

***Osher Lifelong Learning Institute, Summer 2022***  
**Contemporary Economic Policy**

Emory University  
June-July, 2022

Jon Haveman, Ph.D.  
National Economic Education Delegation

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**Available NEED Topics Include:**

- Coronavirus Economics
- US Economy
- Climate Change
- Economic Inequality
- Economic Mobility
- Trade and Globalization
- Minimum Wages
- Immigration Economics
- Housing Policy
- Federal Budgets
- Federal Debt
- Black-White Wealth Gap
- Autonomous Vehicles
- US Social Policy

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## Course Outline

- **Contemporary Economic Policy**

- Week 1 (6/30): US Economic Update
- Week 2 (7/7): The U.S. Federal Debt (Geoffrey Woglom, Amherst College)
- Week 3 (7/14): Climate Change
- Week 4 (7/21): Economic Inequality
- **Week 5 (7/28): Autonomous Vehicles – New!**
- Week 6 (8/4): The Black-White Wealth Gap
- Week 7 (8/11): Discriminatory Policies
- Week 8 (8/18): Cryptocurrencies

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## Submitting Questions

- **Please submit questions in the chat.**
  - I will try to handle them as they come up, but may take them in a bunch as time permits.
- **We will do a verbal Q&A once the material has been presented.**
  - And the questions in the chat have been addressed.
- **OLLI allowing, we can stay beyond the end of class to have further discussion.**

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*OLLI – Emory University*

# Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

Jon Haveman, Ph.D.

*July 28, 2022*



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- **This slide deck was authored by:**
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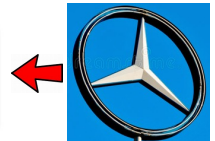
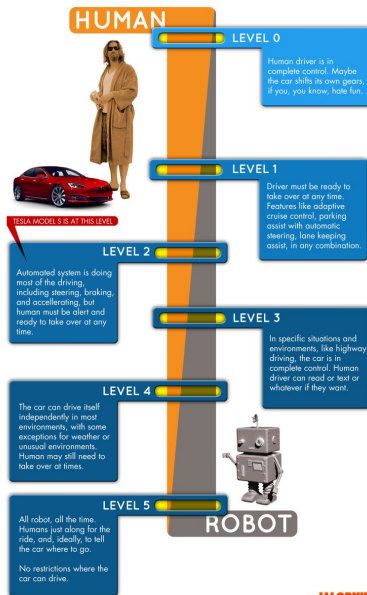
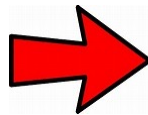
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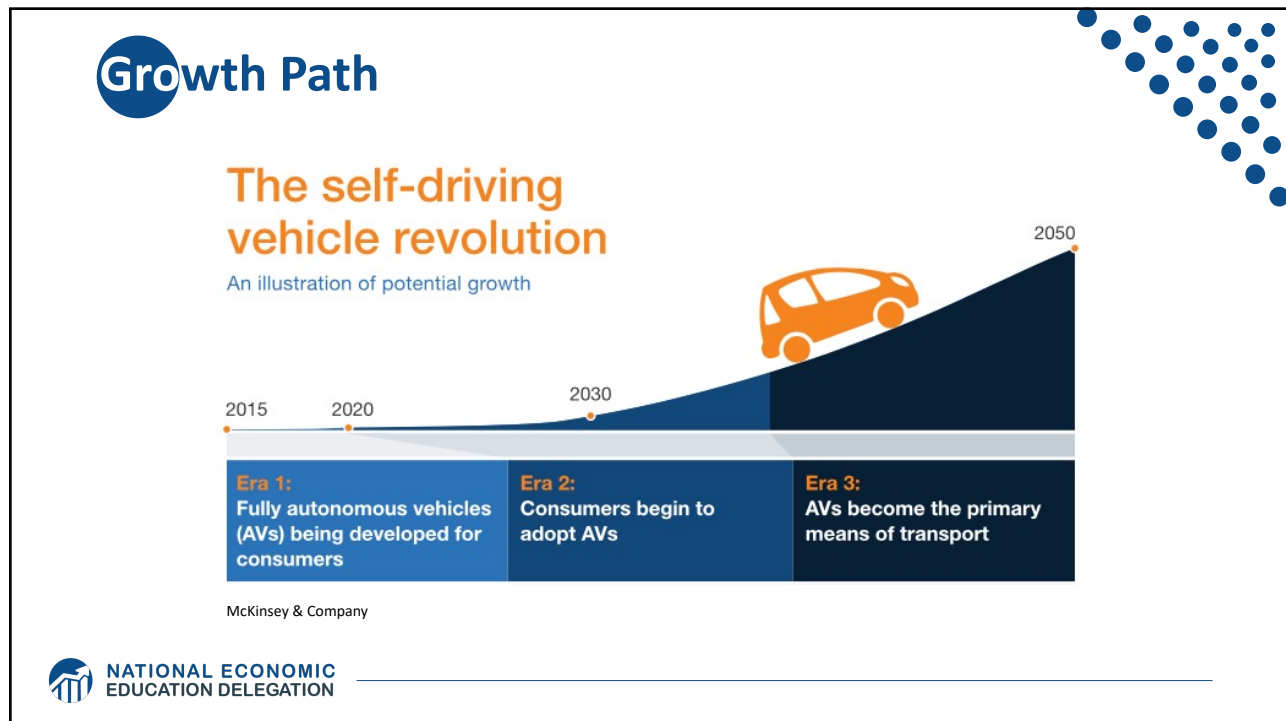
# Outline

