The Race for Automated Mobility

Stephen Buckley, P.E., AICP
2018 ACEC-KY\FHWA\KYTC Partnering Conference
September 5, 2018
Agenda

- Key Factors
- The Race
- Impacts of Ride-Hailing
- How Might This Play Out?
- Steps for Kentucky
- Resources
New Mobility

Connected

Automated

Electric

Shared

SAE Levels of Automation

<table>
<thead>
<tr>
<th>Level</th>
<th>Automation Type</th>
<th>Steering and acceleration/deceleration</th>
<th>Monitoring of driving environment</th>
<th>Fallback when automation fails</th>
<th>Automated system is in control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>NO AUTOMATION</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>DRIVER ASSISTANCE</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
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<tr>
<td>2</td>
<td>PARTIAL AUTOMATION</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
</tr>
<tr>
<td>3</td>
<td>CONDITIONAL AUTOMATION</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
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</tr>
<tr>
<td>4</td>
<td>HIGH AUTOMATION</td>
<td>SOME DRIVING MODES</td>
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<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
</tr>
<tr>
<td>5</td>
<td>FULL AUTOMATION</td>
<td>SOME DRIVING MODES</td>
<td>SOME DRIVING MODES</td>
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Source: SAE
Two Paths

Private Ownership Model
Driven by Auto Industry
Incremental Moves in Functionalities
Mostly Privately Owned
Here Today

Shared Mobility Model (MaaS/TaaS/Robo-taxis)
Driven by Tech and Ride-Hailing Companies
Jump to Fully Automated Transportation-as-a-Service
A few (or many, many) years away
The Promise of AVs

- Improved road safety
- More equitable access for all
- Economic benefits of less lost productivity
- Increased travel options
- Reduced stress of driving
- Reduced fuel consumption and emissions
- Reduced collisions, reducing incident-related congestion
- In the future, potentially greater capacity
Key Factors

- Speed of Technological Advancement
- Economics
- Public Acceptance
- Political Support
- Market for a Shared Model
Key Factors
Launched in March

https://www.youtube.com/watch?v=QqRMTWqhwzM
Things are Heating Up.....

Uber orders up to 24,000 Volvo XC90s for driverless fleet

Darrell Etherington, TechCrunch November 21, 2017

Waymo Orders Up to 20,000 Jaguar SUVs for Driverless Fleet – WSJ

Wall Street Journal, March 27, 2018

Up to 62,000 additional Chrysler Pacifica Hybrid minivans will join Waymo's driverless fleet, starting in late 2018

PRNewswire, May 31, 2018
Cost Per Mile

Figure 1. Percentage of consumers who think fully self-driving vehicles will not be safe (2018 vs. 2017)

Note: Percentage of respondents who strongly agreed or agreed have been added together.
Political Support

Uber, Lyft dealt a major blow after New York City votes to cap vehicle licenses
Seung Lee, www.mercurynews.com, August 8, 2018

Ride-Hailing Companies Agree to Tax in San Francisco
James Brasuell, www.planetizen.com, August 18, 2018

Gov. Doug Ducey welcomes Uber self-driving cars with open arms
The Arizona Republic, December 23, 2016
What is Mobility-as-a-Service?
What is Mobility-as-a-Service?
New Mobility

Connected

Automated

Electric

Shared

New Mobility

The Race
Waymo Miles Driven

Things are Heating Up.....

**GM WILL LAUNCH ROBOCARS WITHOUT STEERING WHEELS NEXT YEAR**

Lex Davies, Wired, January 18, 2018

**WAYMO LAUNCHES ITS SELF-DRIVING ARMADA**

ARIAN MARSHALL, Wired.com, Jan. 30, 2018

**Tesla will start rolling out its ‘full self-driving’ package in August, Elon Musk says**

Andrew J. Hawkins, The Verge, June 11, 2018, 1:58pm
Wildcards

Catastrophic Event

Public Backlash Regarding Data and Privacy
Impacts of Ride-Hailing
TNCs and Transit

– Conventional wisdom is that TNCs are cannibalizing transit ridership

– With automation, prices will likely decrease, making (automated) TNCs even more attractive
Fare Choices

- In line with the narrative:
  - most users are under the age of 35,
  - most use the service on a weekly basis,
  - most don’t own a car.

- Less predictably:
  - rider incomes are similar to the region overall,
  - a substantial number of trips are by people from households earning less than $38,000 per year
  - NOT linking to transit
  - high off-peak usage
Fare Choices: Complement or Competition?

Figure 11. Travel mode being substituted by ride-hailing services for sampled trips.
Fare Choices: Private to Shared?

