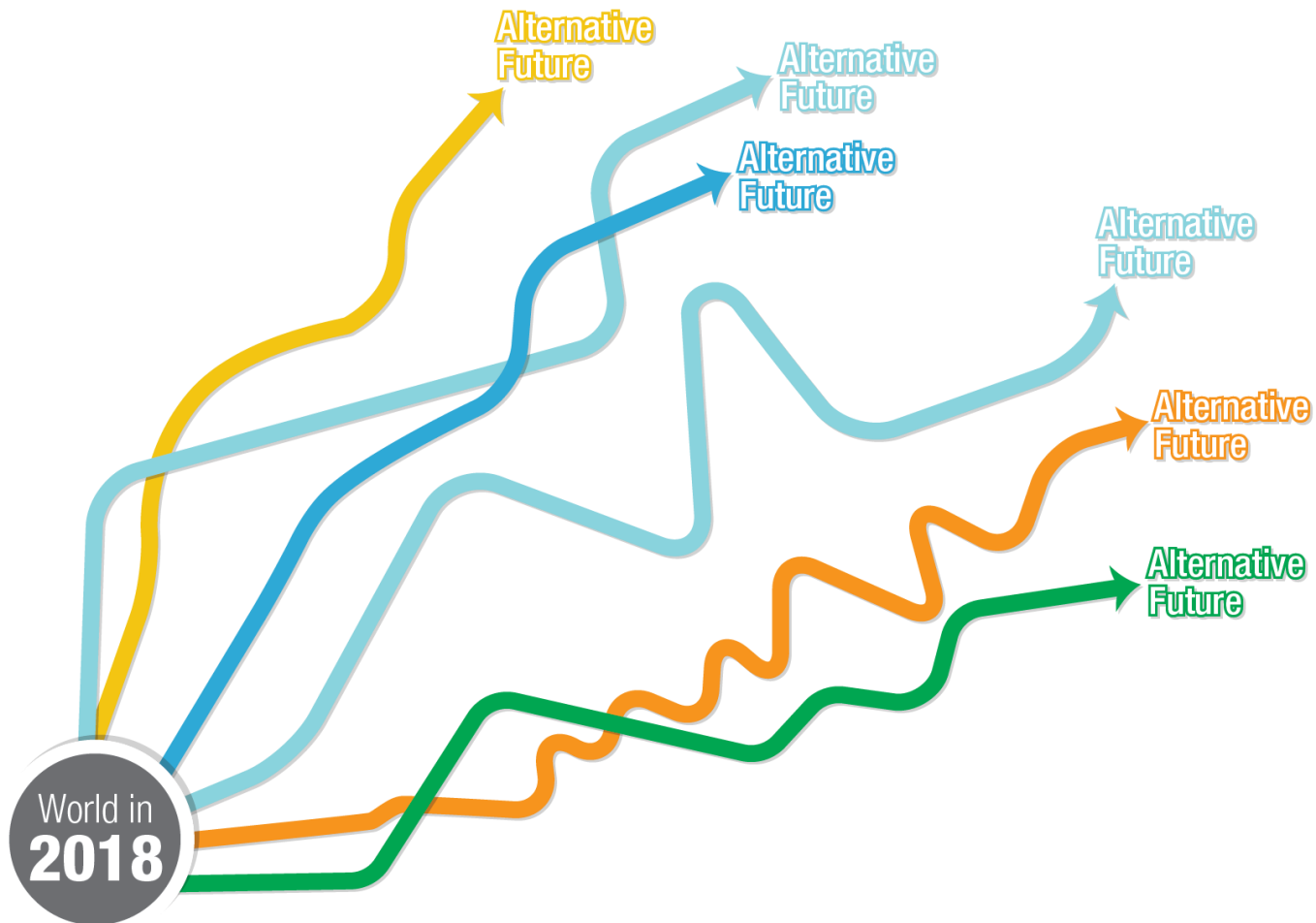
Where we're going

Strategic Plan



-  Long Range Planning
-  Capital Needs
-  Research
-  Partners
-  Regulation
-  Operations
-  Strategic Staffing
-  Multi-Modal
-  Outreach

