AUTOMATED VEHICLES 101

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AGENDA

Definitions of vehicle automation

Automation and current urban transportation problems

Other policy issues with vehicle automation

Some policy suggestions (highly subjective)

LEARN STILL MORE ABOUT AUTOMATED VEHICLES!

URP 6930

Future of Urban Mobility: Shared and Automated Transport

Offered at Florida Atlantic University in Spring 2019

DEFINITIONS OF VEHICLE AUTOMATION

SAE J3016

LEVELS OF AUTOMATION FOR ROAD VEHICLES

Level of Automation	Example Technology	Primary Responsible Driver
0 – No Automation	Regular cars	Human
1 – Driver Assistance	Cruise control	Human
2 – Partial Automation	Adaptive cruise control with lane keeping	Human
3 – Conditional Automation	Full highway automation	System with human backup
4 – High Automation	Full automation in many conditions, but not all	System, potentially with human backup
5 – Full Automation	Full automation from origin to destination	System

CURRENT MARKET PRODUCTS

Emergency Brake Assist – Volvo V60

Adaptive Cruise Control – 2014 Honda Accord, 2014 Cadillac CTS, 2014 BMW 3 Series

Adaptive Cruise Control + Lane Keeping - Mercedes Benz Distronic Plus.
- Maintains speed, keeps lane, avoid encroaching vehicles.

Traffic Jam Assist - BMW X5 2014
- Controls the speed of the car and distance to the car ahead up to 35 MPH.
- Vehicle also maintains correct lane.

GM Super Cruise 2017
- Hands off lane following, braking and speed control on freeways only

Tesla Model X Autopilot – Level 3 Automation
- https://www.tesla.com/autopilot

Waymo – Level 4 Automation
- No one behind the wheel since Nov 2017 in Phoenix, AZ

HIGHLY AUTOMATED VEHICLES AND MAP DEPENDENCY

Current highly automated vehicles, i.e. Waymo, are dependent upon very detailed maps

Therefore an automated car that works in Pittsburgh might not work in Philadelphia

Also, it is unclear how automated vehicles will cope with unexpected changes in the surrounding environment, i.e. construction, large storms, unusual human behavior, etc.

CONNECTED VS. AUTOMATED

Automated = vehicle that drives on its own

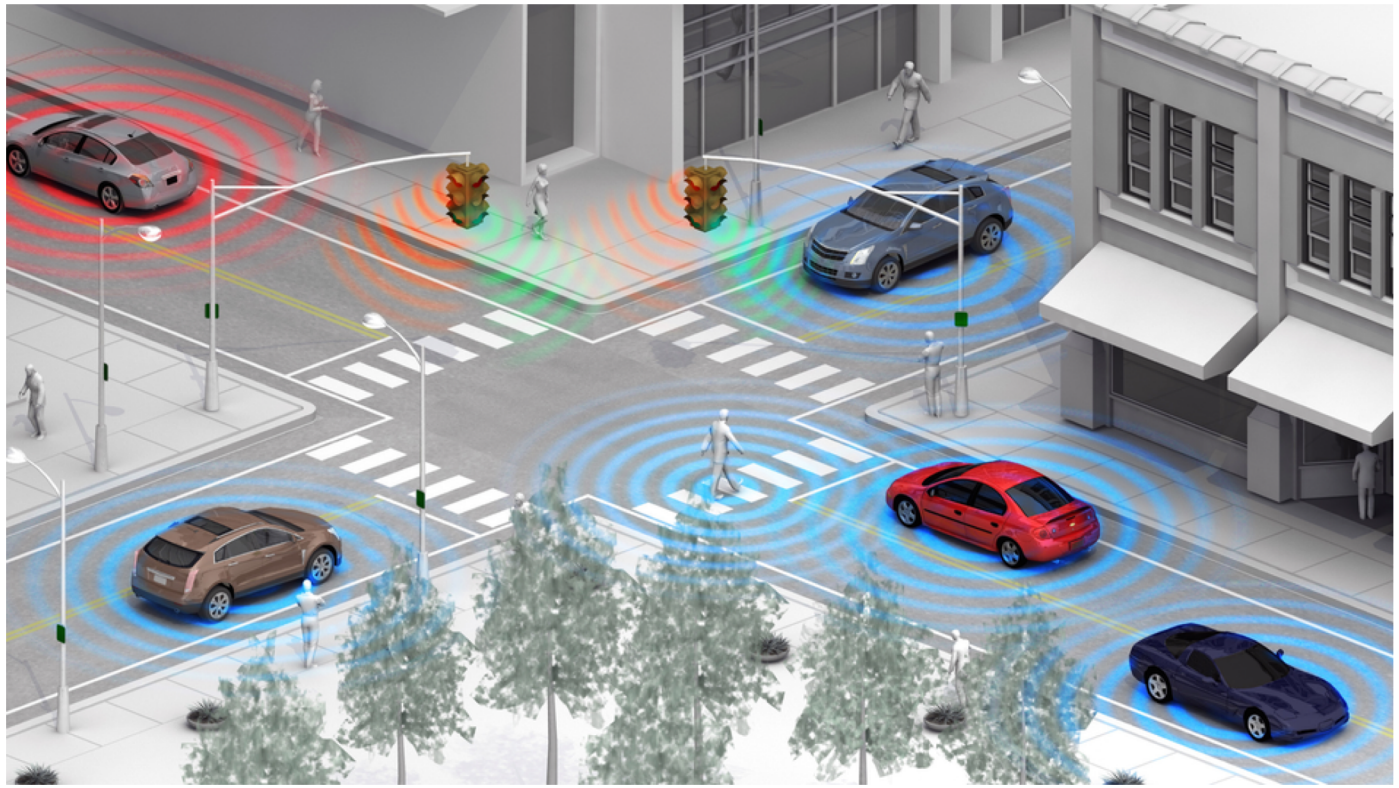
Connected = vehicle that communicates with other vehicles and infrastructure in real time