- Where does the AV path lead?
- Transition
- Policy/Planning Issues
- Major Economic/Development Changes
- Environmental Implications

# Autonomous Taxonomy

## SAE AUTONOMY LEVELS





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## McKinsey isn't Always Spot On

- "In 1980, McKinsey & Company was commissioned by AT&T to forecast cell phone penetration in the U.S. by 2000.
  - The consultant's prediction, 900,000 subscribers,
  - was less than 1% of the actual figure, 109 Million."
- Professor Angel Lozano, 2014

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# Three Important Questions:

1. When will Transportation as a Service (TaaS) be available?
2. How quick will the transition be?
3. What will the future look like?

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# WHEN? What do the headlines say?



NVIDIA to introduce level-4 enabling system by 2018



First autonomous Toyota to be available in 2020



**Volkswagen**

Volkswagen expects first self driving cars on the market by 2019



**Audi**

Audi to introduce a self-driving car by 2020



**TESLA MOTORS**

Elon Musk now expects first fully autonomous Tesla by 2019, approved by 2021

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# 40+ Corporations Working On Autonomous Vehicles



**TOYOTA**



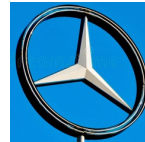
WAYMO



**HONDA**



**Audi**



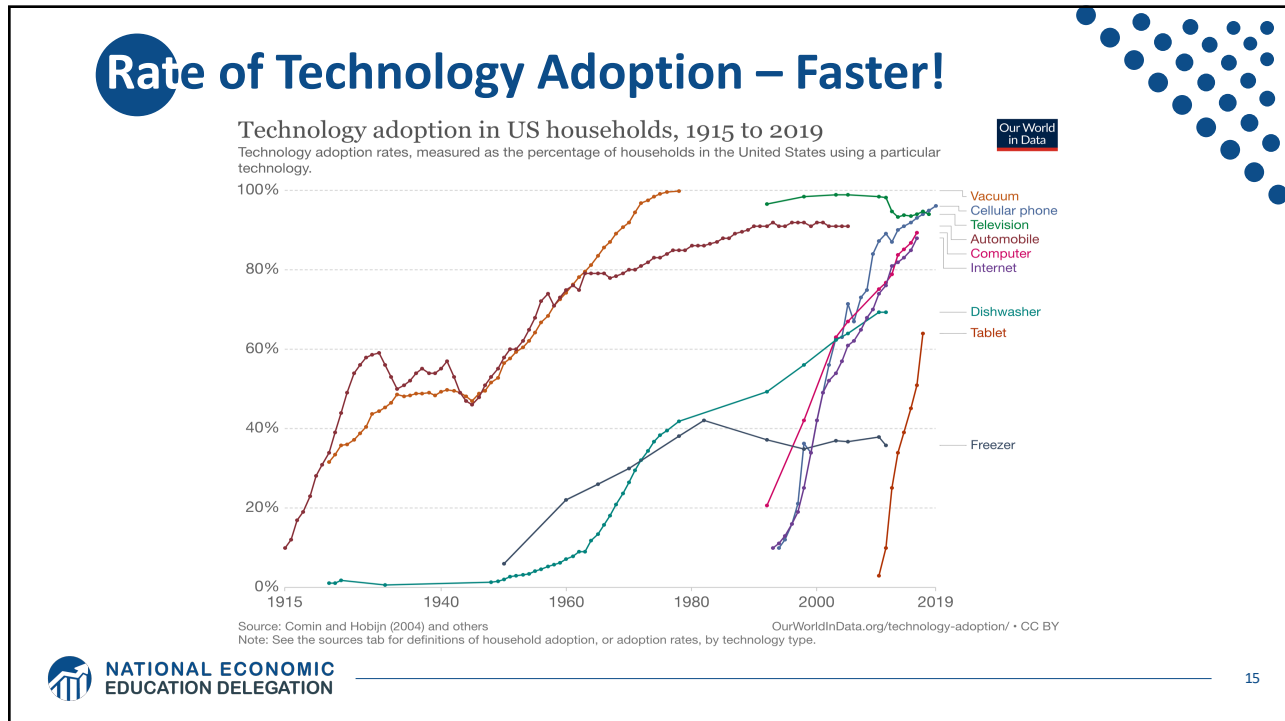
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# WHEN? What is possible?