Scenario Planning



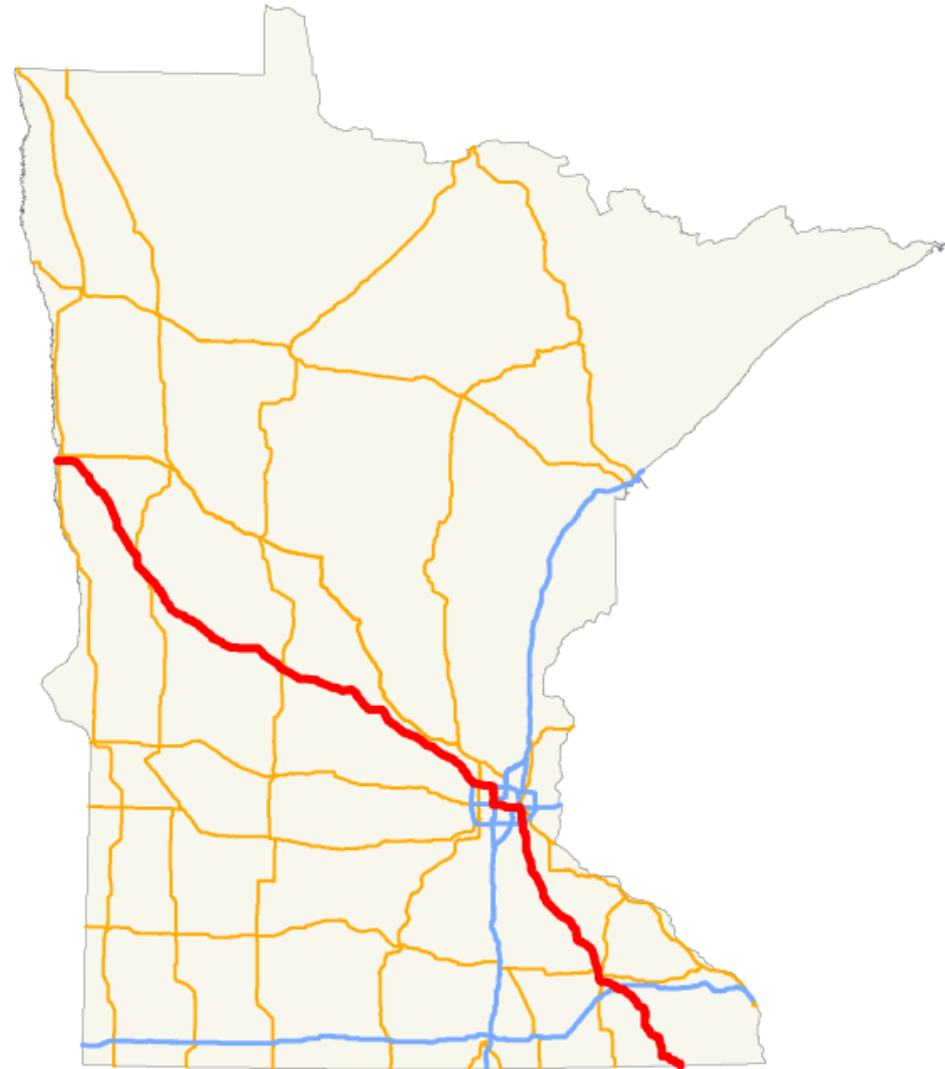
Connected Corridors

TH 55 Minneapolis

- Urban corridor
- High vehicle miles traveled

TH 52 Mayo Clinic

- Regional artery for Minneapolis to Rochester
- Urban and rural impacts
- Medical patients & medical deliveries