41% of trips were previous in private motor vehicles

Figure 11. Travel mode being substituted by ride-hailing services for sampled trips.
59% of trips were previous \textit{not} in private motor vehicles
Fare Choices: Shift from Transit Trips?

42% of trips were previous on transit

Figure 11. Travel mode being substituted by ride-hailing services for sampled trips.
TRR 195: Key Findings

- The heaviest use is during evening hours and weekends.
- Most TNC trips in the study regions are short and concentrated in downtown core neighborhoods.
- There is no clear relationship between the level of peak-hour TNC use and public transit usage.
- TNCs are used on a more occasional basis.
- Transit travel and wait times were top concerns of transit users.
- TNC usage takes place in communities of all income levels.
Cost Per Mile

Source: [uberestimate.com/prices/Philadelphia](http://uberestimate.com/prices/Philadelphia) (April 14, 2018); ARK Investment Management (2015); Morgan Stanley (2016); World Economic Forum/Boston Consulting Group (2016)
Average Length of Transit Trips

Figure 3: Average Unlinked Passenger Trip Length, 2011

Source: APTA 2011 Fact Book
Cost Per Mile

Source: [uberestimate.com/prices/Philadelphia](http://uberestimate.com/prices/Philadelphia) (April 14, 2018); ARK Investment Management (2015); Morgan Stanley (2016); World Economic Forum/Boston Consulting Group (2016)
Launched in February

With new Express Pool option, Uber customers walk a block or two to catch a ride

- Chicago Sun Times, February 26, 2018
The Future of Mobility - From Transit Authority to Mobility Integrator

This uniquely-designed event is a discussion-based summit that puts the attendee at the center of the conversation by featuring a series of in-depth panel discussions and roundtable breakouts, which will focus on how traditional public transportation modes must adapt to compete in the new mobility marketplace.

The event will be led by senior transit officials, business executives, advocates and other mobility experts serving as thought leaders and conversation starters who will delve into the crux of critical issues facing public transportation agencies today, highlight innovations underway around the country and discuss ways public transportation can be the backbone of multimodal lifestyles.

Don't miss this opportunity to learn how public transportation providers can strategically position themselves in the New Mobility Paradigm.
From Transit Agency to Mobility Integrator
From Transit Agency to Mobility Integrator
How Might This Play Out?
<table>
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<tr>
<th>Automation (Speed of Technological Advancement)</th>
<th>Connectivity</th>
<th>Cooperation</th>
<th>Price</th>
<th>Private Uptake</th>
<th>Shared Uptake (in areas served)</th>
<th>Shared Footprint</th>
<th>Scenario Name</th>
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<tr>
<td>Slow</td>
<td>Possibly</td>
<td>Low; competing platforms</td>
<td>More than current TNCs</td>
<td>High</td>
<td>Less than current</td>
<td>Smaller than current</td>
<td>Slow Roll</td>
</tr>
<tr>
<td>Fast</td>
<td>Not Required</td>
<td>Low; competing</td>
<td>Less than current TNCs</td>
<td>Moderate (in areas served)</td>
<td>Moderate</td>
<td>Most profitable locations</td>
<td>Competing Private</td>
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<tr>
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<tr>
<td>Fast</td>
<td>Necessary</td>
<td>Among Privates and Public; Centralized</td>
<td>?????</td>
<td>Moderate (in areas served)</td>
<td>Higher</td>
<td>Comparable to your current transit system</td>
<td>Integrated Public/Private</td>
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## Viable Scenarios

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Shared Mobility Deployment

Source: Uber website (5/22/17).
Potential MaaS Markets
Key Takeaways……

• Currently being driven by the private sector and market (…..follow the industry…..)

• Pricing will influence usage

• Shared won’t be everywhere, so what it looks like will depend on local conditions

• Ride-hailing is impacting transit usage, so how do we integrate the positives while managing the negatives?

• We need to begin to rethink the mission and roles of our departments of transportation and transit agencies
Steps for Kentucky
 Autonomous Vehicle Playbook

Few things fundamentally affect the nature, feel, and operation of a city like its transportation system. Decisions about it affect nearly every facet of the community, and so, it is crucial to Louisville’s future that as major changes emerge, Metro will stand ready to make the most informed decisions possible. Based on the level of testing underway and a raft of announcements from car makers and mobility providers, the commercial availability of autonomous vehicles (AVs) seems imminent. While projections of how, and how quickly, the technology will be adopted are still being debated, the potential for AVs to have a dramatic impact on how people and goods move to, from, and around makes for a compelling case to begin research and work toward the adoption of a policy framework that prepares for this technological shift while ensuring that mobility is enhanced in an equitable manner for all of Louisville’s residents.