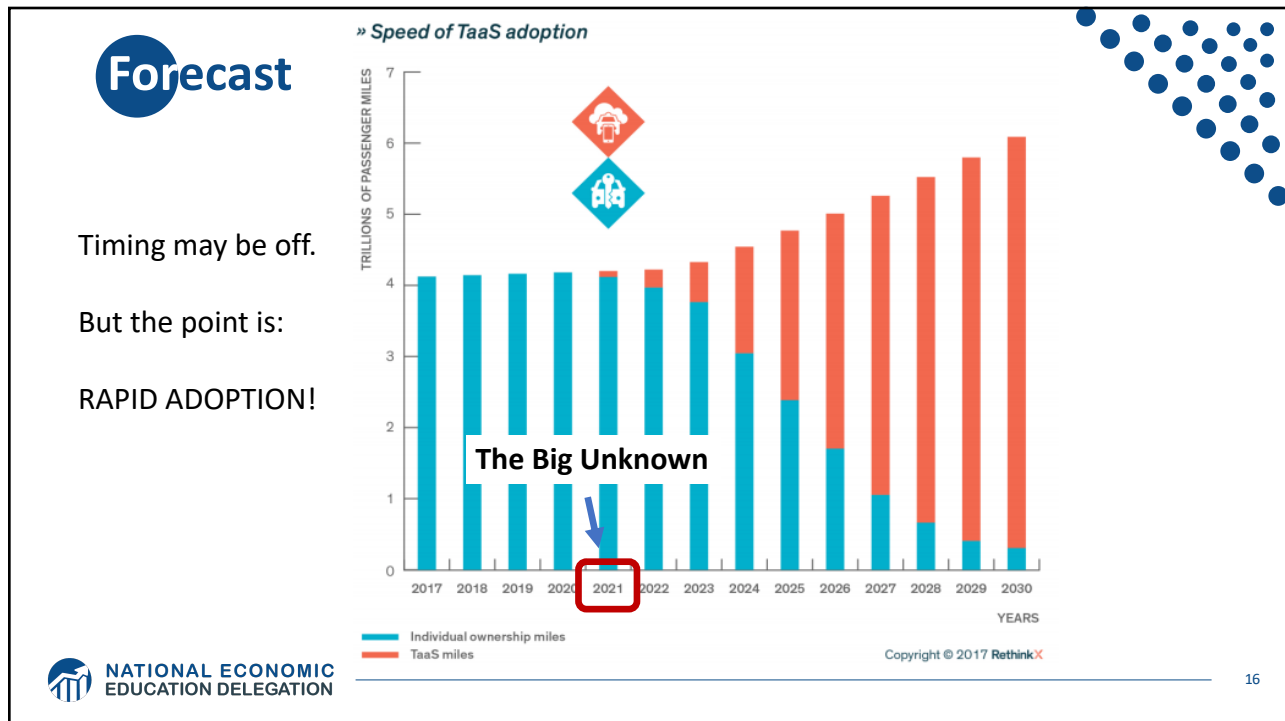
- **By 2025 (?)**
- **Potentially 95% of VMT by 2035.**
- **Last 5% is going to be very difficult to achieve.**
- **Is this possible?**
  - Horses to cars: 10 years – early 1900s
  - But adoption of EVs is so slow!
  - Adoption of AVs will be rapid.



