

*Brookline Rotary Club, VA*

# Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

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*March 4, 2021*



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## National Economic Education Delegation

- **Vision**

- One day, the public discussion of policy issues will be grounded in an accurate perception of the underlying economic principles and data.

- **Mission**

- NEED unites the skills and knowledge of a vast network of professional economists to promote understanding of the economics of policy issues in the United States.

- **NEED Presentations**

- Are **nonpartisan** and intended to reflect the consensus of the economics profession.



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## Who Are We?

- **Honorary Board: 53 members**

- 2 Fed Chairs: Janet Yellen, Ben Bernanke
- 6 Chairs Council of Economic Advisers
  - Furman (D), Rosen (R), Bernanke (R), Yellen (D), Tyson (D), Goolsbee (D)
- 3 Nobel Prize Winners
  - Akerlof, Smith, Maskin

- **Delegates: 585+ members**

- At all levels of academia and some in government service
- All have a Ph.D. in economics
- Crowdsource slide decks
- Give presentations

- **Global Partners: 45 Ph.D. Economists**

- Aid in slide deck development



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## Available NEED Topics Include:

- **Coronavirus Economics**
- **Climate Change**
- **Economic Inequality**
- **Economic Mobility**
- **US Social Policy**
- **Trade and Globalization**
- **Trade Wars**
- **The U.S. Economy**
- **Immigration Economics**
- **Housing Policy**
- **Federal Budgets**
- **Federal Debt**
- **Black-White Wealth Gap**
- **Autonomous Vehicles**



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## Credits and Disclaimer

- **This slide deck was authored by:**
  - Jon Haveman, NEED
- **This slide deck was reviewed by:**
  - Ronald Fisher, Michigan State University
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- **Disclaimer**
  - NEED presentations are designed to be nonpartisan.
  - It is, however, inevitable that the presenter will be asked for and will provide their own views.
  - Such views are those of the presenter and not necessarily those of the National Economic Education Delegation (NEED).



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## Outline

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



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# Autonomous Taxonomy

## SAE AUTONOMY LEVELS

**HUMAN**

**LEVEL 0**  
Human driver is in complete control. Maybe the car shifts its own gears, if you, you know, have fun.

**LEVEL 1**  
Driver must be ready to take over at any time. Features like adaptive cruise control, parking assist with automatic steering, lane keeping assist, in any combination.

**LEVEL 2**  
Automated system is doing most of the driving, including steering, braking, and accelerating, but human must be alert and ready to take over at any time.

**LEVEL 3**  
In specific situations and environments, like highway driving, the car is in complete control. Human driver can read or text or whatever if they want.

**LEVEL 4**  
The car can drive itself independently in most environments, with some exceptions for weather or unusual environments. Human may still need to take over at times.

**LEVEL 5**  
All robot, all the time. Humans just along for the ride and, ideally, to tell the car where to go. No restrictions where the car can drive.

**ROBOT**

**WAYMO**

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**JALOPNIK**

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# Growth Path

## The self-driving vehicle revolution

An illustration of potential growth

**2015**    **2020**    **2030**    **2050**

**Era 1:**  
Fully autonomous vehicles (AVs) being developed for consumers

**Era 2:**  
Consumers begin to adopt AVs

**Era 3:**  
AVs become the primary means of transport

McKinsey & Company

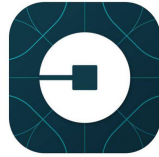
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## 40+ Corporations Working On Autonomous Vehicles



WAYMO



TESLA



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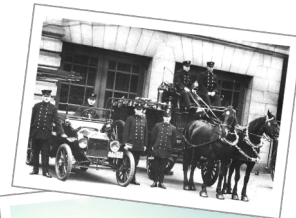
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## WHEN?

### What is possible?

- **By 2025 (?)**
- **Potentially 95% of VMT by 2035.**
  - Last 5% may 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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# What will the future look like?



