



Photo courtesy
Waymo, a self-driving technology company at Alphabet Inc.
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Planning for Autonomous Vehicles

Transportation Policy Committee
November 15, 2017

SAFETY

94
PERCENT
of U.S. crashes involve
human error. [1]

1.2
MILLION
deaths worldwide
due to vehicle crashes
in 2013. [2]

37,461
ROAD DEATHS
in the U.S. in 2016 and
2.4 million injuries
in 2015. [3]

2
OUT OF 3
people will be involved
in a drunk driving crash
in their lifetime. [4]

SOCIETY

\$594
BILLION
in harm from loss of life and
injury each year. [5]

\$277
BILLION
in annual economic costs. [6]

\$160
BILLION
in gas burned and
time lost each year. [7]

MOBILITY AND QUALITY OF LIFE

3
MILLION
Americans age 40 and older
are blind or have low vision. [8]

79
PERCENT
of seniors age 65 and older
living in car-dependent
communities. [9]

42
HOURS
wasted in traffic each year
per person. [7]

Important Facts About the Current State of Travel

Source: "On the Road to Fully Self Driving – Waymo Safety Report", Waymo, Inc., October 2017

For on-road vehicles



		Steering and acceleration/ deceleration	Monitoring of driving environment	Fallback when automation fails	Automated system is in control
Human driver monitors the road	0 NO AUTOMATION				N/A
	1 DRIVER ASSISTANCE				SOME DRIVING MODES
	2 PARTIAL AUTOMATION				SOME DRIVING MODES
Automated driving system monitors the road	3 CONDITIONAL AUTOMATION				SOME DRIVING MODES
	4 HIGH AUTOMATION				SOME DRIVING MODES
	5 FULL AUTOMATION				

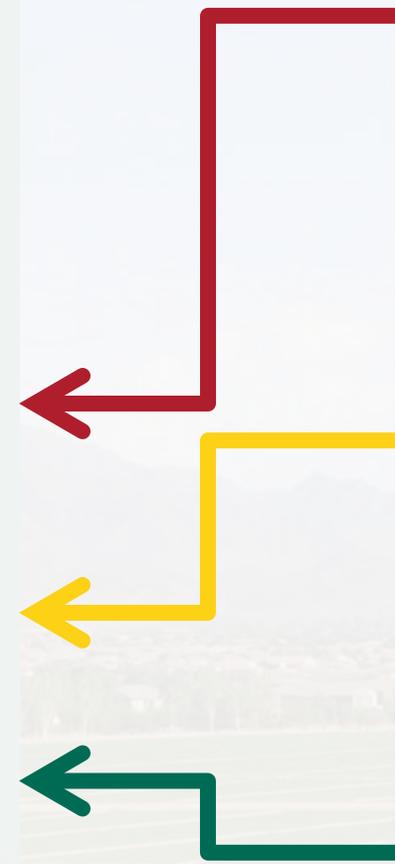
GM "Super Cruise"



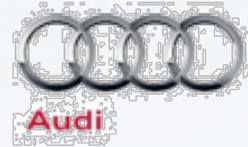
Tesla Model S



Waymo (Google)