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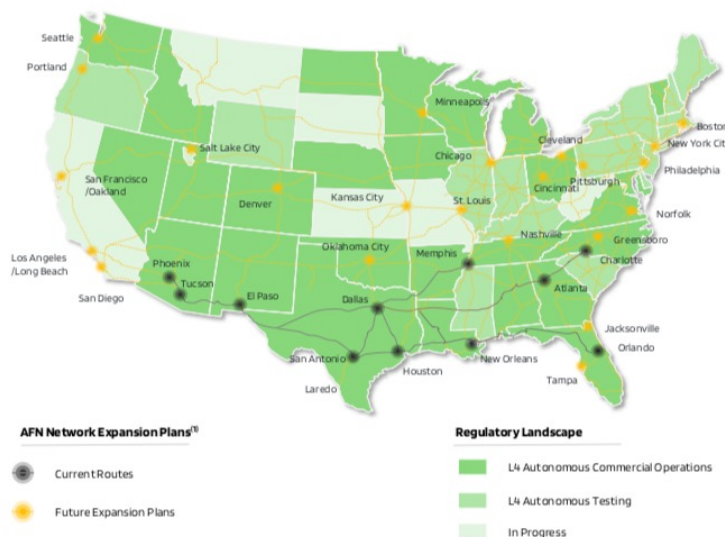




# Trucking – Highly Fertile Ground

- **Long haul trucking is likely the first place we will see it adopted.**
  - Reduces costs associated with drivers.
  - End run around limits on hours of driving.
- **Where does it stand?**
  - Lots of trials underway.
  - TuSimple – actively building a long haul network.
  - Waymo – focused more on last mile/local delivery.

# TuSimple Current and Future Routes (Level 4)



**44** states  
allow autonomous semi-truck testing

**26** states  
allow autonomous semi-truck commercial deployment

**50** states  
cohesive AV operations framework laid out in US DOT 4.0 AV Regulations

# What will the future look like?



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This:



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**But, will it be:**



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**Hell**

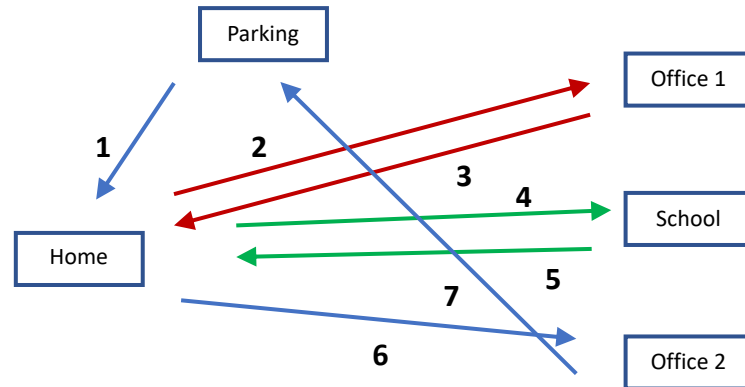
- **Primarily individual private car ownership**
  - Much as today.
- **Internal combustion engines**
- **Why Hell?**
  - Dramatically increased VMT and pollution.
  - Potentially increased congestion
  - Parking.



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## Two Adults and a Child: Morning Miles



*And this is just the morning.....*

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## Heaven



- **Vehicle ownership will be very limited**
  - Private ownership for those with specialized vehicle needs.
  - Fleet ownership will serve everybody else.
- **Engines: electric**
- **Insurance: product liability**
- **Not clear when we will get there, but this is the likely model.**
  - 2030 for widespread adoption in many regions.

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## Why is this Heaven?

- **Not only autonomous, but:**
  - Shared
  - Connected
  - Green
- **Far fewer cars in existence.**
  - Better resource utilization.
- **VMT could go up or down, but more productive than in Hell.**
- **Congestion effects – unclear, but likely reduced.**
  - Right-sized vehicles, platooning, sharing, V2V communication
- **Minimal need for parking.**



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## Transition

- **Short term: Tesla model of highway autonomy**
  - Level 2, adaptive cruise control
- **Medium term:**
  - short period of personal vehicle ownership with level 3 capability
  - introduction of independent private fleets – Uber, Lyft, Google, nuTonomy, etc., with level 4/5 capability
- **Long term:**
  - Personal vehicle ownership is largely a thing of the past



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## Economics Drives Transition: Private

- **Adoption dividend for private individuals**

- Eliminate car ownership
  - o Ave annual cost of owning a car: \$9,666 (2021)
  - o Cost per mile will fall: \$0.64 to \$0.19
- Repurpose your garage
  - o \$50,000 from transition to bedroom

*Average Costs Per Mile*

Miles per Year	10k	15k	20k
Average Cost	82¢	64¢	55¢

- **Time recovery**

- 50% of the King County workforce has a commute in excess of 30 minutes.