Testing Corridors



**Camp Ripley National
Guard facility**

Connected Vehicle Testing



Signal phasing & timing

Snow plow priority



Connected Vehicle Testing

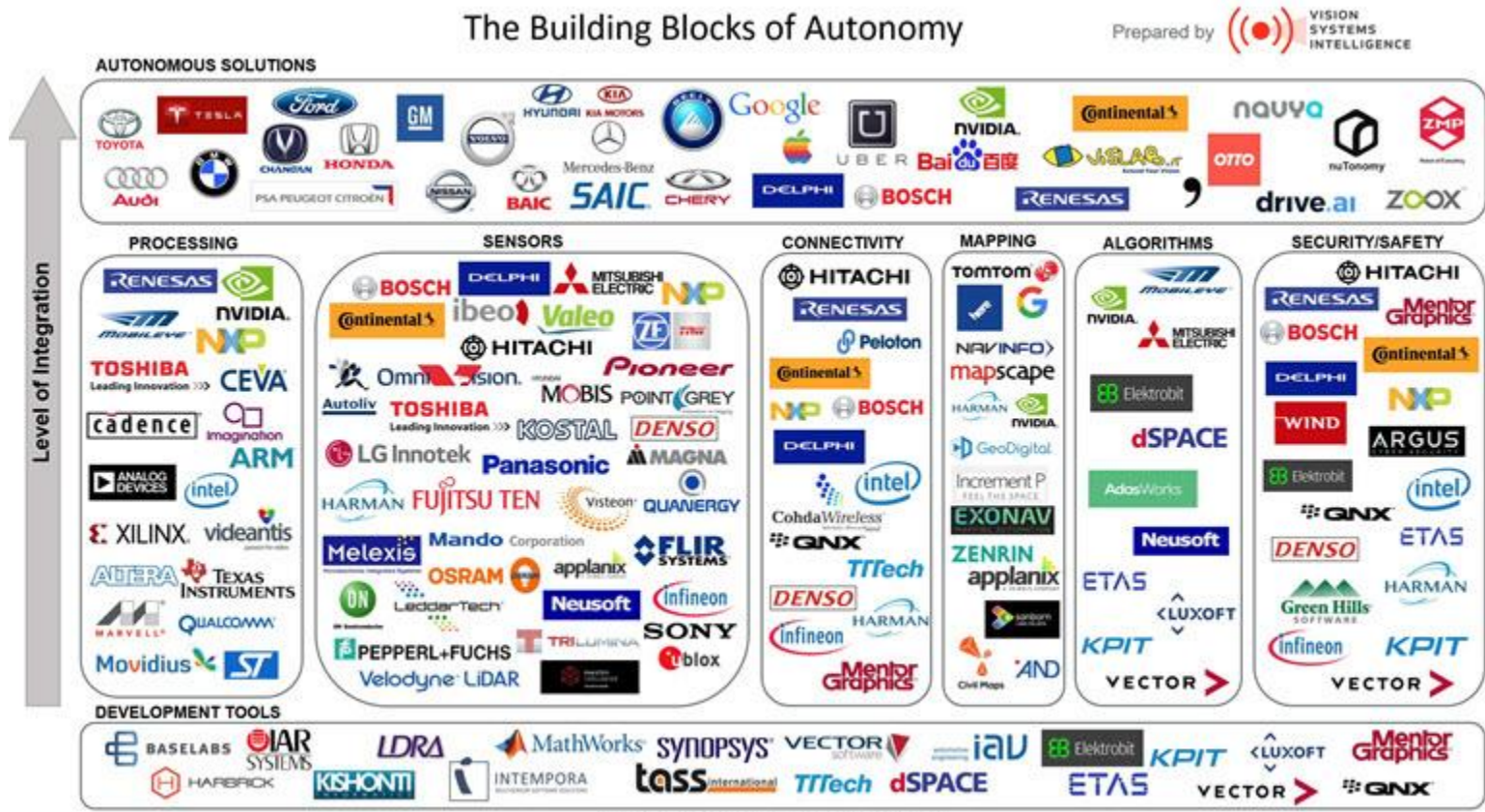


Pedestrian signal warnings



Cyber Security & Data Management

- How do we **capture and store** messages and other data?



- How do we **share** with researchers and **protect privacy**?

