



## How New Technologies and Autonomous Vehicles May Impact Transportation

**TBRPC**

Steven E. Polzin, PhD.  
Monday, February 8, 2016



## The Automated Vehicle Institute™ @ CUTR

The Center for Urban Transportation Research has established The Automated Vehicle Institute™ @ CUTR to assist communities, businesses, and government in navigating complex policy and planning issues that will accompany the evolution of connected and automated vehicles

# We are in Perhaps the Most Transformational Period in Transportation Since the Development of Personal Vehicles

**Demographics**

**Economics**

**Technology**

**Governance**

**Culture/values**



# The Public is Being Bombarded with Stories on Autonomous Vehicles



Chris Urmson, Director of the Google Self-Driving Car Program

**Will your driverless car kill you so others may live?**  
Los Angeles Times, 2015

**Cop pulls over Google self-driving car - going 24 in 35 mph zone**

CNN November 13, 2015



# The Business World Is Being Rocked by Technology Deployed for Transportation

**Uber Valuation Put at \$62.5 Billion After a New Investment Round**

By [MIKE ISAAC](#) and [LESLIE PICKER](#), New York Times, DEC. 3, 2015

- GM \$53.6 B
- Ford \$54.09
- Tesla \$29.08

**GM is Investing \$500 Million in Lyft to Develop Self-Driving Cars**

January 2016

**Google, Ford in Talks on Self-Driving Car Partnership**

December 2015

**Toyota Chief Shifts to Self-Drive:** Akio Toyoda, once a skeptic, steers automaker into autonomous vehicle race.

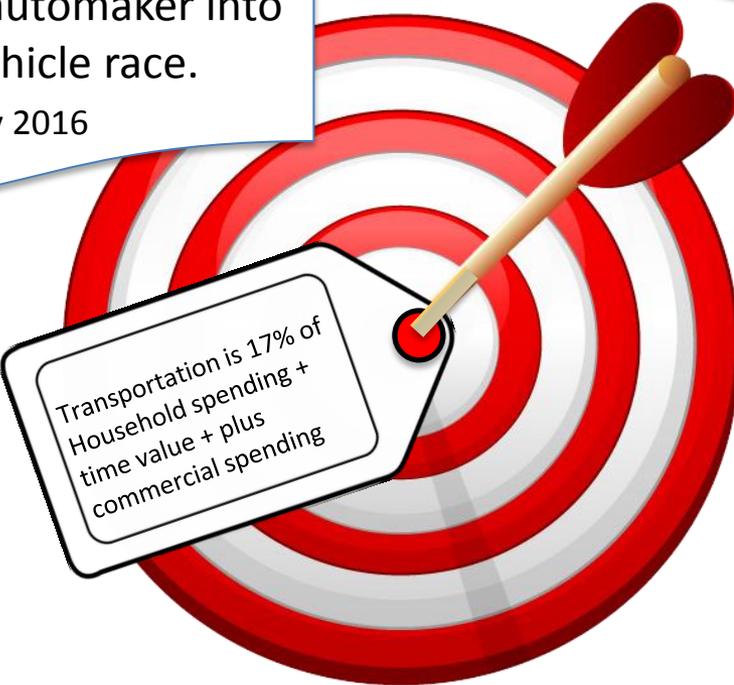
WSJ, January 2016

**Transportation as a Service Envisioned as Massive Global Market Opportunity**

Uber  
Google  
Apple



Ford  
Chrysler  
GM



Transportation is 17% of Household spending + time value + plus commercial spending

# How Disruptive?

## **Self-driving buses will be a big part of the transit puzzle**

Roberto Baldwin , @strngwys  
January 2016

<http://www.engadget.com/2016/01/01/self-driving-buses-will-be-a-big-part-of-the-transit-puzzle/>

## **What Will Happen to Public Transit in a World Full of Autonomous Cars?**

From the Atlantic, CITYLAB

January 2014

<http://www.citylab.com/commute/2014/01/what-will-happen-public-transit-world-full-autonomous-cars/8131/>