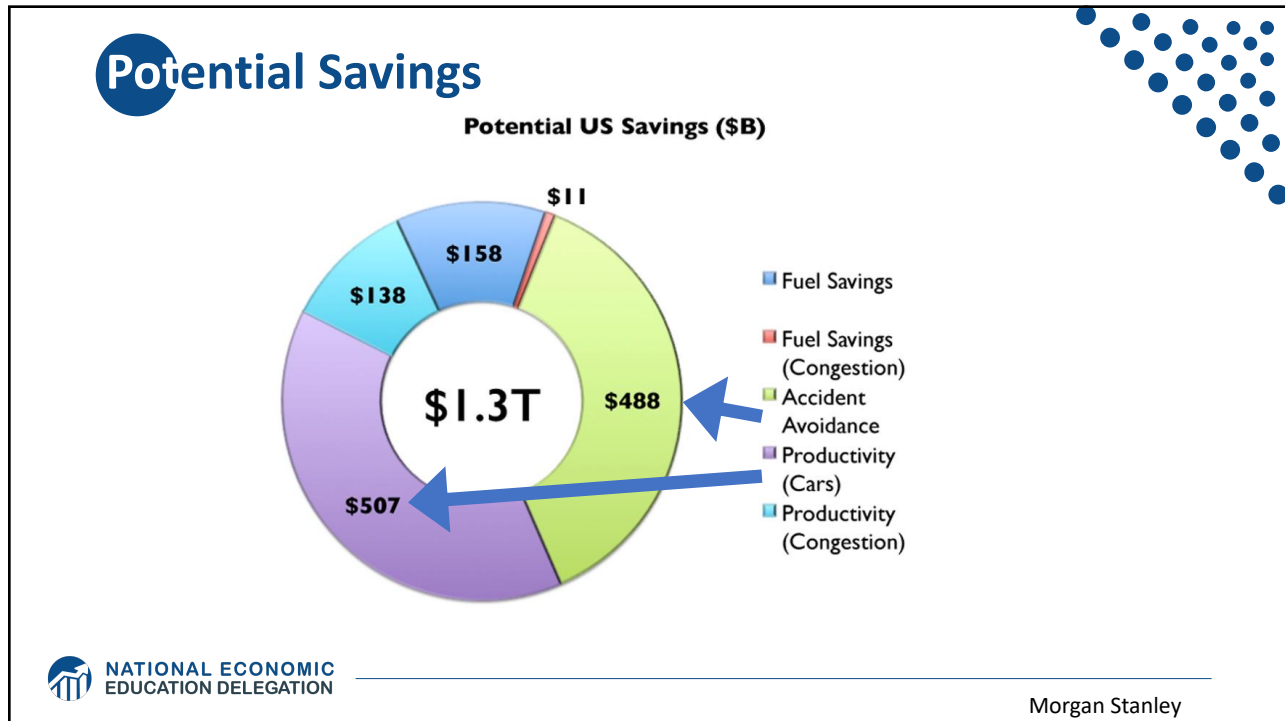
## Economics Drives Transition: Public

- **Economic and social costs associated with human drivers are enormous:**

- ACCIDENTS:
  - o Drive 25% of congestion.
  - o Result in 40,000 deaths.
  - o And 2 million injuries.
  - o 90+% caused by human error.
- Increased productivity from not driving.
- Costs of human drivers estimated at up to \$1.3 TRillion each year







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## Public Policy/Planning Issues

- **Government buy-in:**
  - Essential – gov’t must encourage progress
  - Difficult – because of displacement issue
- **Important transitional issues:**
  - What infrastructure should be developed?
  - What to do about public transportation?
  - What to do with all of the parking spaces?

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 Morgan Stanley

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## Responding to the coming changes:



- **Transportation organizations must develop a forecast for adoption in their specific geography**
  - San Francisco – faster than Chicago
  - Chicago – faster than Fresno
  - Fresno - faster than Kansas
- **How does this affect the ROR calculation on projects?**
  - Highway expansion? Public Transportation?