Levels of Automation



BOSCH

DAF

DAIMLER

DELPHI



Google



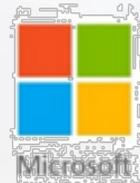
HONDA



IVECO



Mercedes-Benz



RENAULT



PSA
GROUPE



TATA ELXSI
engineering creativity

TESLA



TOYOTA



Volkswagen



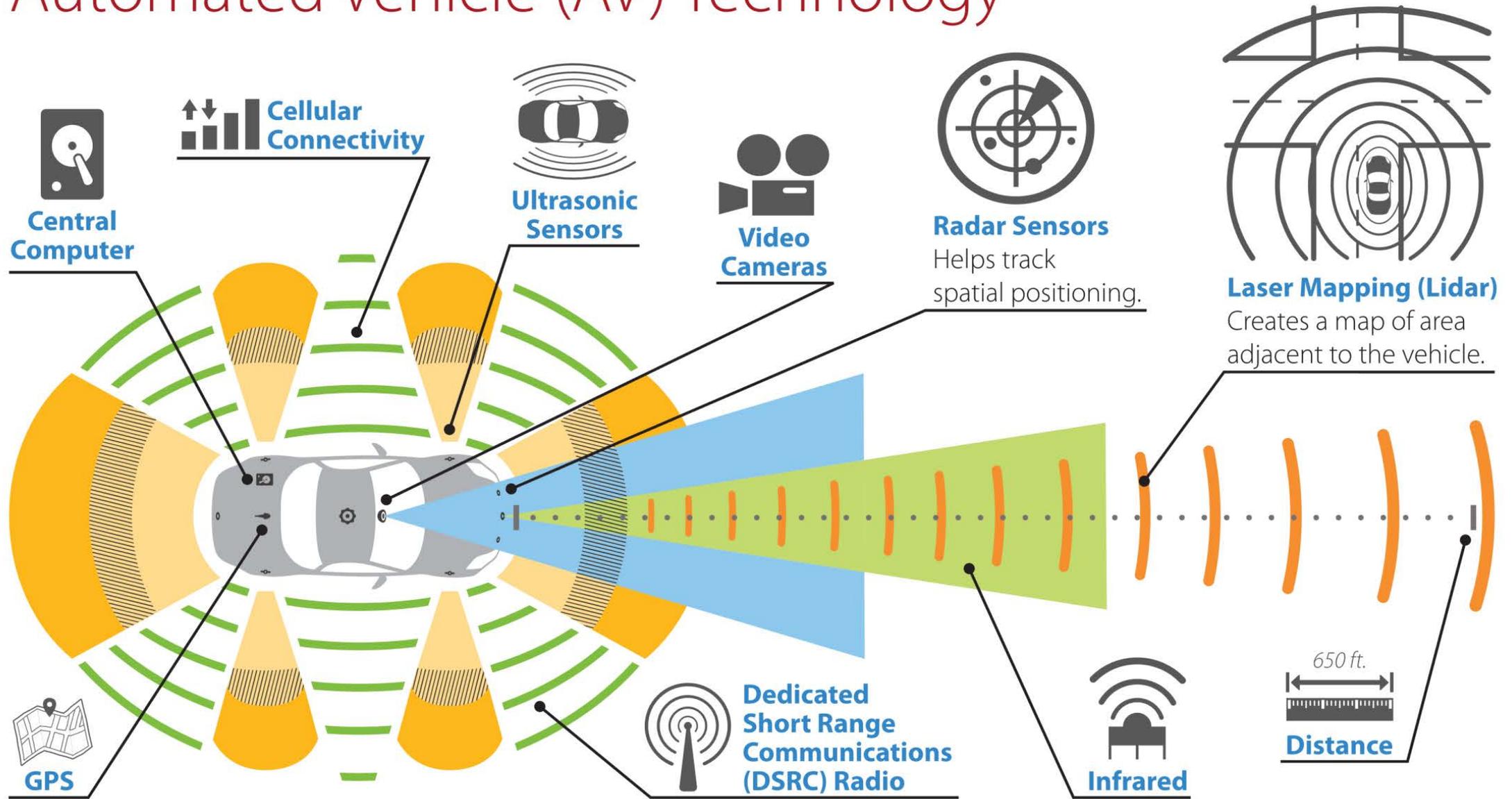
YUTONG

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GOVERNMENTS

Automated Vehicle (AV) Technology



How will autonomous vehicles arrive?