## **Driverless Cars: What Could Possibly Go Wrong?**

by Robert Hutchinson  
Harvard Business Review

January 2016

[https://hbr.org/2016/01/driverless-cars-what-could-possibly-go-wrong?utm\\_source=feedburner&utm\\_medium=feed&utm\\_campaign=Feed%3A+harvardbusiness+%28HBR.org%29](https://hbr.org/2016/01/driverless-cars-what-could-possibly-go-wrong?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+harvardbusiness+%28HBR.org%29)

## **Autonomous Vehicles' Disruptive Potential for Transit**

Surface Transportation News #147  
January 2016

<http://reason.org/news/printer/surface-transportation-news-147>

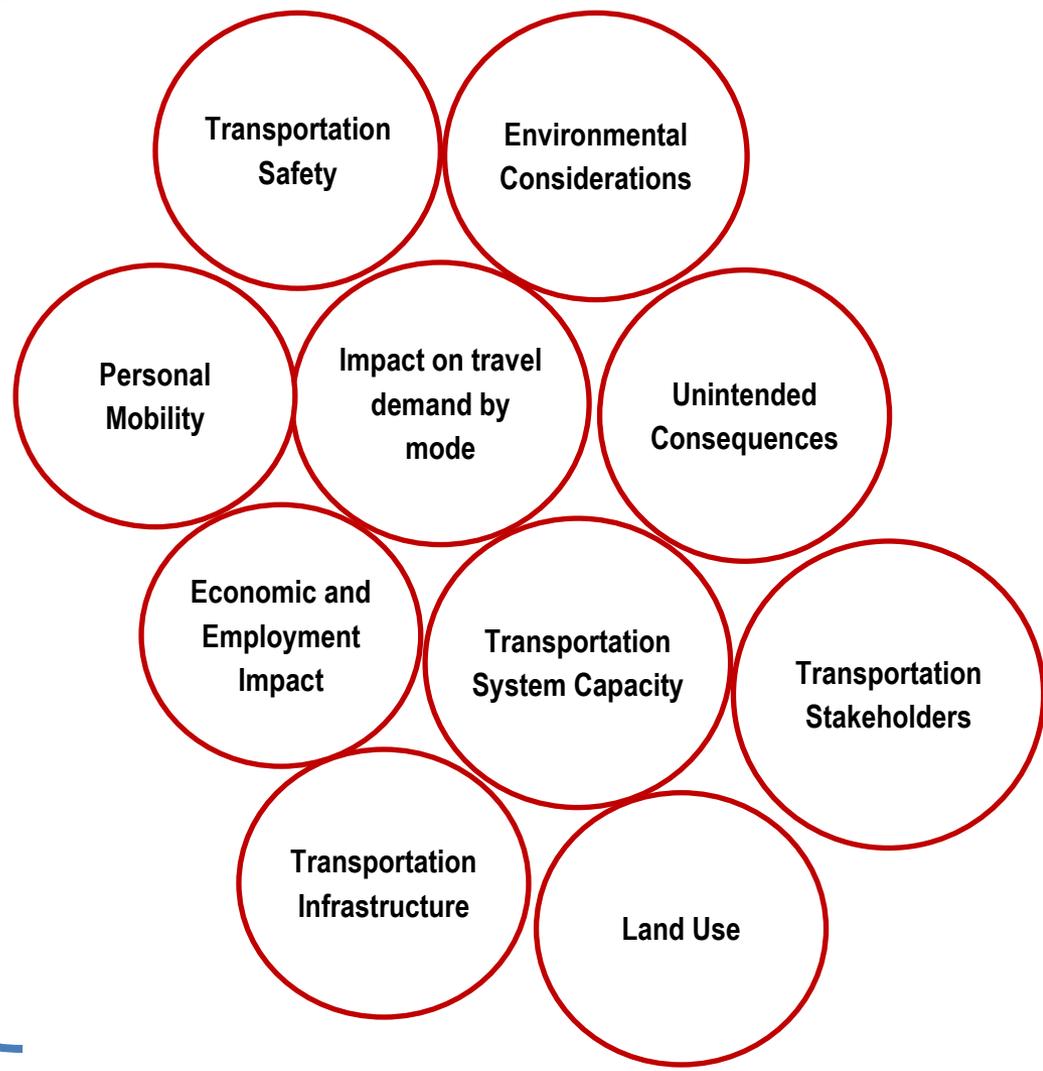
## **Urban Transit's Uncertain Future**

NOVA NEXT

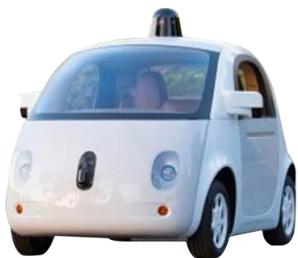
January 2016

<http://www.pbs.org/wgbh/nova/next/tech/urban-transits-uncertain-future/>

# Consequences



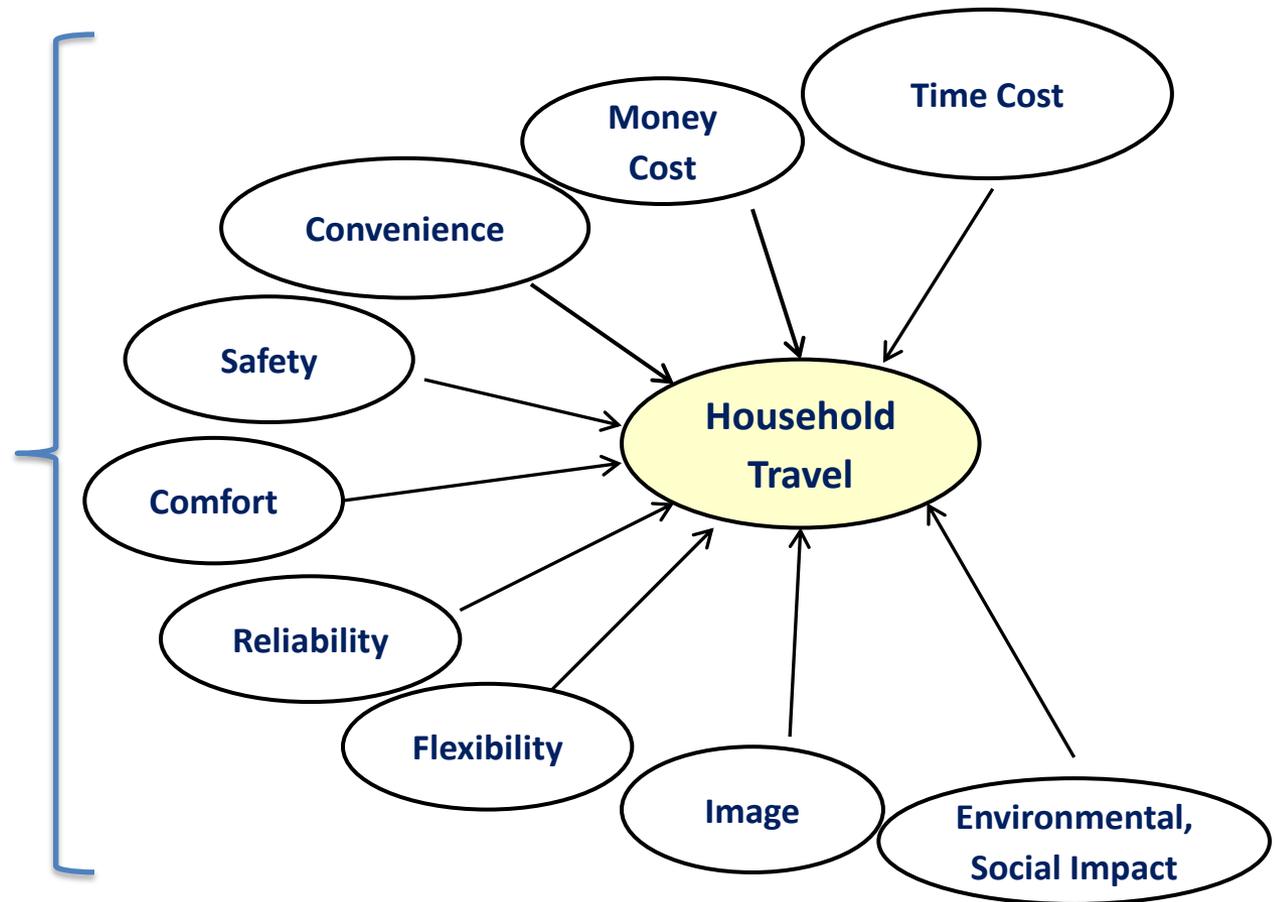