## Encourage Change

- **Mobility and equity considerations.**
  - Elderly/disabled/impooverished
- **Safety:** only way to reduce traffic fatalities is by coordinated effort.
- **Productivity:** reduced congestion.
- **Environment:** speed transition to electric vehicles.

These are all societal benefits that come about too slowly  
if the private market is left to itself.

# Mobility and Equity

- **Mobility**

- Handicapped
- Elderly
- Lower income

- **Equity**

- Public Transportation often does not work well for low-income workers/residential workers
  - o Does not go from residential to residential, but from residential to commercial



# Safety and Productivity



## Environment



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## Environmental Implications Depends: Heaven or Hell

- **Improved resource utilization**
- **More efficient travel**
  - Right sized vehicles
  - Optimized routes
  - Reduced congestion
  - No searching for parking
- **Increased VMT**
- **Cleaner technologies**
  - Electric
  - Lighter vehicles
- **Energy use of onboard electronics**
  - Weight and functional
- **Increased urban sprawl**

Bottom line: push governments at all levels to embrace and to implement policies deterring private vehicle ownership and zero passenger miles



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## Incentives Through Policy and Planning

- **Allow vehicles equipped with ACC into HOV lanes**
  - Eventual conversion of HOV lanes to ACC/AV lanes
- **Allow ACC equipped vehicles to travel faster in HOV lanes**
- **Subsidize ACC upgrades**
  - Arguably more concrete benefits than electric vehicles
- **Sticks: higher costs of vehicle ownership**
  - Registration fees, VMT taxes, etc.



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Note: ACC = Adaptive Cruise Control

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## Interim Summary

- **Transition is coming very quickly!**
  - Most reports are extremely conservative
  - Apply generally, but faster in many regions.
- **Very important to start incorporating AVs into planning now.**
  - To realize the benefits of AVS.
  - Sacrifice expansion for maintenance.



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## What Changes Will This Bring?

- Disposable income
- Government finances
- Transportation
- Infrastructure
- Public transportation
- Employment
- Housing
- Parking

Potentially dramatic improvements in infrastructure planning and maintenance -  
Data sharing and integration



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## Disposable Income



- Costs \$9,666 to own a car
- Will cost \$3,000 to use TaaS
- Net increase in disposable income of > \$6,000
- Spread across all households:  
more than \$1 trillion in new spending in the economy
- Major boost to economic activity  
- CREATING JOBS!



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## Government Finances



- **Government finances thrown for a loop:**

- Revenues up and down:
  - o Parking revenue, tickets, traffic violation revenues
  - o More commercial, retail and residential space
- Less spending on road development
- More (maybe less) spent on road maintenance
  - o Fewer road miles
  - o but perhaps more VMT

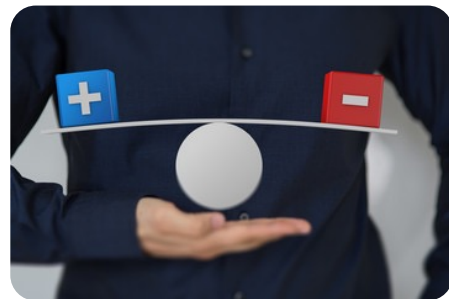
## Transportation

- **Demand for transportation will likely increase significantly: price falls, demand rises**

- Commutes may increase in distance, but not necessarily in duration
- Zero passenger trips will arise
  - o Deliveries

- **At the same time, demand for roadway lane-miles will likely decrease**

- AVs make significantly more efficient use of space
- Front to back and side to side





## Infrastructure

- **Focus of transportation infrastructure:**

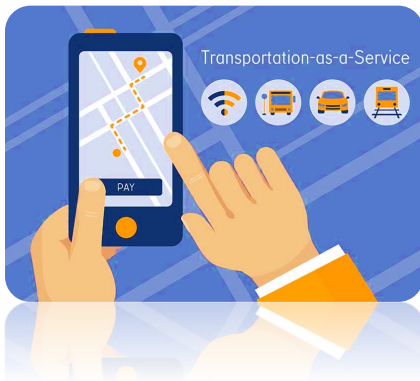
- Currently on expansion
- Will turn toward:
  - Maintenance
    - TaaS providers push for fewer potholes?
  - Adding technology
    - Stop lights will be digital as well as visual
- Some will disappear: Signs!