Fully
Autonomous

Personal Automation



**Shared Automated/
Platooning**



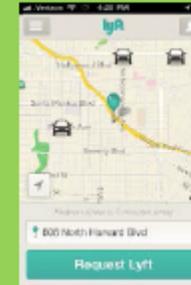
Semi-
Autonomous

Driver

Business as Usual

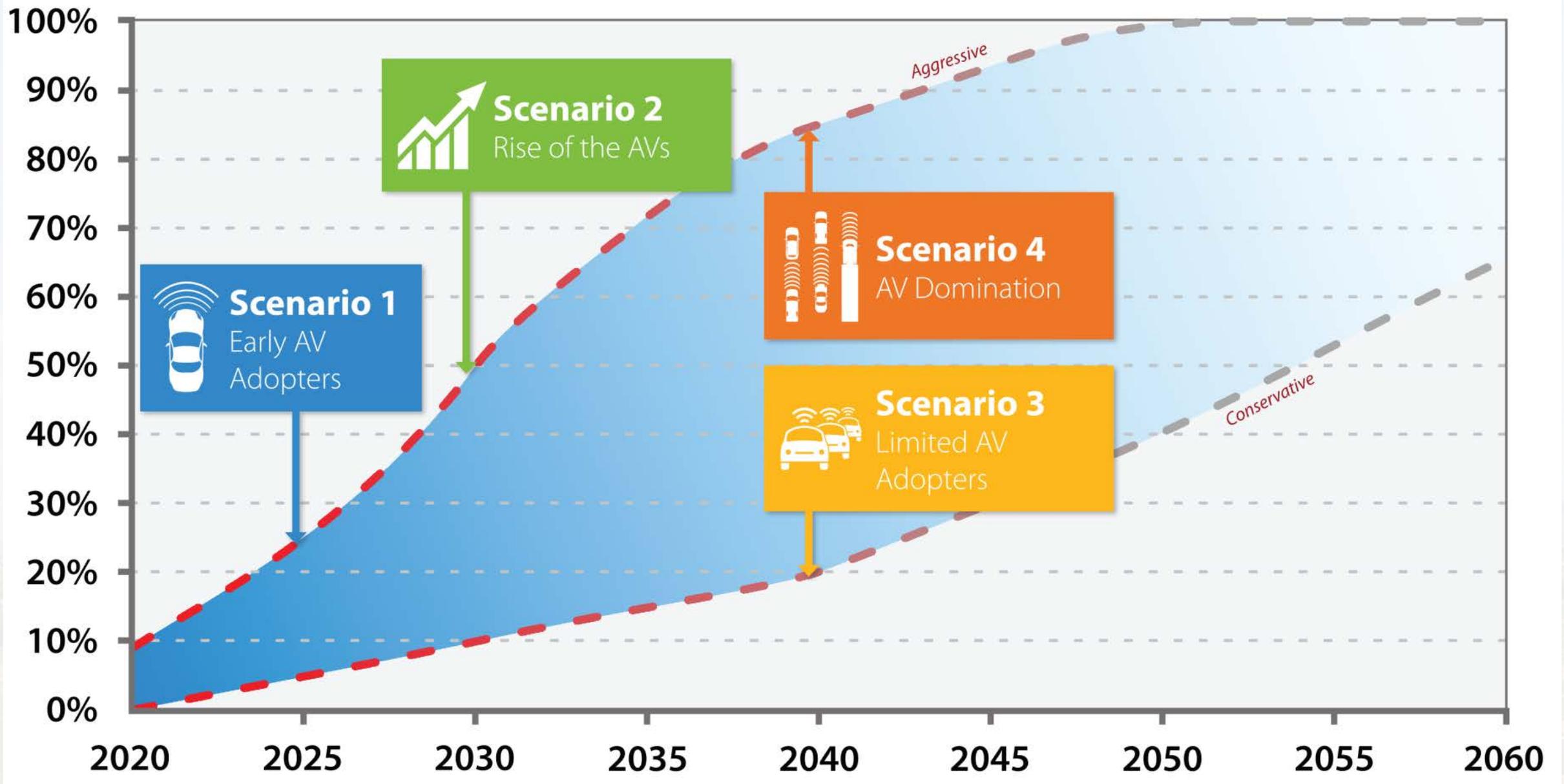


Shared Mobility



Personally Owned

Mobility Fleets



50% Penetration for Partial AV by 2030 or Not

Source: HDR Engineering, Inc.



**Why does this
matter?**

**How does this
effect us?**

Ford Motor Company Photo
Downloaded 10/16/2017



Where Self-Driving Cars Go to Learn

Arizona's promise to keep the driverless car industry free of regulations has attracted dozens of companies, including Uber, Waymo and Lyft.

By CECILIA KANG NOV. 11, 2017

A Unique Opportunity . . .



New Travel Choices
Ridesharing
Reduced Car Ownership



Repurposed Parking
Space for Housing
Public Space



Safer Streets
Improved User Experience
Efficient Network Management



Higher Efficiency Transit
Lower Operating Costs

...but not without risks.