## Travel Behavior



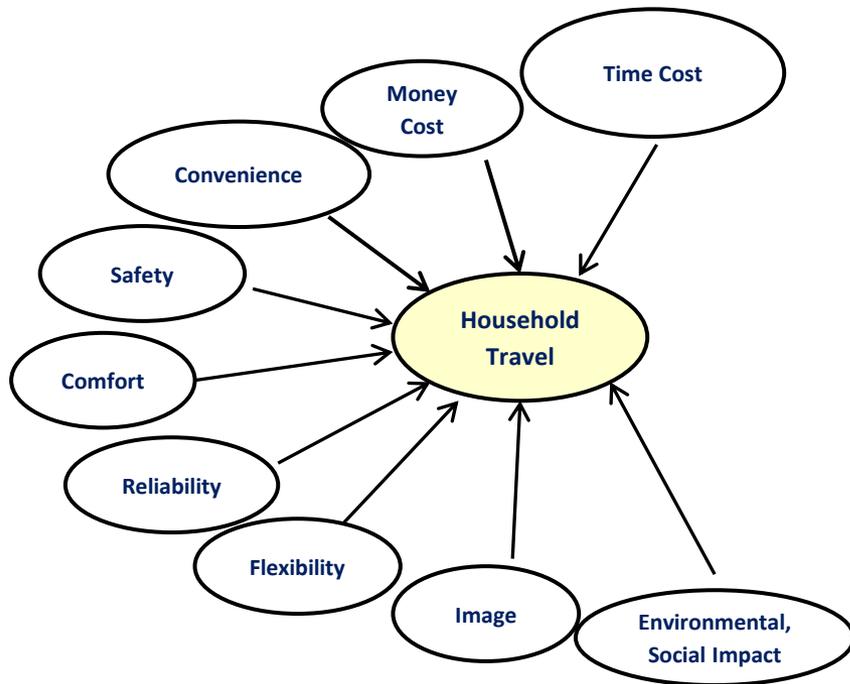
# Factors that Influence Travel Behavior

## Technology Enables:

- Real time information
- Electronic payment
- Trip planning
- Trip scheduling
- Navigation/trip tracking
- Electronic hailing
- Trip aggregating /ride matching
- Dynamic pricing
- Electronic satisfaction feedback
- Automated driving



# Factors that Influence Travel Behavior

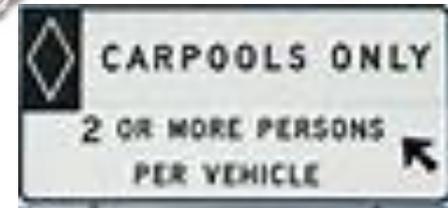
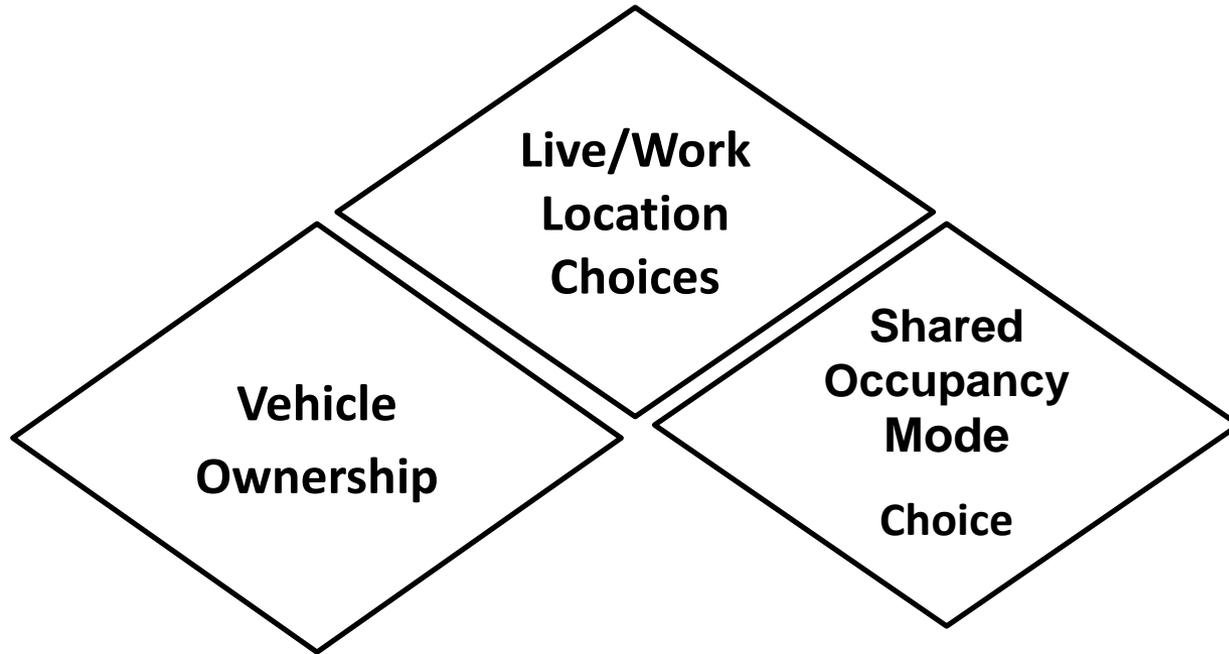