(Autonomous = vehicle that drives without communication)

Key debate in the industry is which should come first, connected or automated?

But we already have some automated cars and no connectivity standard

CONNECTION: V2V, V2I, V2X



Source: Florida Department of Transportation

AUTOMATION AND CURRENT URBAN TRANSPORTATION CHALLENGES

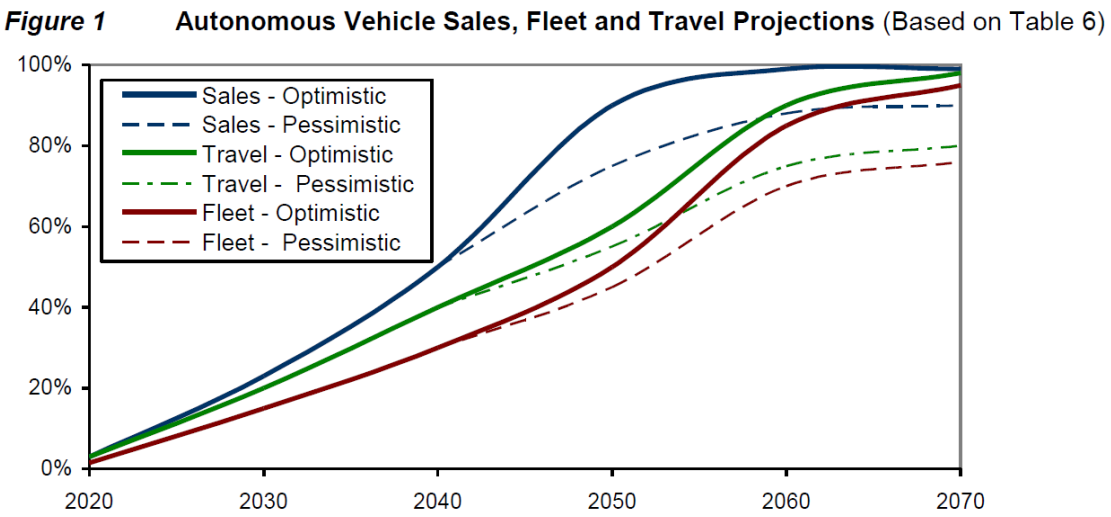
TRANSITION TO AUTOMATION

Shift to 100% automation will take many decades based on turnover of the vehicle fleet

Many people say they would not pay $5000+ for automation

Advantages of all-automated and connected vehicle coordination are not possible in mixed traffic

Automated vehicles have to operate in complex environments with human-driven vehicles and non-connected vehicles



AUTOMATION AND SAFETY

Automated vehicles in theory should be able to avoid most existing crash types

Better vision, better connectivity, better reaction times, focused

But automated vehicles may introduce new safety issues, i.e. vehicle hacking, software failures, hardware failures, vision issues (i.e. snow, rain, etc.)

