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TECHNICAL SUMMARY

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TOTAL PROJECT COST:
$100,000

LRRB PROJECT COST:
$50,000

The Google car brings fully autonomous vehicles to today's roads, offering cars that require no drivers.

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OFFICE OF TRANSPORTATION SYSTEM MANAGEMENT

Minnesota Looks to the Future of Transportation

What Was the Need?

Many transportation professionals believe that the next few decades will bring more changes to the transportation system than have been seen in centuries.

Already autonomous vehicles, requiring little or no driver action to move people or freight from one place to the next, have been introduced as prototypes by automakers and Google. Autopilot, automatic parallel parking and other features of new cars have already introduced elements of autonomous vehicles to drivers.

Mobile and information technologies appear to be driving online shopping and remote working. Alternative fuels are emerging in greater strength to challenge the fossil fuels that define current transportation technologies.

Minnesota's transportation infrastructure will need to respond to these and other emerging trends in vehicle and information technologies and travel behavior, making long-term planning critical.

Technological change will dramatically alter transportation infrastructure needs in the next few decades. Autonomous vehicles will bring a future of smaller, driverless cars, changes in road design and parking needs, and shifts in both urban and rural travel behavior.

What Was Our Goal?

Investigators aimed to identify technological trends and their potential impacts on transportation infrastructure.

What Did We Do?

Researchers identified eight areas in which developing technologies and behavioral trends will have a substantial influence on future transportation practices. Various investigators with expertise in these areas prepared individual papers on the topics, which will be published in a single report. Highlights from three of the eight areas are summarized below.

What Did We Learn?

Autonomous Vehicles. Researchers expect that driving faces near-extinction by 2040, when nonautonomous vehicles will no longer be allowed on public roads at most times. As a result:

• Total transportation-related fatalities may drop 90 percent.

• Road geometry, sightlines and other design priorities may shift.

• Capacity may increase and speed limits rise on most major roadways.

• Costs for vehicles, insurance and repairs may drop.

• Travel distances may lengthen as people choose to live farther from workplaces and city centers.

Information and Communications Technologies. Academic focus on the impact of information and communication technology on commuting has expanded to consider electronic shopping. Online banking, telemedicine and virtual leisure also impact transportation uses, but are only now gaining much analytical attention. Trends include:

continued

Investigators evaluated the features of autonomous vehicles, including this Tesla sedan. Researchers and automakers believe autonomous technology will become standard on roadways in the next 30 years.

- Commute travel declines during peak and nonpeak hours.
- Telecommuting to slightly reduce vehicle miles traveled, but increase nonwork travel close to home.
- E-shopping for digital books, videos and music to continue altering retail patterns and shopping travel behavior.
- Online buying to increase delivery traffic and freight transportation.

Mobility-as-a-Service. Shared car services, in which drivers pay to use a car, and ride-sharing services like taxis, Uber, Lyft and Sidecar may reduce rates of car ownership in the future. Urban density may increase dramatically as the expenses of city life associated with car ownership and parking drop relative to income and as city dwellers grow more comfortable with Mobility-as-a-Service (MaaS). Impacts may include:

- Cars becoming less like durable goods and more like personal devices such as phones.
- Private ownership (which favors large vehicle sizes for atypical uses such as vacation or recreation over daily uses for one- and two-person commuting) to drop.
- Cars becoming smaller on average as fleets tailor inventory to meet demand.
- MaaS customers traveling less frequently than car owners.
- Street design trends moving away from parking toward loading and unloading.

In addition to these three significant areas of potential change, the study also describes ways in which **mobile telecommunications** will also impact future transportation needs, as will **sensors** carried by people and attached to vehicles and roadways. **Energy** developments suggest that by 2050 electric vehicles will account for 68 percent of new car sales, forcing transportation funding off reliance on gasoline taxes. Use of dynamic **pricing** may accelerate as pay-per-use systems evolve hand-in-hand with transformations in vehicle usage. **Logistics** will continue to adapt to e-shopping, freight pooling, same-day delivery and autonomous vehicles, and fewer but heavier vehicles will transport freight.

What's Next?

This final report has been shared within MnDOT and has already spurred discussions about planning. Presentations may spread to more staff at MnDOT and other organizations. To remain useful to planners, this study will require periodic updating as technologies evolve. Autonomous vehicles, for example, may develop into more effective winter vehicles than they are currently. Logistics will continue to change rapidly. The impacts of these trends on vehicle and lane sizing warrants further study, as does impact on infrastructure capacity and state highway plans. Technology not addressed in this report—robotics, drones, pavement and bridge technology—will also impact transportation infrastructure and warrant study.