Increased VMT
Empty Vehicle Circulation
Fight for the Market



Urban Sprawl
Higher Congestion
Longer Travel Times



Cyber Attacks
Privacy Concerns

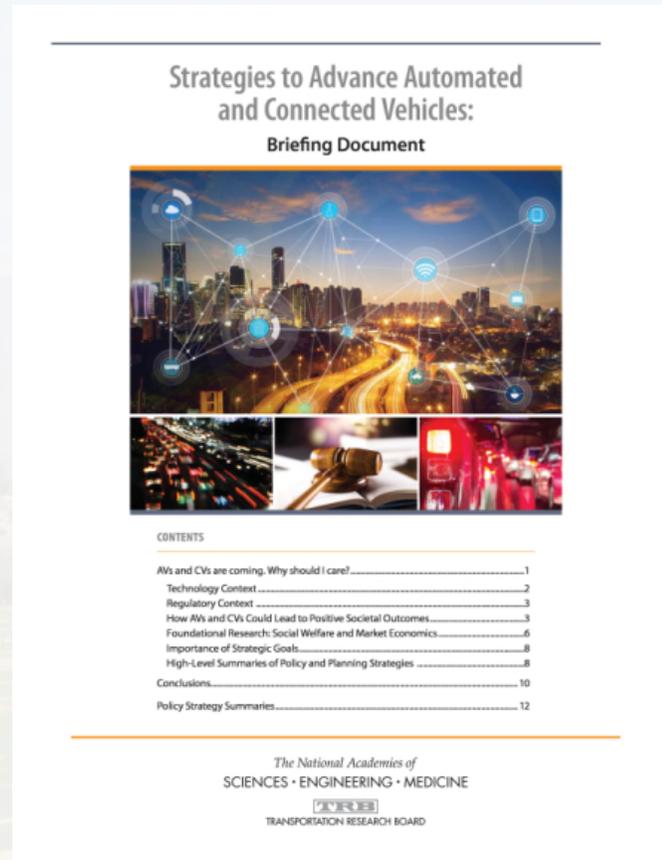


Declined in Transit Use
Inequity

Literature Review Ranges for Key Variables



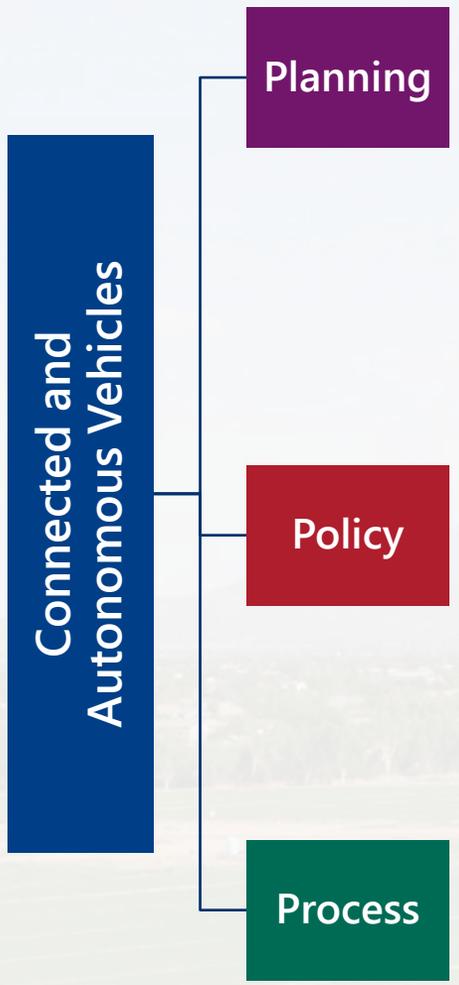
Research

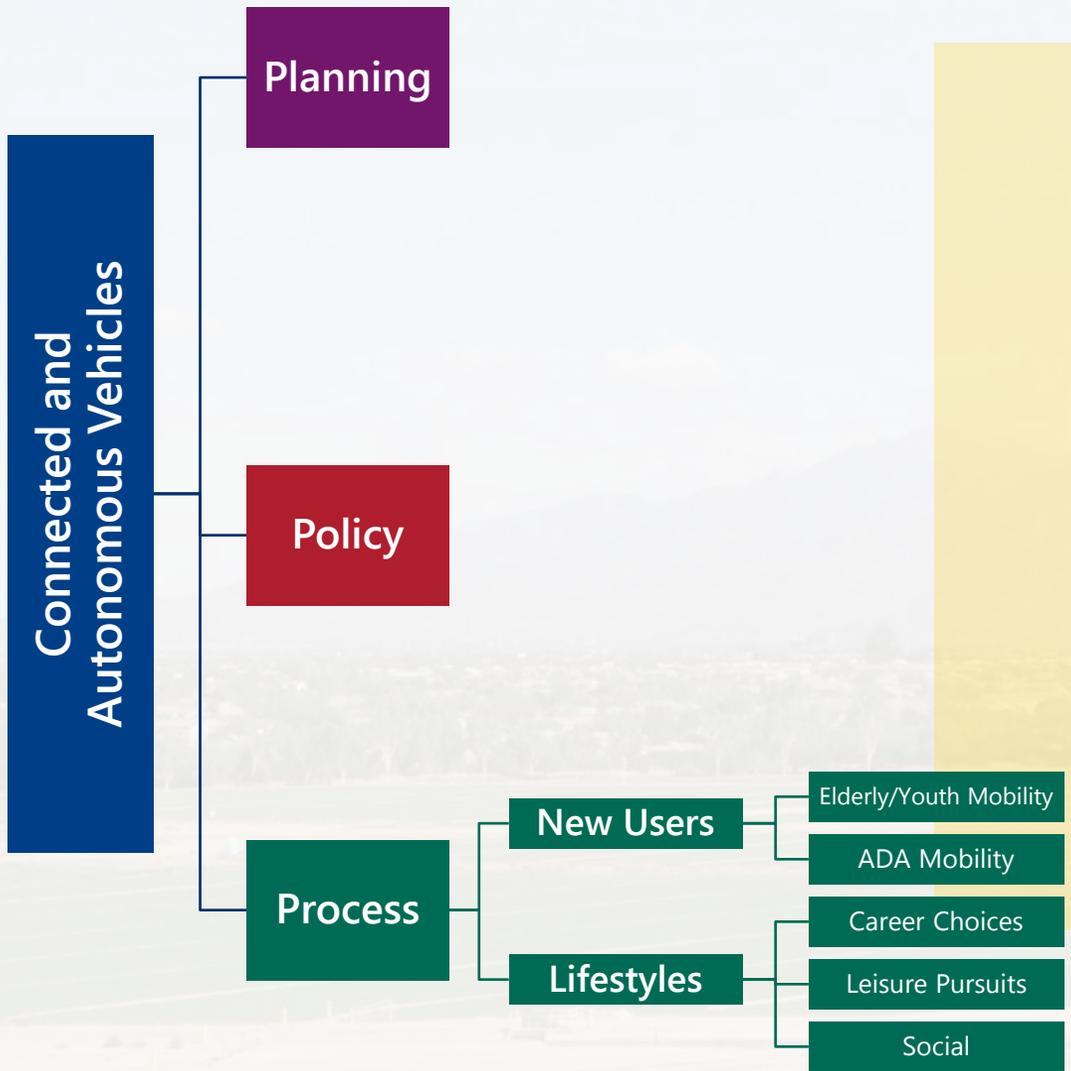


The National Academies of Science, Engineering, and Medicine

Transportation Research Board

U.S. Department of Transportation ▪ Federal Highway Administration ▪ Federal Highway Administration ▪ Federal Transit Administration ▪ National Highway Traffic Safety Administration ▪ State Departments of Transportation ▪ American Association of State Highway and Transportation Officials ▪ Association of Metropolitan Planning Organizations ▪ National Association of Regional Councils ▪ National League of Cities



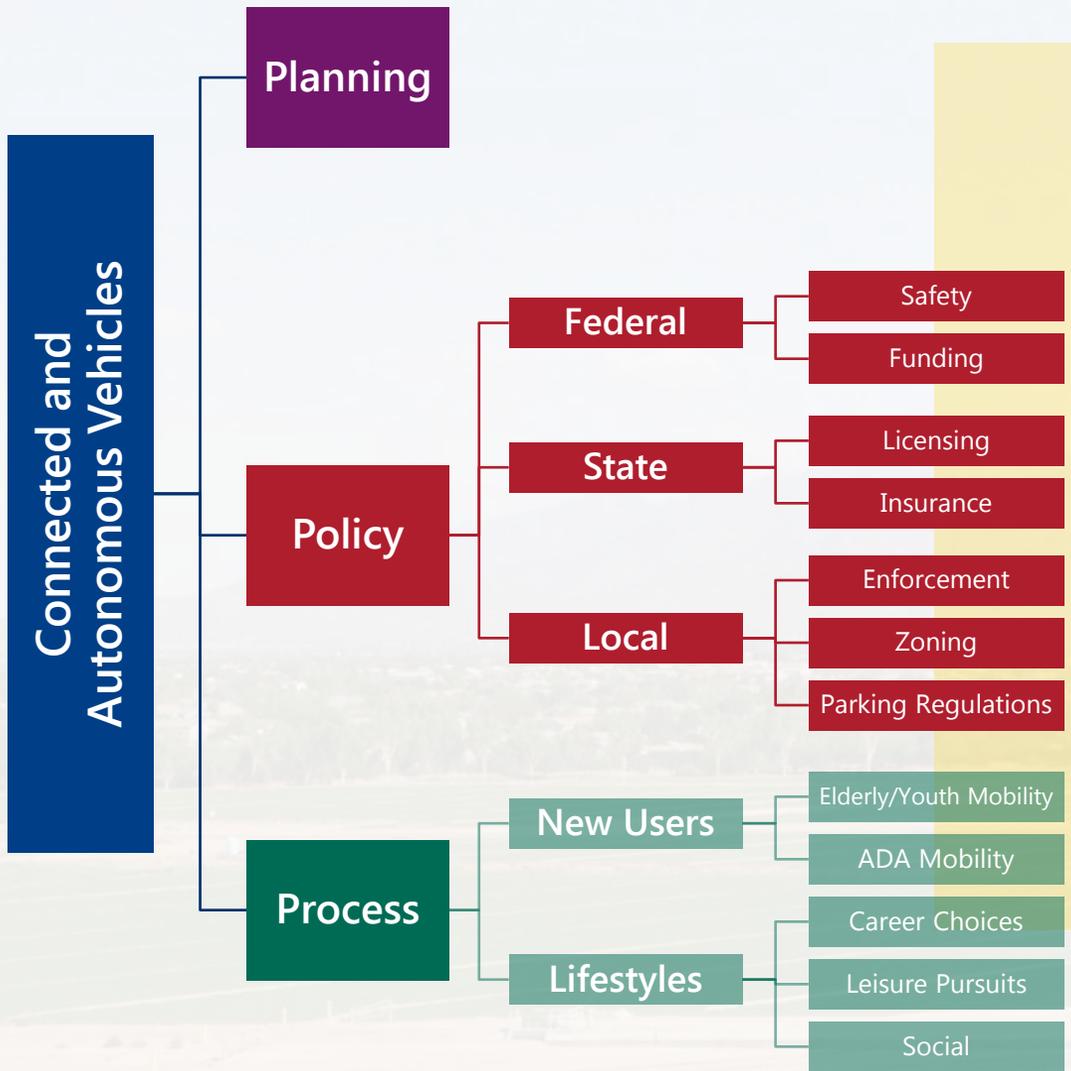


Potential Benefits

	Driving Externality	Connected Vehicles	Autonomy	Share Autonomy	Electric Fleet
Safety	😊	😊	😊	😊	😐
Congestion	😊	❓	😊	😊	😐
Emissions	😊	😐	😐	😐	😊
Land Use	😐	❓	😊	😊	😐
Mobility	😐	😊	😊	😊	😐