How does the public sector verify the safety of complex, proprietary automation technology?

	Automated Vehicle	Mature Driver
Distractibility and Attention	X	
Sensory Input of Environment	X	
Predictive Capability of Other Drivers		X
Data Overload		X
Human Hand/Eye Communications		X

AUTOMATION AND LIABILITY

Under current law, the licensed driver is completely responsible for their vehicle

Under automation, who will be held responsible for a crash?

Likely shift in liability from the driver to the manufacturer under defective product liability standards

Some auto makers are saying they will self-insure their automated vehicles (i.e. Volvo)

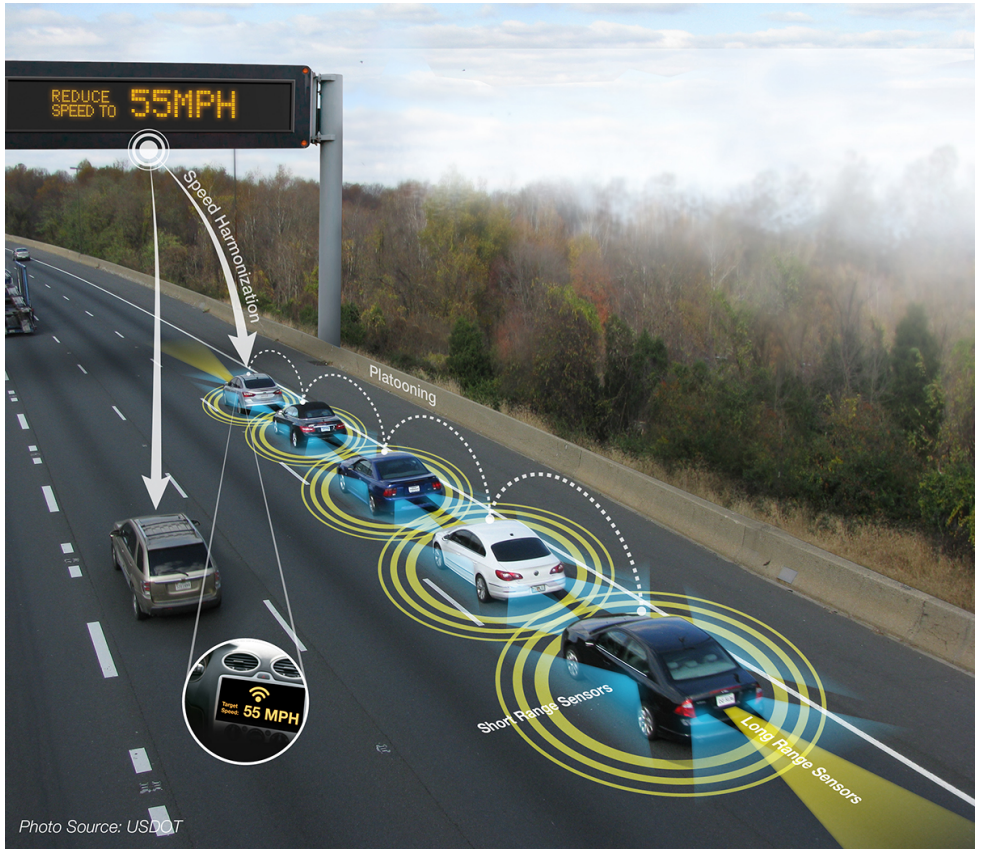
AUTOMATION AND CONGESTION

Connected vehicles can ***platoon*** – travel close together at small distances and common speed – increasing capacity

Unfortunately these benefits do not show up until by far most vehicles are automated and/or connected

Automation may place more people on the road, worsening congestion

May make sense to have automated lanes and automated-only districts in dense urban centers