## Traditional Travel Decision Making (4-Step Process)

*e-commerce,  
e-learning,  
streaming media,  
etc.*

1. Number of Trips Made  
(trip generation **vs. communication**)
2. Destination Choice (trip distribution **impacted by better knowledge of choices**)
3. Mode Choice
  - Drive personal traditional car
  - Ride in my automated car
  - Hail automated car
  - Ride with family/friend
  - Taxi
  - Ridesourcing, e-hailing, Uber, Lyft, ~~Sidecar~~
  - Ridesharing - Carma, eRideShare
  - Carsharing
  - Personal bike
  - Bikesharing
  - Transit
  - Transit Alternatives/Feeders  
"microtransit", Bridj, ~~Leap~~, MetroBee, TransLoc
  - Walk
4. Path Assignment (Choice **assisted by real time information**)

# Impacts of Technology is Highly Dependent on Three Key Decisions



# Cost of Mobility Options

Source: IRS	Auto Capital and Operating Cost (business)	\$0.54/mi., \$0.575 in 2015	
	Variable Cost (moving and medical)	\$0.19, \$0.23 in 2015	
	Out of Pocket (charitable, by statute)	\$0.14	Auto owners "feel" \$0.14 per mile costs
	BLS Consumer Expenditure Survey	\$0.44/ vmt \$0.26/ pmt	in mode choice decision
	<b>Transit Fares</b>	<b>~ \$0.24/mi</b>	
	<b>TNC (Uber, Lyft)</b> (sequentially shared vehicle, not concurrently shared ride)	<b>~\$0.65-2.00/mi</b>	
	<b>Automated Vehicle (shared ride)</b>	<b>~&lt;\$0.20-????</b>	

# Envisioned Cost Structures Imply Possible New Institutional Roles Governing/Providing Mobility



Government



Self



Family



Community



Private sector



# Land Use Impacts

What will automated mobility enable?

Without having to own and park a car I can afford the urban lifestyle.



After a day at the office and a nap on the ride home I can enjoy the great outdoors.

