AUTOMATED VEHICLES: A Guide for Planners and Policymakers

Fehr & Peers
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OBJECTIVE.

- Planning and policymaking is future oriented
- These professions are left without a reasonable range of outcomes
- **Better understand vehicle automation in order to make more accurate predictions**
  - How does society deal with innovation?
  - How has innovation influenced travel behavior?
  - What lessons can be used to predict how AVs will influence change?
LIMITATIONS.

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Dr. Michael Boswell, Ph.D., AICP
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Dr. Steven Shladover
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Automated Vehicles: A Guide for Planners and Policymakers
WHAT ARE AUTOMATED VEHICLES?

Automated Vehicles
- Sense environment
- Safety critical control

Connected Vehicles
- V2V and V2I
- Improve accuracy (safety and mobility)

Autonomous Vehicles
- Self-contained
- Not dependent on data from other vehicles
AUTOMATION DEFINITIONS.

Levels of Automation

No Automation

Driver is in complete control at all times. Vehicles may be enhanced by warning or intervention systems, such as blind spot monitoring (level-0 NHTSA or level-0 SAE).

Driver Assistance

Driver carries out all steering and braking maneuvers. Vehicles are equipped with technology to enhance one or more specific driving functions, such as stability control and collision avoidance especially when changing lanes or when emergency braking is required (level-1 NHTSA or level-1 SAE).

Hands Free

Vehicle carries out steering, lane changing, and braking maneuvers in specific situations, such as in severely congested or low-speed environments. Driver is required to keep attention on roadway at all times and be able to take over control quickly (level-2 NHTSA or level-2 SAE).
# Automation Definitions

## Levels of Automation

<table>
<thead>
<tr>
<th>Eyes Free</th>
<th>Mind Free (Limited)</th>
<th>Mind Free (Unlimited)</th>
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<tbody>
<tr>
<td>Vehicle carries out all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene. Driver no longer needs to continuously monitor the system but must remain available to react when notified (level-3 NHTSA or level-3 SAE).</td>
<td>Vehicle carries out all aspects of the dynamic driving task but are restricted to low speeds and/or operation in dedicated right-of-way environments. Passengers may be required to provide destination or navigation input (level-4 NHTSA or level-4 SAE).</td>
<td>Vehicle carries out all aspects of the dynamic driving task in any environment without restrictions. Passengers may be required to provide destination or navigation input (level-4 NHTSA or level-5 SAE).</td>
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"You can come up with radically different answers to predicting the impacts of automated vehicles based on… your visions of what automation might mean and how it might be implemented, depending on what you assume the automation does and where it operates”
– Dr. Steven Shladover
Automated Vehicles: A Guide for Planners and Policymakers
“[People] think of the most advanced level of automation where you open an app on your cell phone, walk out to your driveway, hop into the back of the car and it takes you to wherever you want... That’s the vision. I don’t think the technology is mature enough for that to be a primary mode of transportation right now for a lot of people... I think there’s a long way to go with the technology, but I think that the technology can get there.”
– Ken Leonard
AUTOMATED VEHICLES.

VISIBILITY

1. Peak of Inflated Expectations
2. Plateau of Productivity
3. Slope of Enlightenment
4. Trough of Disillusionment

Technology Trigger

TIME
POLICY RECOMMENDATIONS.

- Remain flexible in order to easily adapt as new information becomes available and new applications are released/approved.
LESSONS FROM GROUND TRANS.
LESSONS FROM GROUND TRANS.

- Innovators: 2.5%
- Early Adopters: 13.5%
- Early Majority: 34%
- Late Majority: 34%
- Laggards: 16%

Market share %
Key Finding: Higher levels of vehicle automation may first become available to more affluent households who can afford to pay the higher costs of travel.
POLICY RECOMMENDATIONS.

- Provide accessibility (medium-low density transit)
  - Underserved communities
  - Connect workers with jobs
  - First and last mile solutions
  - Improve access to education and healthcare
  - Reduce congestion
- Support non-automobile travel and rebalance travel right-of-way
  - Walking
  - Bicycling
  - Transit
LESSONS FROM GROUND TRANS.

Carsharing
• Zipcar & Getaround

Transportation Network Companies (TNCs)
• Lyft, Uber & Scoot

Convergence
• GM + Lyft
• Chevy + Maven
• Didi Chuxing + Apple
LESSONS FROM AVIATION.

Aircrafts Today:
- Privately developed, owned, and operated
- Infrastructure that is publicly owned and operated
- Autopilot: hands free automation
- Highly trained pilots
- Aircrafts separated by 1000’s of feet in 3D
LESSONS FROM AVIATION.

Automobiles Today:
- Privately developed, owned, and operated
- Infrastructure that is publicly owned and operated
- Autopilot: hands free automation
- Vehicles separated by 10’s of feet in 2D
- Mixture of modes
LESSONS FROM AVIATION.

“One thing people don’t do well, that’s been observed in aviation, is remaining engaged by monitoring the system when you have an airplane that’s mostly on autopilot. What’s even worse is when pilots’ skills deteriorate because they’re flying less often. [This] is going to be a question in any automated mode... It’s my opinion that the highway [Eyes Free] operations, where you could be watching a video for 10 minutes legally, but then be expected to grab the wheel in 5 seconds, [should never] be allowable.” – Kevin Dopart
POLICY RECOMMENDATIONS.

- Restrict Eyes Free Automation (level-3 NHTSA or level-3 SAE)
- Support Mind Free Automation (level-4 NHTSA or level-4 and -5 SAE)
Thank you for your time.

For more information, please contact:

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