Planning for An Autonomous Vehicle Demonstration

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State and Local Policy Program

Why Autonomous Vehicles?

• Safety
  — According to the National Safety Council, over 40,000 deaths in 2018 from auto accidents
  — Economic Costs > $500 billion per year
  — Over 90% due to human error
  — Rural and Small Urban: 19% of population, but 49% of fatal crashes

• Increased Mobility
  — Elderly and People with Disabilities
  — Rural and Small Urban public transportation gaps

• Efficiency
  — Electric vehicles
11/18/2019

Microshuttles

- Last mile transit gaps and campuses
- Max speed: 25 mph
- Capacity: 12-15 Passengers
- No steering wheel or brakes
- USA demonstrations:
  - Grand Rapids, MI
  - Las Vegas, NV
  - University of Michigan
  - Arlington, TX

What is an Autonomous Vehicle?

<table>
<thead>
<tr>
<th>SAE level</th>
<th>Name</th>
<th>Narrative Definition</th>
<th>Execution of Steering and Acceleration/Deceleration</th>
<th>Monitoring of Driving Environment</th>
<th>Failback Performance of Dynamic Driving Task</th>
<th>System Capability (Driving Modes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Automation</td>
<td>The full-time performance by the human driver of all aspects of the dynamic driving task, with the expectation that the human driver will respond appropriately to any unexpected circumstances.</td>
<td>Human driver and system</td>
<td>Human driver</td>
<td>n/a</td>
<td>Human driver</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance</td>
<td>The driving mode-specific execution by a driver assistance system of either steering or acceleration/braking, with the expectation that the human driver will respond appropriately to any unexpected circumstances.</td>
<td>Human driver and system</td>
<td>Human driver</td>
<td>n/a</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>2</td>
<td>Partial Automation</td>
<td>The driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration, with the expectation that the human driver will respond appropriately to any unexpected circumstances.</td>
<td>System</td>
<td>Human driver</td>
<td>n/a</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>3</td>
<td>Conditional Automation</td>
<td>The driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, with the expectation that the human driver will respond appropriately to any unexpected circumstances.</td>
<td>System</td>
<td>System</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>4</td>
<td>High Automation</td>
<td>The driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, with the expectation that the human driver will respond appropriately to any unexpected circumstances.</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>5</td>
<td>Full Automation</td>
<td>The full-time performance by an automated driving system of all aspects of the dynamic driving task, with the expectation that the human driver will respond appropriately to any unexpected circumstances.</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>All driving modes</td>
</tr>
</tbody>
</table>
How Can Communities Effectively Prepare for SDV Technologies?

Rural / Small Towns
• Greater efficiency in low density?
• Last mile complement to existing service?
• Age in place?
• Exactly who benefits?

The SDV Task Force & The Usability Matrix

• Convened to examine potential impacts of SDV technology on “transportation disadvantaged” populations in MN
• Strategic group of elected officials, policy experts, social advocates, MnDOT and more
• Identified disparities in SDV technology and helped facilitate outreach in Greater Minnesota

➢ A tool developed by the SDV Task Force
➢ A table to analyze current and needed SDV deployment models
➢ SDV Task Force identified
  ○ A need for outreach with Greater Minnesota
  ○ What SDV models can serve rural and suburban transit needs?
### Usability Matrix

<table>
<thead>
<tr>
<th>User Groups (Ex: Affordability of Transportation)</th>
<th>Geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Barriers (Ex: Affordability of Transportation)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Communication Barriers (Ex: Within health promotion messages with banners that present people with visual impairments from reading the message. Auditory health messages may be inaccessible to participants.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Physical Barriers (Ex: Stairs and curbs that impede a person with mobility impairment from entering a building or using a sidewalk.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Policy Barriers (Ex: Denying reasonable accommodations to qualified individuals with disabilities, so they can perform the essential functions of the job for which they have applied or have been hired to perform.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Programmatic Barriers (Ex: Inconsistent training, procedures, policies, knowledge, and understanding of people with disabilities.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Social Barriers (Ex: People with disabilities are the last to be employed.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Transportation Barriers (Ex: Lack of accessibility for people who are not able to drive, to access or use public transportation.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
<tr>
<td>Affluential Barriers (Ex: People sometimes stereotype those with disabilities and are often in poor or that they are unhealthy because of their impairments.)</td>
<td>Federal, State, local, region, municipality, for profit</td>
</tr>
</tbody>
</table>