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This:



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**But, will it be:**



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**Hell**

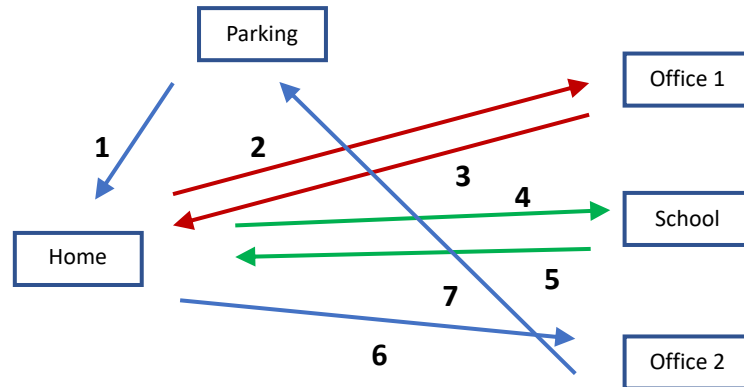
- **Primarily individual private car ownership**
  - Much as today.
- **Internal combustion engines**
- **Why Hell?**
  - Dramatically increased VMT and pollution.
  - Potentially increased congestion.
  - Parking



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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**
- **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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## Economics Drives Transition: Private

- **Adoption dividend for private individuals**
  - Eliminate car ownership
    - Ave annual cost of owning a car: \$9,282
    - Cost per mile will fall: \$0.59 to \$0.19
  - Repurpose your garage
    - \$50,000 from transition to bedroom
- **Time recovery**
  - 50% of Boston Area workforce has a commute in excess of 30 minutes.



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## Economics Drives Transition: Public

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

- **ACCIDENTS:**
  - Drive 25% of congestion.
  - Result in 40,000 deaths.
  - And 2 million injuries.
  - 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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## 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

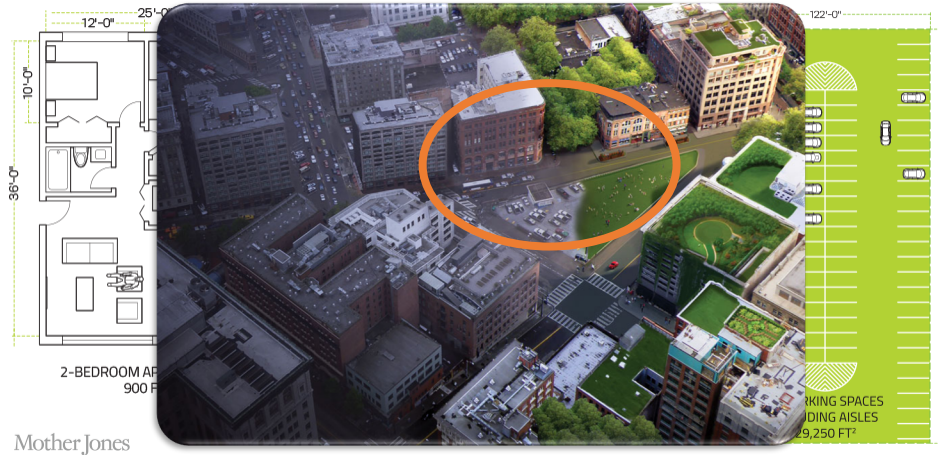
These are all societal benefits that come about too slowly  
if the private market is left to itself.



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# Environment



Mother Jones

# What Changes Will This Bring?

- Disposable Income
- Government Finances
- Transportation demand
- Infrastructure
- Public Transportation
- Employment
- Parking
- Housing

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



## 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...

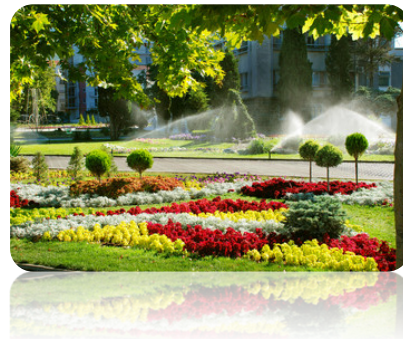


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## Parking

- **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 60 miles longer than California's entire 840-mile coastline
- **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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## 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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## 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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## Thank you!

## Any Questions?

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