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## Public Transportation



- **Ambiguous implications for public transportation**
- **Demand may:**
  - Shrink because of low cost of TaaS
  - Grow because last mile problem is solved
- **Extensions may be added through contract with TaaS company**



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## Cautionary Tale From Long Ago

- **Automobiles impact on rail:**

“The increasing dominance of cars was also felt by railway companies, which by June 1894 had to start making **pricing concessions** for transporting goods, even including free transport.”



- Samuel I. Schwartz, No One at the Wheel, 2018



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## Employment

- **Massive job displacement/relocation (Millions!):**

- Drivers of all varieties: truck, taxi, delivery...
- Car production jobs, car parts production jobs
- Gas station, vehicle repair, and body shop
- Police and fire
- Health care workers
- And so on...



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## Employment (con't)



- **What jobs will be created?**
  - IT jobs
  - Retail/Production jobs
  - ??
- **Always easier to identify things that will go away than to identify what will pop up in its place.**
- **Regardless of where they are created, training programs will be crucial to the transition.**



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## Housing



- **Housing is suddenly easier to build**
  - Issue of traffic congestion is significantly reduced.
  - Space for new housing is available where parking lots used to be.
- **Existing houses can now accommodate more people: garage to bedroom conversions.**



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## Parking

- **Greatly reduced demand for parking lots.**
- **Service providers will own parking lots in strategic places.**
  - Where the cost of land is low.
- **Street parking will largely be a thing of the past.**
  - More green space in cities.
- **Shopping mall parking will be converted to:**
  - More shopping mall? Housing?
- **Apartment complexes will convert parking.**



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## Freeing Up Urban Space from Parking

- **Los Angeles: 14% of incorporated land area**
  - 200 Square miles
- **San Francisco: 275,450 on-street parking spaces**
  - Enough to parallel-park a line of cars 900 miles.
    - o California's entire coastline is 840-miles.
  - Enough parking to fill parking lots that would cover the **Presidio, Golden Gate Park, and Lake Merced.**
- **Nationwide: (estimate) 500 million spaces**
  - That's larger than Delaware and Rhode Island combined.
  - Could be as many as 2 billion (add in Connecticut and Vermont).



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## Potential Problems and Concerns

- **Expansion of the electric grid to provide sufficient capacity.**
- **Mining for rare earth minerals for batteries.**
- **Hacking of autonomous vehicles for nefarious purposes.**
- **Competition in service provision in some markets.**
- **And many more...**



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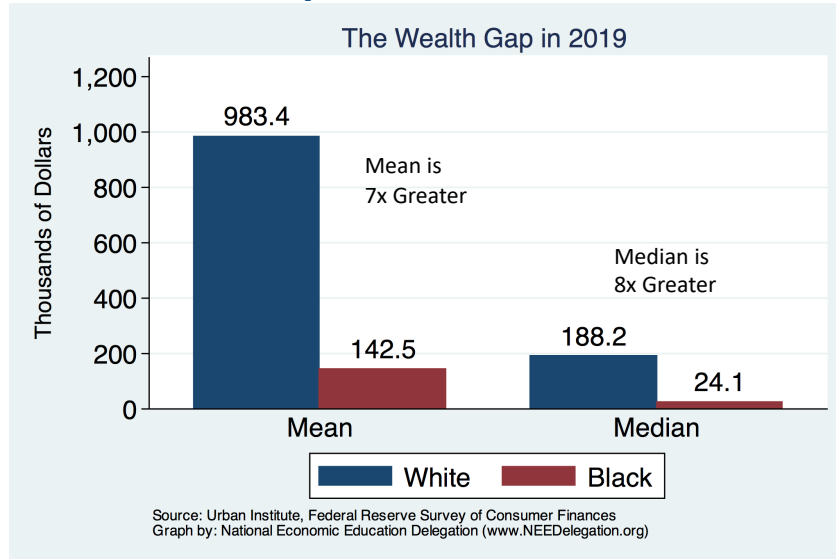
## Summary of Change

- **Massive employment upheaval.**
- **Local government finances will look very different.**
- **Housing will be easier to build and more plentiful.**
- **Parking conversions will be commonplace.**
- **Demand for transportation infrastructure will likely decline.**
  - Transportation infrastructure technology will be a booming business.
- **Demand for public transportation may well decline.**
- **Coming likely sooner rather than later!**



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# The B-W Wealth Gap



# Thank you!

## Any Questions?

[www.NEEDelegation.org](http://www.NEEDelegation.org)

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