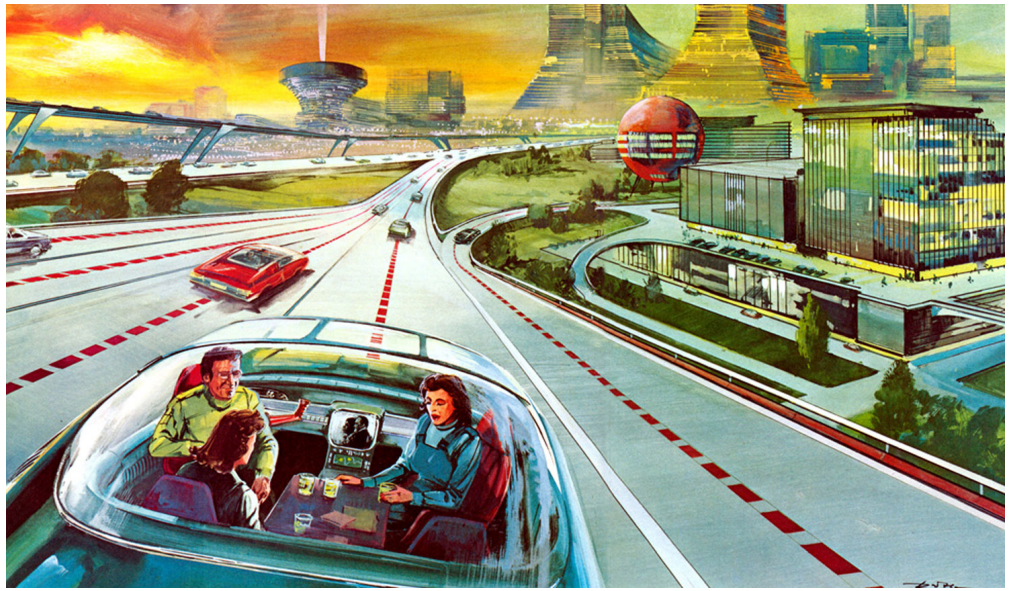
AUTOMATION AND VEHICLE MILES TRAVELED / ENVIRONMENT

Automation is likely to raise vehicle miles traveled, perhaps greatly

New groups of people will be able to travel who could not travel before: blind, disabled, too old, too young, etc.

Automation will reduce the subjective cost of time, so people may not mind long travel times as much

Automation may result in a new wave of sprawl, as it enables people to live further from work



AUTOMATION AND NEW SHARED MODES

Convenience – Automation makes shared mobility more convenient, available on demand

Cost – Shared mobility helps split the cost of automation over many users

Transportation as a Service – Why buy the cow when you can just get fresh milk when you want it?

AUTOMATION AND PARKING

At the least, automated vehicles will be able to park themselves in out-of-the way locations

Less need for parking in high value, dense urban areas

Also, if there is a shift towards shared mobility, as many as **10 owned vehicles** could be replaced by a single shared vehicle (our current cars sit parked most of the time)

Potential for **drastic drop in parking (90%)**, depending on how large the shared mobility market becomes

AUTOMATION AND PEDESTRIANS

Presumably, automated vehicles will always yield to pedestrians

Presumably, automated vehicles will always travel the official speed limit

But how will pedestrians be prevented from unduly interrupting traffic?

And some people want to drastically increase vehicle speeds and remove traffic lights

If we place vehicular mobility as the forefront goal, pedestrians will once again become an afterthought

AUTOMATION AND URBAN FORM

Automation may create both strong push and pull forces for cities

The ease of long distance travel may create a new wave of sprawl, particularly in areas with unaffordable housing

The ease of shared mobility and reduced need for parking may create a new wave of infill development

Both of these could happen at the same time – a new wave of infill and redevelopment and a new wave of sprawl

AUTOMATION AND TRANSPORTATION INFRASTRUCTURE

May not make sense to widen roadways if automated vehicles will be able to use existing roadway widths more efficiently – less vehicle spacing, even narrower lanes

May not make sense to build some types of transit if new shared mobility systems will be more responsive and as energy efficient

Perhaps we should be investing in infrastructure that supports a connected vehicle and infrastructure paradigm to improve safety and operations

Hard to know what investments will stand the test of time in this era of unprecedented flux

POLICY CHOICES

LAISSEZ FAIRE VS. PLANNED IMPLEMENTATION

In the US, the policy debate often centers around the prospect of "Over-regulation"