😊 Strong 😊 Some 😐 Weakest ❓ Uncertain

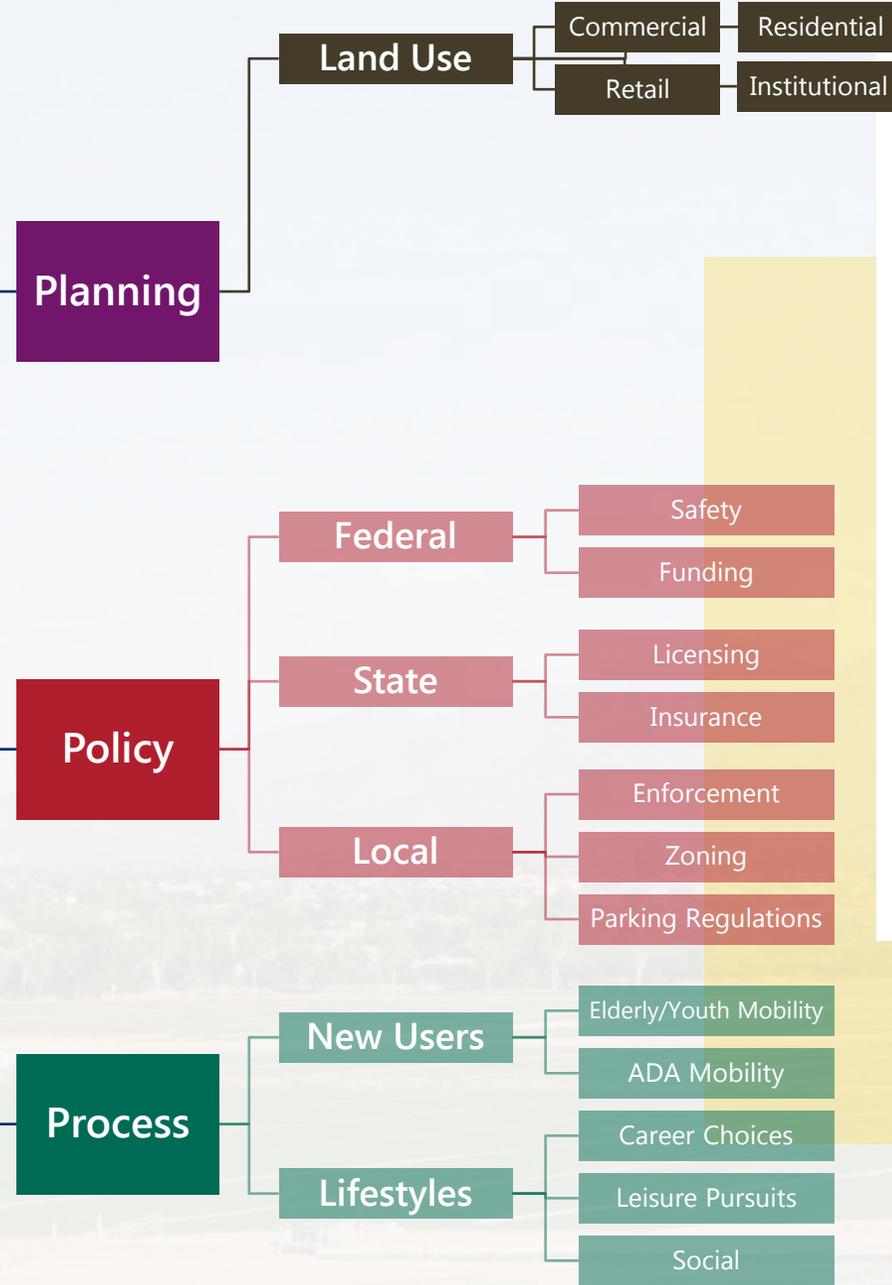
Source: NCHRP Research Report 845, Advancing Automated and Connected Vehicles: Policy and Planning Strategies for State and Local Transportation Officials, Transportation Research Board, The National Academies of Sciences, Engineering, and Medicine, Washington DC, August 2017.



- **Economic Instruments**
 - Fuel Taxes
 - Value Added Taxes
 - Vehicle Age Taxes
- **Regulatory Instruments**
 - Insurance Requirements
 - Establish/Update Rules of the Road and License Requirements
- **Structure of Private Rights**
- **Service Provisions**
- **Information/Education**
- **Financing/Contracting/Collaboration**

Source: NCHRP Research Report 845, *Advancing Automated and Connected Vehicles: Policy and Planning Strategies for State and Local Transportation Officials*, Transportation Research Board, The National Academies of Sciences, Engineering, and Medicine, Washington DC, August 2017.