North/West Passage Truck Platooning



Multi-state
vehicle platoon
demo

Interstate
coordination

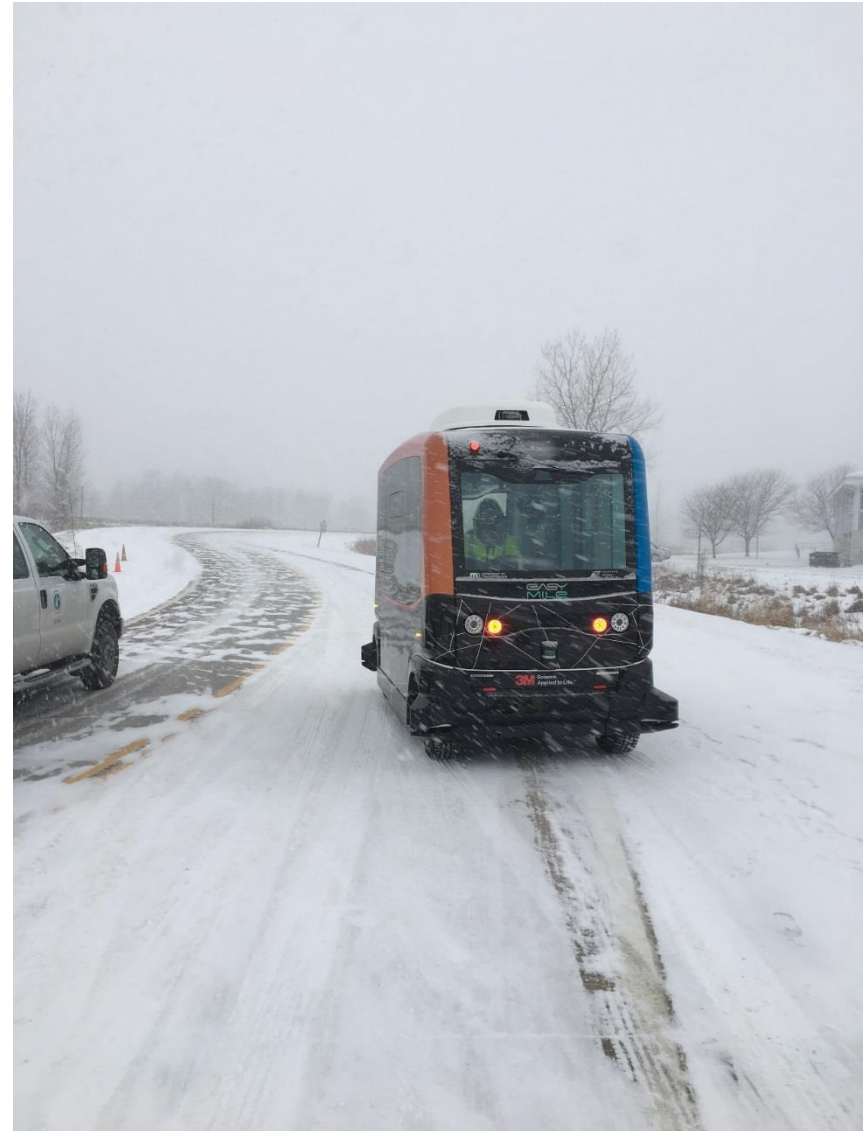
Freight
involvement



Automated Bus Pilot

Project Goals

1. Cold weather testing
2. Identify infrastructure
3. Understand operations impacts
4. Improve future mobility options
5. Expand Minnesota's influence
6. Develop partnerships
7. Public feedback



