

*Chilliwack Fraser Rotary Club, BC, Canada*

# Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

Jon Haveman, Ph.D.

*February 2, 2022*



NATIONAL ECONOMIC  
EDUCATION DELEGATION

1

## 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.



NATIONAL ECONOMIC  
EDUCATION DELEGATION

2

2

## Who Are We?

- **Honorary Board: 54 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: 600+ 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



NATIONAL ECONOMIC  
EDUCATION DELEGATION

3

3

## Available NEED Topics Include:

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



NATIONAL ECONOMIC  
EDUCATION DELEGATION

4

4

## Credits and Disclaimer

- **This slide deck was authored by:**
  - Jon Haveman, NEED
- **This slide deck was reviewed by:**
  - Ronald Fisher, Michigan State University
  - William F. Fox, University of Tennessee, Knoxville
- **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).



5

## Outline

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



6

# Autonomous Taxonomy

## SAE AUTONOMY LEVELS

**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.

**WAYMO**

**NATIONAL ECONOMIC EDUCATION DELEGATION**

**JALOPNIK**

7

7

# Growth Path

## The self-driving vehicle revolution

An illustration of potential growth

**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

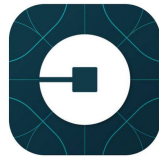
McKinsey & Company

**NATIONAL ECONOMIC EDUCATION DELEGATION**

8

8

## 40+ Corporations Working On Autonomous Vehicles



WAYMO



NATIONAL ECONOMIC  
EDUCATION DELEGATION

9

9

## 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.



NATIONAL ECONOMIC  
EDUCATION DELEGATION

10

# What will the future look like?



11

This:



12

**But, will it be:**



NATIONAL ECONOMIC  
EDUCATION DELEGATION

13

**Hell**

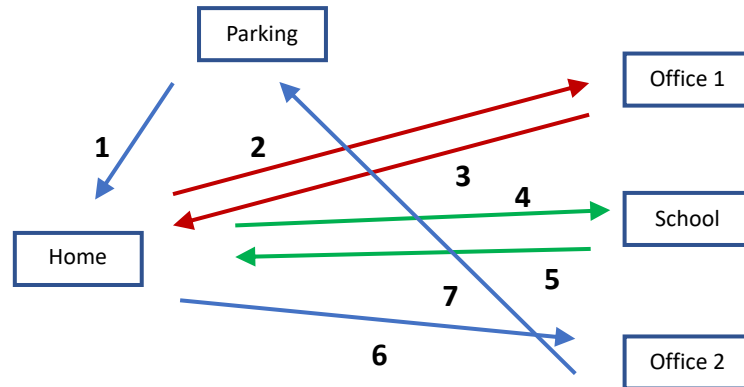
- **Primarily individual private car ownership**
  - Much as today.
- **Internal combustion engines**
- **Why Hell?**
  - Dramatically increased VMT and pollution.
  - Potentially increased congestion.
  - Parking



NATIONAL ECONOMIC  
EDUCATION DELEGATION

14

## Two Adults and a Child: Morning Miles



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

15

## 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.

16



## Why is this Heaven?

- **Not only autonomous, but:**
  - Shared
  - Connected
  - Green
- **Far fewer cars in existence.**
  - Better resource utilization: steel, rubber, aluminum, and land!
- **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.**



NATIONAL ECONOMIC  
EDUCATION DELEGATION

17

## Economics Drives Transition: Private

- **Adoption dividend for private individuals**
  - Eliminate car ownership
    - Ave annual cost of owning a car: \$9,561 (2020)
    - Cost per mile will fall: \$0.59 to \$0.19
  - Repurpose your garage
    - \$50,000 from transition to bedroom
- **Time recovery**
  - 50% of the San Francisco Bay Area workforce has a commute in excess of 30 minutes.



NATIONAL ECONOMIC  
EDUCATION DELEGATION

18

## Economics Drives Transition: Public

- **Economic and social costs associated with human drivers are enormous:**
  - ACCIDENTS (U.S.):
    - 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 in the U.S.

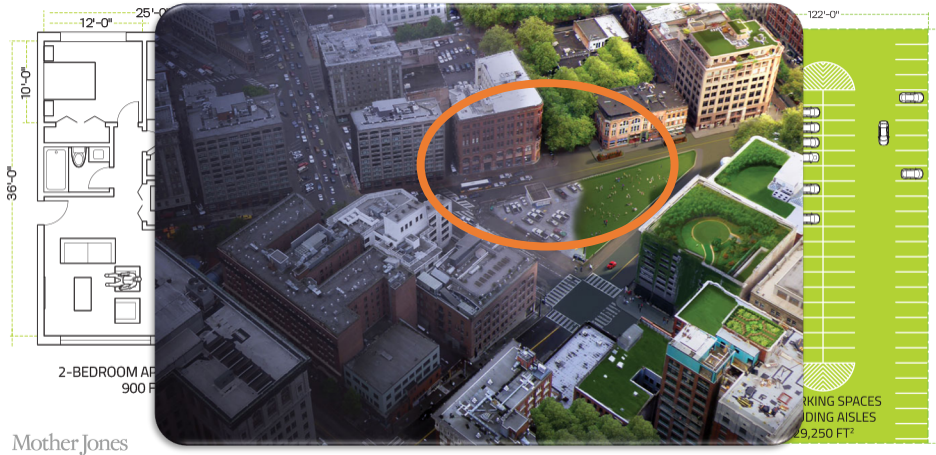


## Encourage Change

- **Mobility and equity considerations**
  - Elderly/disabled/impovertished
- **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.

# Environment



NATIONAL ECONOMIC  
EDUCATION DELEGATION

21

# What Changes Will This Bring?

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

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



NATIONAL ECONOMIC  
EDUCATION DELEGATION

22

## 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...



NATIONAL ECONOMIC  
EDUCATION DELEGATION

23

## Parking

- **Greatly reduced demand for parking lots.**
- **Service providers will own parking lots in strategic places.**
- **Street parking will largely be a thing of the past.**
  - More green space in cities.
- **Shopping mall and apartment parking?**
  - Converted to housing?



NATIONAL ECONOMIC  
EDUCATION DELEGATION

24

## 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
- **In the US: (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).



25

## 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!**



26

**Thank you!**

# Any Questions?

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

Jon D. Haveman

[Jon@NEEDelegation.org](mailto:Jon@NEEDelegation.org)

Contact NEED: [info@NEEDelegation.org](mailto:info@NEEDelegation.org)

Submit a testimonial: [www.NEEDelegation.org/testimonials.php](http://www.NEEDelegation.org/testimonials.php)

Become a Friend of NEED: [www.NEEDelegation.org/friend.php](http://www.NEEDelegation.org/friend.php)



NATIONAL ECONOMIC  
EDUCATION DELEGATION