MOVE Louisville, Louisville’s 20 year transportation plan, calls for eight policy initiatives to meet existing needs, anticipate the future demands of transportation users and ensure long term sustainability and high quality of life. One of those eight policies...
Louisville AV Playbook: Values

- Connected
- Healthy
- Authentic
- Sustainable
- Equitable
Louisville AV Playbook: Plays

- **Play 1**: Ensure that major infrastructure decisions focus on moving people and consider the effects of AVs.

- **Play 2**: Forge public and private partnerships to prepare for new regulatory and technological challenges, anticipate emerging technologies, and establish best practices.

- **Play 3**: Prepare for fundamental shifts in parking demand.

- **Play 4**: Ensure AV technology supports TARC operations to strengthen our transit system.

- **Play 5**: Develop and maintain transportation technology and data infrastructure to encourage innovation and promote accountability.
“The best way to predict the future is to create it.”
New Mobility Now
Resources
TCRP Research Report 195 Pre-Publication Draft—Subject to Revision

Broadening Understanding of the Interplay Between Public Transit, Shared Mobility, and Personal Automobiles

Sharon Felgon
Colin Murphy
Shared-Use Mobility Center
Chicago, Illinois

Submitted January 2018

DISCLAIMER
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SPECIAL NOTE: This document IS NOT an official publication of the Transportation Research Board or the National Academies of Sciences, Engineering, and Medicine. A final, edited version of this document will be released at a later date.
Reshaping Urban Mobility with Autonomous Vehicles
Lessons from the City of Boston

In collaboration with The Boston Consulting Group

June 2015
Resources

THREE REVOLUTIONS
STEERING AUTOMATED, SHARED, AND ELECTRIC VEHICLES TO A BETTER FUTURE

DANIEL SPERLING
The New Automobility: Lyft, Uber and the Future of American Cities

July 25, 2018
http://smartdrivingcar.com/GreenLight-092316

Friday, September 23, 2016

NHTSA Federal Automated Vehicles Policy: Accelerating the Next Revolution In Roadway Safety

September 2016, "Executive Summary...For DOT, the excitement around highly automated vehicles (HAVs) starts with safety. (p5)

...The development of advanced automated vehicle safety technologies, including fully self-driving cars, may prove to be the greatest personal transportation revolution since the popularization of the personal automobile nearly a century ago. (p5)

...The benefits don’t stop with safety. Innovations have the potential to transform personal
Autonomous Vehicles

Autonomous and connected vehicle technology is expected to transform the nation’s transportation system over the coming decades, with major implications for the planning and design of cities and regions. Autonomous vehicles (AV), also known as driverless or self-driving cars, have been sharing city streets for several years.

This technology is moving very quickly, with the 11 largest automakers planning to have fully-autonomous vehicles on highways between 2018 and 2021 (arriving somewhat later in urban driving conditions). AV technology, as defined by the International Society of Automotive Engineers, ranges from a baseline of no automation, up to five levels of increasing autonomy:

- Level one, driver assistance (e.g., adaptive cruise control)
- Level two, partial automation (e.g., Tesla’s autopilot)
- Level three, conditional automation (e.g., human drivers serve as backup for an autonomous system that operates under certain conditions)
Integrating Ridesharing into Transit Operations (November 9, 2017)

The U.S. Department of Transportation (USDOT) will be hosting a webinar which will discuss how to integrate ridesharing opportunities into transit operations. This webinar will allow interested stakeholders to learn about different approaches for rideshare-transit integration.

Participants will hear from Uber and Via regarding their partnerships and integration with transit operations.

Traditional transit operations are designed to maximize the number of people served and optimize the service provided to as many of those people as possible. However, if a potential rider lives or works outside a half mile radius from the nearest stop, the rider usually forgoes transit use. Ridesharing (and other Mobility on Demand) services have rapidly growing to bridge this first-mile/last-mile gap in transit coverage. Our speakers will discuss the integration of their ride sharing platforms with traditional transit operations.

This webinar is sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO) and is free and open to the public.

To learn more about the ITS JPO, please visit: www.its.dot.gov

If you have any questions about this webinar, please contact Kevin Vitta (ITS America) at kvitta@itaa.org

Date & Time:
Thursday, November 9, 2017
1:00 PM - 2:00 PM ET

Presenters:
The Race for Automated Mobility

Stephen Buckley, P.E., AICP
2018 ACEC-KY\FHWA\KYTC Partnering Conference
September 5, 2018
Discussion Questions

‒ How do we use technology to capture the positives and manage the negatives?

‒ Should we be shifting to a more demand-responsive system? If so, how do we do it without undermining existing transit services?

‒ What does “public transportation” of the future look like?

‒ What does the public transportation agency of the future look like?

‒ What is the road map for migrating to a new model?

‒ What steps can agencies take now?