Connected and Autonomous Vehicles



When car ownership fades, this parking garage will be ready for its next life



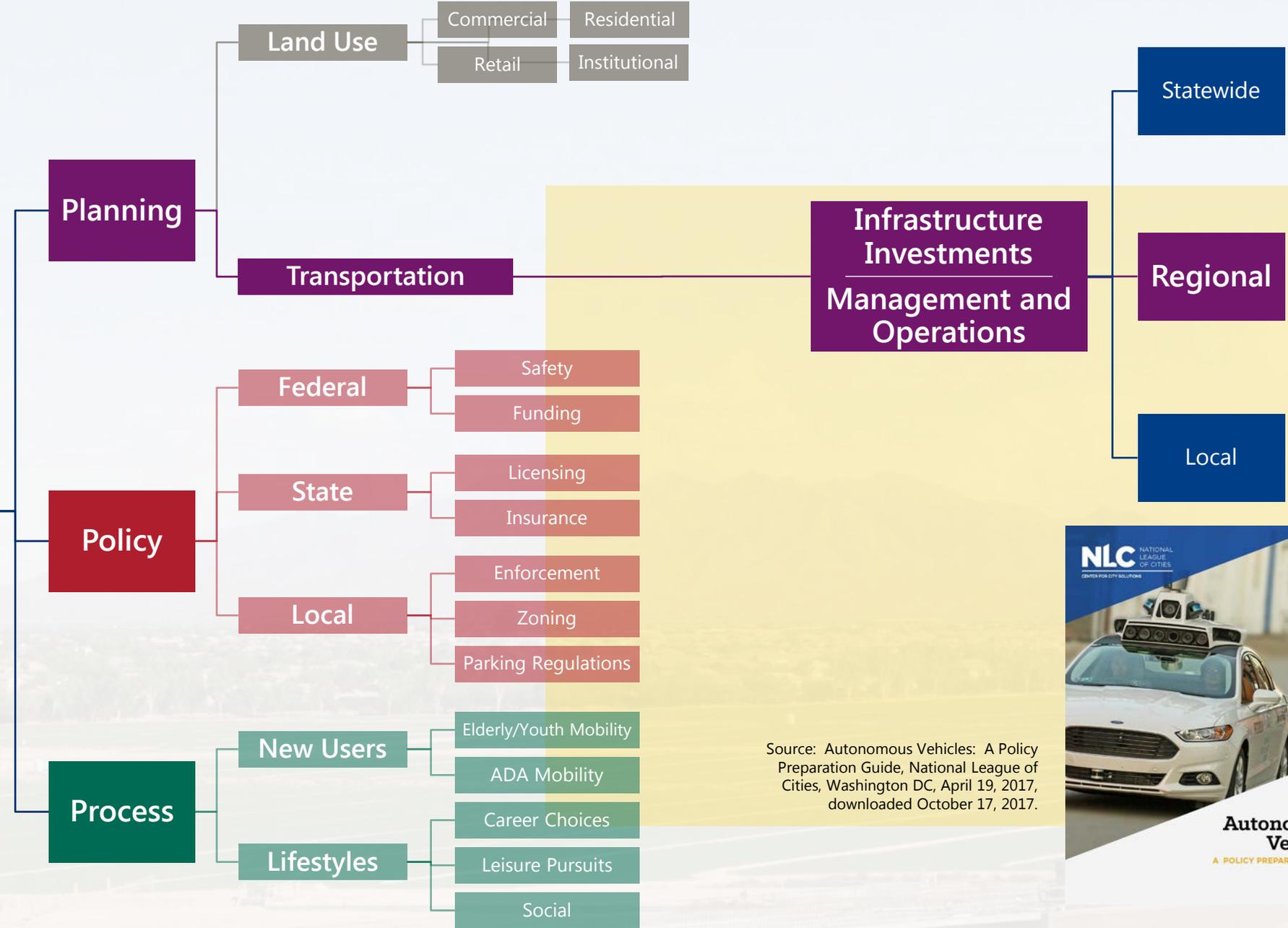
If fewer people were to own and drive their own cars, parking lots and garages could be converted to other uses. Architecture firm Gensler illustrated how a parking structure might be turned into offices. (Gensler)



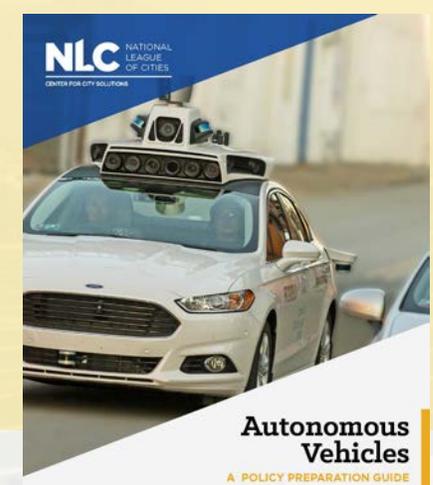
By **Roger Vincent**

Source: *Los Angeles Times*, April 16, 2017, downloaded October 17, 2017.