But setting clear standards and regulations could accelerate rather than slow the development of new technologies and business sectors

The Uber crash makes clear that there is no long-term viability in letting market actors self-regulate for safety

https://www.nytimes.com/interactive/2018/03/20/us/self-driving-uber-pedestrian-killed.html

Connected vehicle standards would likely accelerate rather than slow the market introduction of new products and feature

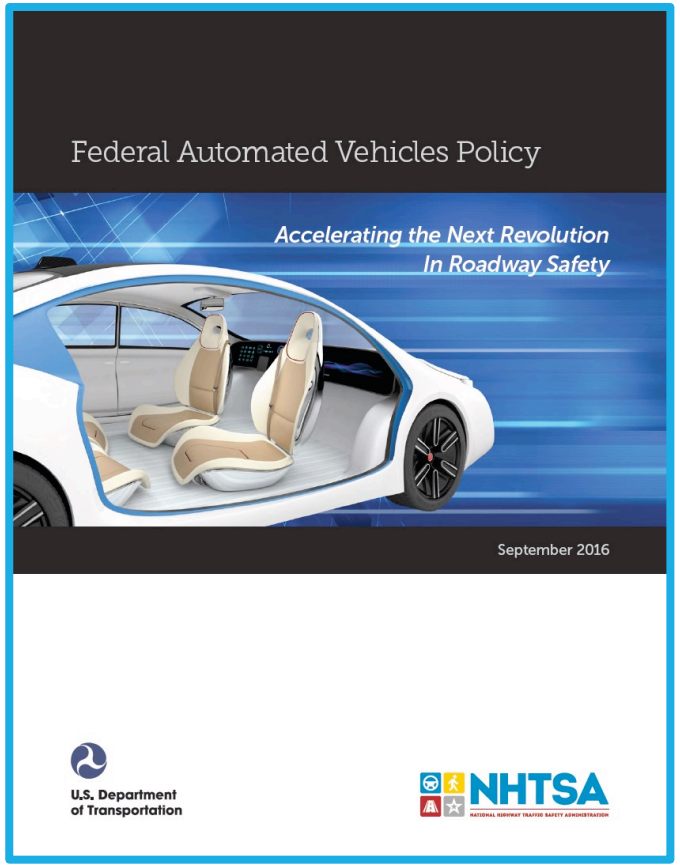
FEDERAL POLICY

Federal Automated Vehicles Policy of 2016

- Conservative policy document
- Laid out the federal role as being limited to safety
- Left states in charge of licensing, registration, liability, and traffic law
- Created voluntary performance guidance
- Recommends new regulatory tools to be created by Congress

No new federal policy has been issued since

No requirement for DSRC or other connectivity for new vehicles, though this was expected in 2017 time frame



STATE POLICY

Arguably a “race to the bottom” with states competing to have as little oversight as possible

Arizona has virtually no oversight over the automated vehicles operating there

- Reactive rather than proactive response to automated vehicle safety

Licensing may go away as a regulatory mechanism

- AV licensing may be necessary in the interim – drivers to understand capabilities and limitations of partial AV systems

Safety might best be handled by feds, single national standard

Data sharing on safety and traffic is essential for improved policy and infrastructure management

METRO AND LOCAL POLICY

Build walkable urban places

Lower parking requirements

- This is already a good policy, but becomes even more important when parking spaces we build today may lie empty in the near future

Integrate public transit and shared mobility

Invest in major transportation infrastructure conservatively

- Projections of congestion 20+ years out should be viewed with skepticism

Focus transit on high speed, high capacity, exclusive right of way corridors

- Brightline is a perfect example of a transit investment that is likely to stand the test of time
- Dedicated right of way, high speed, high capacity = difficult to replicate on the roadway system

QUESTIONS AND COMMENTS?

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AUTOMATION AND OTHER PUBLIC POLICY ISSUES

AUTOMATION AND EMPLOYMENT

In 2018 (Bureau of Labor Statistics):

Truck and delivery drivers 3.50 million jobs

Bus drivers 580,000 jobs

Taxi drivers and chauffeurs 674,000 jobs

Total driving jobs in the US ~ 4.7 million jobs (not all full time)

Out of 153.3 million jobs about 3.0% of all US employment