Cold Weather AV Testing



MnDOT MnROAD facility

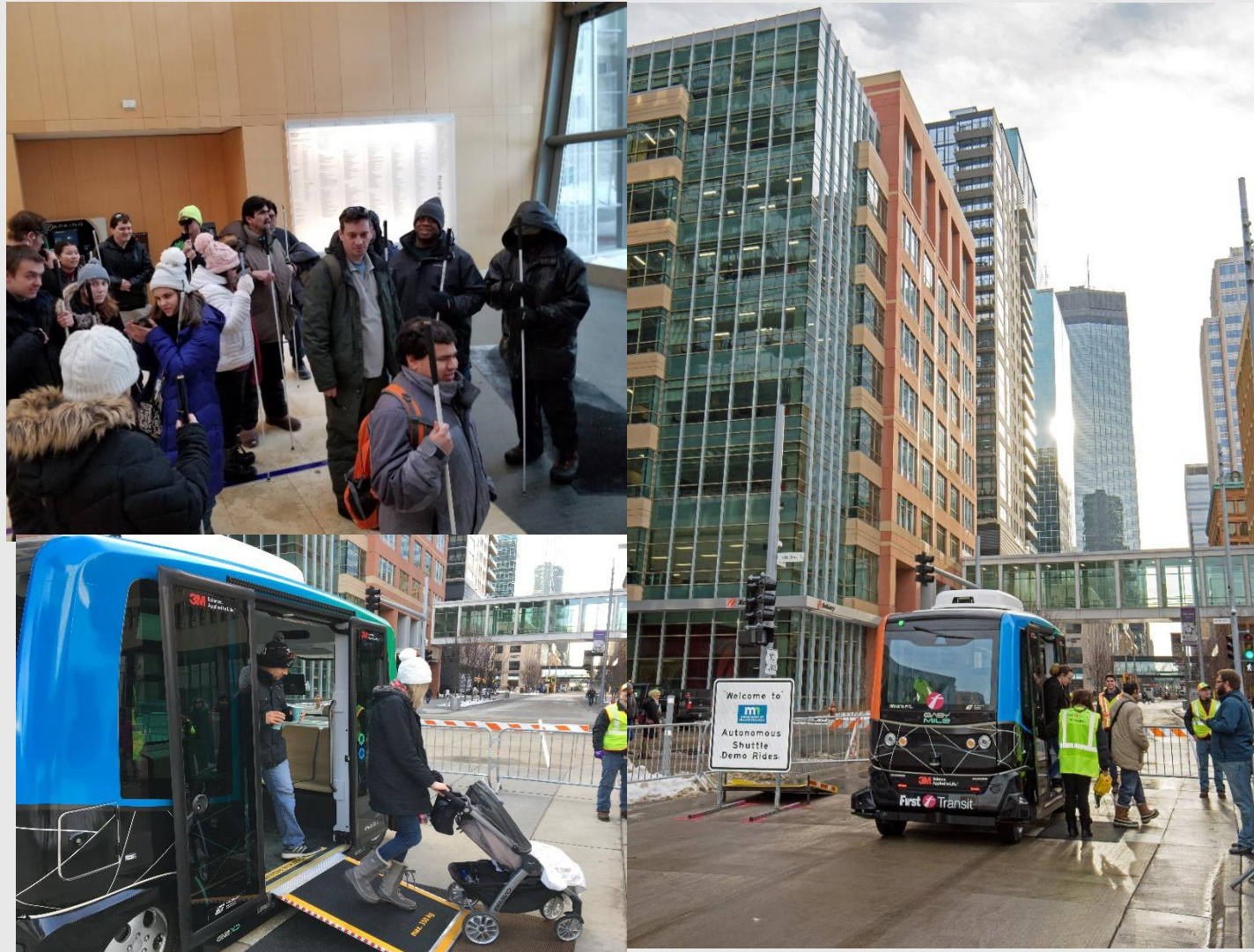
3mm – 1 cm wheel “wander”



Accessibility & Equity Opportunities

1279 riders during 3-day demo

Promoting **engagement, education, and understanding** of CAV technologies



Industry Partners



Policy Considerations

- How do we protect against cyber attacks?
- How do we partnering with auto manufacturers and tech companies?
- How do we prioritize which levels of automated vehicles to focus on?
- How do we invest in connected vehicle infrastructure?
- How do we changes to vehicle codes to accommodate automation?
- How do we update insurance regulations? Who is liable in a crash?
- How do we educate the public?
- How do we enact policies to encourage ride sharing and electric vehicles
- Participating in regional and national cooperative efforts
- What are the impacts on human drivers
- How do we ensure equal access to all?
- What changes in land use and planning will occur?
- What are the workforce impacts?
- When will we see Level 5 vehicles on roads?
- What is the impact on transit?



Thank you

m DEPARTMENT OF
TRANSPORTATION

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