Connected and Autonomous Vehicles



Source: Autonomous Vehicles: A Policy Preparation Guide, National League of Cities, Washington DC, April 19, 2017, downloaded October 17, 2017.



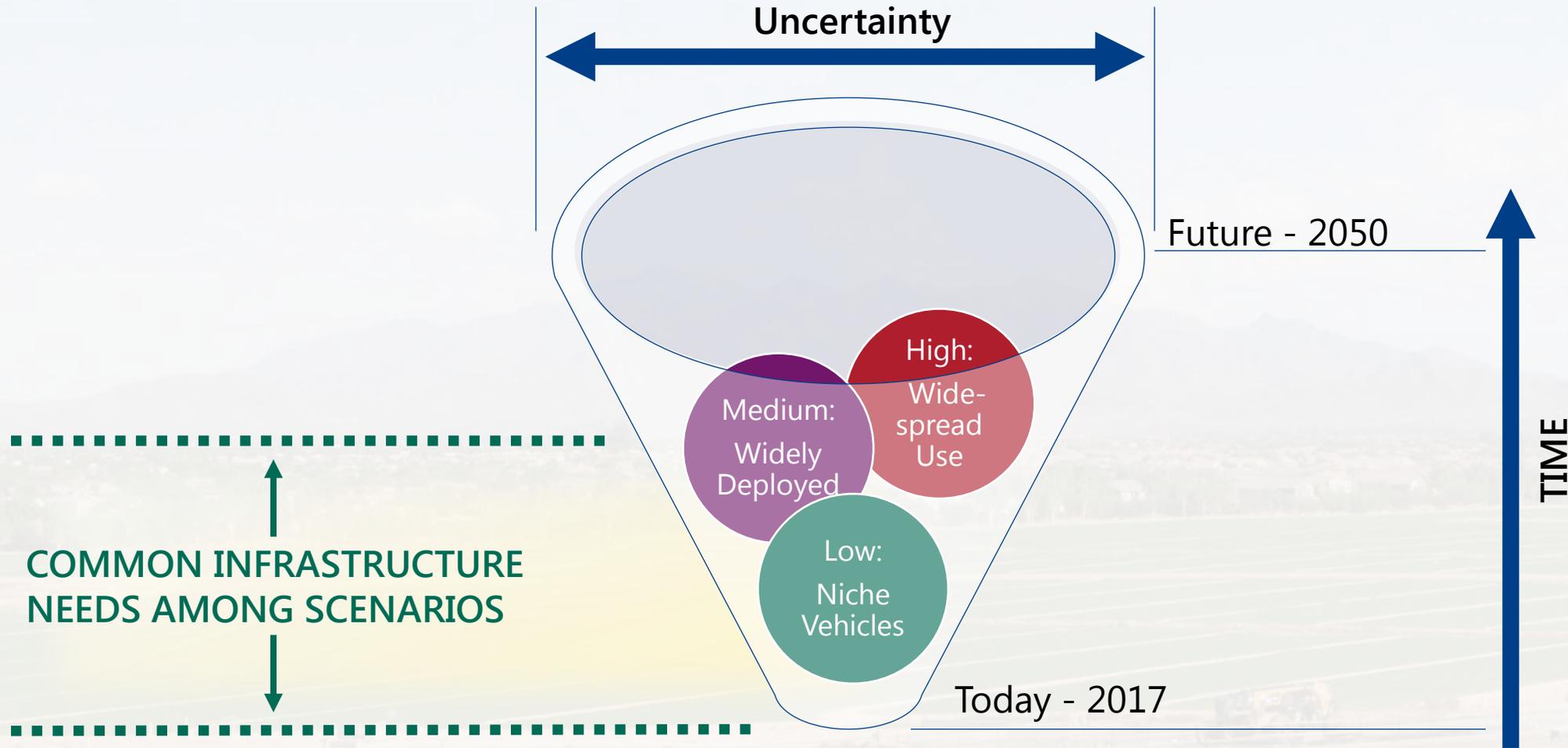
Connected and Autonomous Vehicles



How will these vehicles affect our planning process?

Scenario Planning

CONNECTED VEHICLE/AUTONOMOUS VEHICLE FUTURE



Developing **Imagine**

MAG'S NEXT REGIONAL TRANSPORTATION PLAN

- Pick a range of scenarios.
- Focus what is in our control.
- Look for collaboration opportunities.
- Constantly reassess.
- **Relax!**



Photo source: Fiat-Chrysler, downloaded 10/16/2017.

Roles for MAG to Consider

- Serve as an information clearinghouse.
- Evaluate a range of effects on long-range plans.
- Consider developing guidance documents, templates, etc. for use by local governments.



Photo source: Ford Motor Company, downloaded 10/16/2017.



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