# Land Use Impacts

**Drive till you qualify  
becomes nap till you  
qualify?**

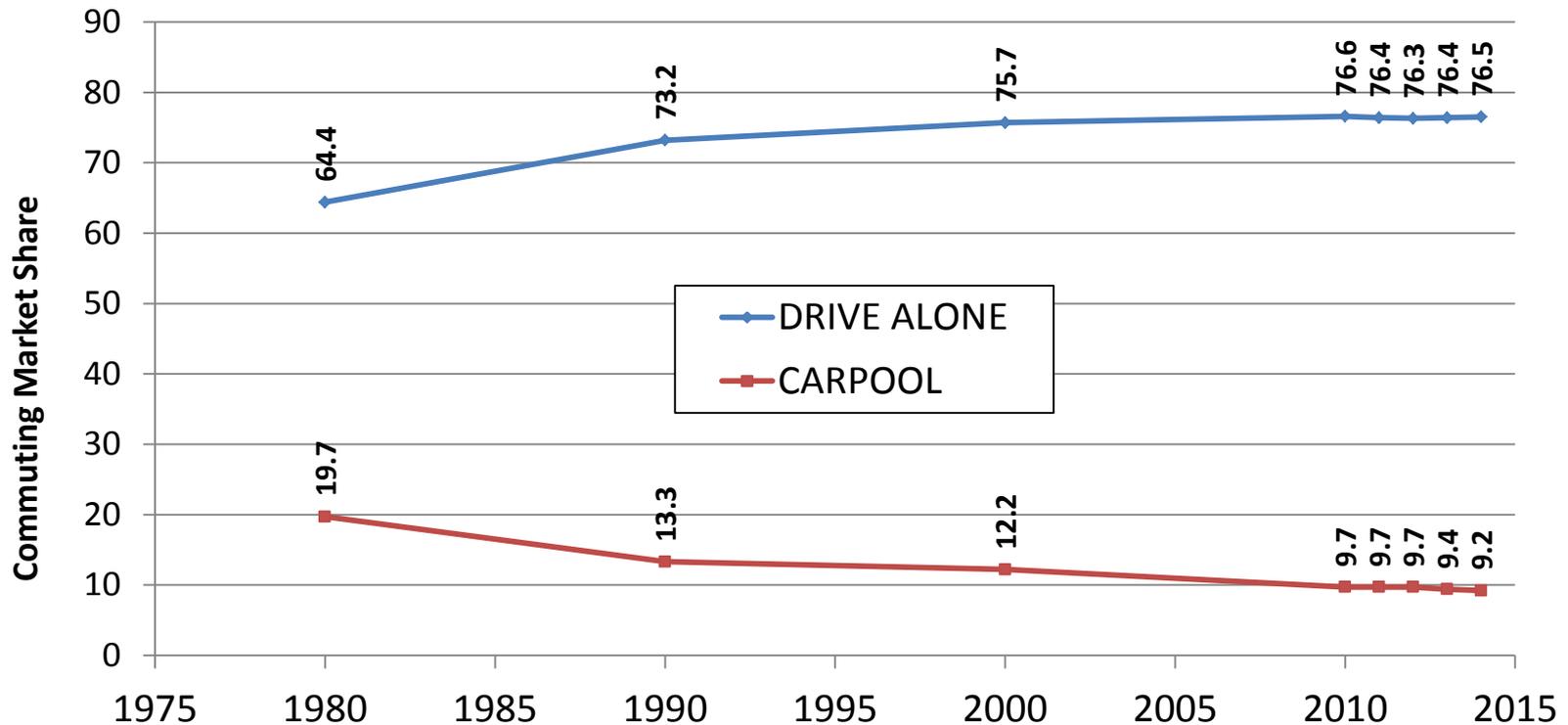
**More house and less  
garage?**



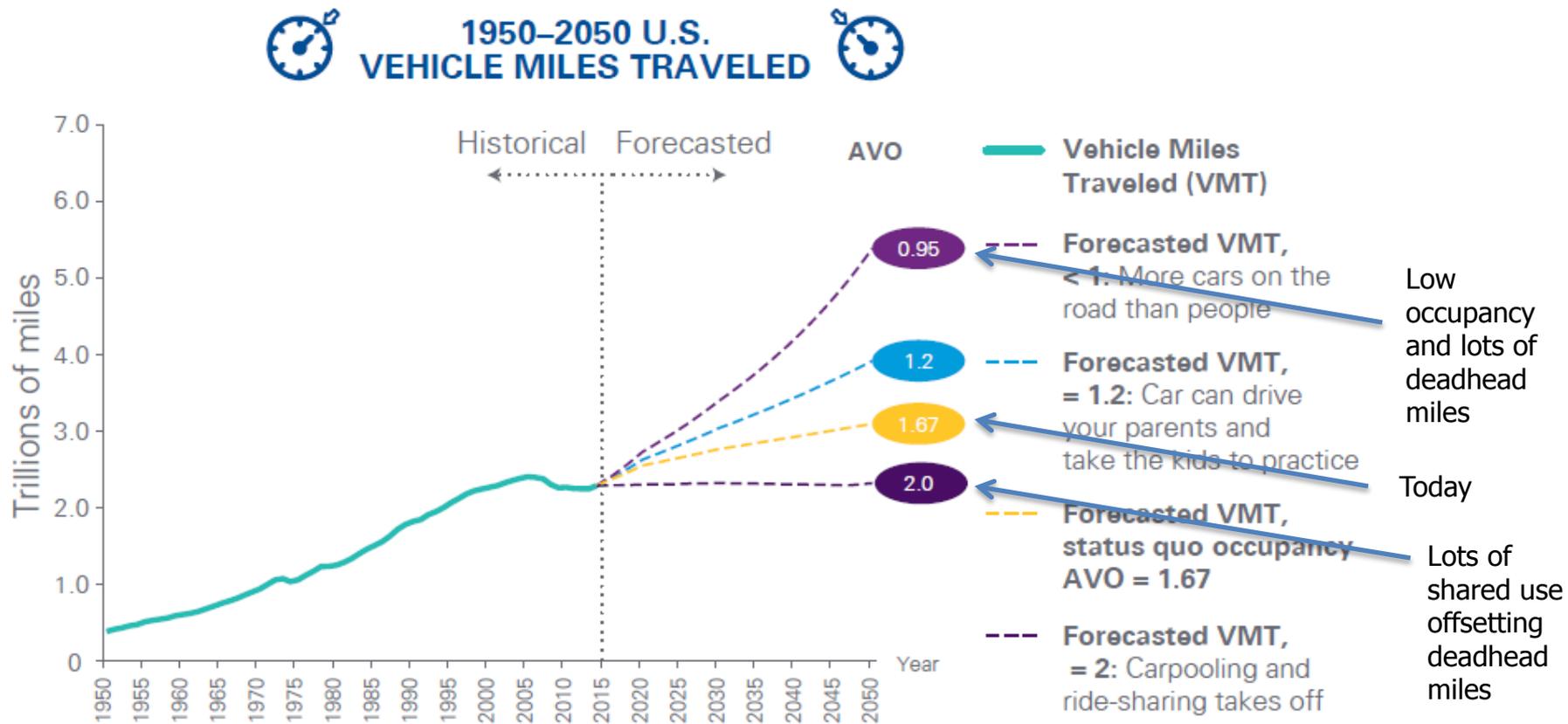
# Do Travelers Want to Share a Ride?



## The Demise of Carpooling?



# Impact on VMT Scenarios



Note: (a) Discounted 25% from U.S. BTS total VMT for 1995, 2001, 2009, 2014 (assumed to be commercial miles), (b) Multiplied by NHTS occupancy rates applied 2009 rate to 2014 numbers).

Source: U.S. BTS data, NHTS data, U.S. Census data, KPMG Analysis

# Transit's Strategic Response?



- 1. Strive to understand/monitor the impact of technology on travel behavior**
- 2. Leverage the emerging modes/services to complement transit**
- 3. Leverage the emerging technologies within transit operations**
- 4. Be at the table in preparing for and adapting to new technologies**
- 5. Advocate for transit's goals/strengths**
- 6. Acknowledge the uncertainty and adapt long-range planning to mitigate risk**

# Planning Challenges?

None of the MPOs most likely to be planning for self-driving cars have incorporated them into their most recent RTPs. 2 Of the twenty-five largest MPOs, only Philadelphia's Delaware Valley Regional Planning Commission mentions autonomous vehicles at all.

- There is a great deal of uncertainty about what technologies will prevail, how much and when they will penetrate the market, whether regulation will hinder or support deployment, what the direct impacts will be on capacity or safety, and how consumers will respond.
- Driverless cars and their potential impacts are too far removed from decisions about whether and how to invest in and maintain transportation infrastructure.
- Vehicle automation is just one of a number of radical changes that could influence regional transportation over the next 30 years. Staff also mentioned changes in federal transportation funding, 3D printers, improvements in telecommunications, and the impacts of and policies to address climate change as potential game-changers.

"Planning for Cars That Drive Themselves: Metropolitan Planning Organizations, Regional Transportation Plans, and Autonomous Vehicles", Erick Guerra, *Journal of Planning Education and Research*, 2015

# Integrating Smart Technology with Dumb Infrastructure



## A Path Toward Success

Policy makers and industry professionals with input from the public should strive to find ways for the positive benefits of technology to be realized without ego, greed, self interest, lust for power, or incompetence denying the public the full benefits of new technologies.



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