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### TPEC: Transportation Policy and Economic Competitiveness

#### Completed research
- Self-Driving Vehicles Task Force Report and Matrix of Users (PDF) 2017
- Self-driving cars: An evolutionary or the 21st century for public health as vaccines were in the 20th, University of Minnesota School of Public Health Ignite Symposium video. Feb. 2016
- Options for Automated Speed Enforcement Pilot Projects in Minnesota Work and School Zones, May 2014. Report no. 675 M-06
- Understanding the Economic Effects of RoboTaxi through Three Employee Case Studies. February 2015, Report no. M4D-OT 2015-07
- Investigating Deployment Potential for Automated Speed Enforcement in Minnesota (2012)
- Minnesota Field Test of Cozari (2012)
- ITS and Locational Privacy: Suggestions for Potential Compliance - FY10 TechPlan (2009)
Project Purpose
– Highlight the need for and ability to test in small urban and rural communities
– Develop plan for realistic AV demonstration
– Focus on mobility for the elderly and people with disabilities

Method
– Engage with local stakeholders to understand community needs, address potential hurdles, and determine what an ideal route would be

Community Criteria
• Rural (<2500) or small urban (2500-50,000) population
• Interest from community members and stakeholders
• Large population of elderly residents, particularly those who no longer drive
• Potential loops of 2-3 miles along local city roads
• Destinations of interest for elderly and/or people with disabilities
• One-way streets with two lanes
• Limited left turns
• Charging stations
Questions Needing Answers

- Technology has limits—are there streets that can accommodate the technology?
  - Asphalt or concrete
  - Preferably 2-lane, one-way roads
  - Speed limit of 35 mph or less
  - Limited Left Turns
  - Signalized intersections
  - Route length: 1-3 miles roundtrip
- Will infrastructure updates/changes be required?
- Is there community interest?
- Are there local traffic ordinances that may impact a demonstration?
- What destinations would community members like to see on the route?
- Should the route be a fixed-route or an on-demand service?
- Will infrastructure updates/changes be required?
- What parties must approve the demonstration?
- What sort of vehicle would best suit the needs of the community

Fergus Falls

- Met with West Central Initiative in July 2018
- Recognized opportunities for AVs to advance aging in place. MN’s older adult (65+) population will double between 2010 - 2030.
- Compact downtown area
- Possibility to connect assistive living w/ shopping, social centers, and healthcare
White Bear Lake

- Fit population, seniors, transit gaps and other criteria
- Multiple presentations to Chamber of Commerce
- City created opportunity for partnership (Chamber of Commerce, NewTrax, School District and others) to create proposed route

Lessons Learned and Conclusions

- Opportunities are real
  - Not just urban phenomenon
  - Interest and benefits may be greater in smaller communities
  - But public sector involvement may be required
- Partnerships are Key
  - Need Local Champion(s)
  - Transparency (duh?)
Thank you – Questions?

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Adapted Shuttles

• Polaris GEM shuttles
• May Mobility
  – Detroit
  – Connecticut
• Optimus Ride
  – Boston
The Villages, Florida

- Central Florida retirement community
- Door-to-door self-driving taxis
- Connects residents with restaurants, regional hospital, tennis courts, & others

Grand Rapids, MI

- 3.2 mile route, 22 stops
- Connects city-owned parking lots with current bus routes
- Also YMCA, college, children’s museum, and Arena