

*Bay Area Transportation Working Group*

# Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

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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: 48 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: 500+ 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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## 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).

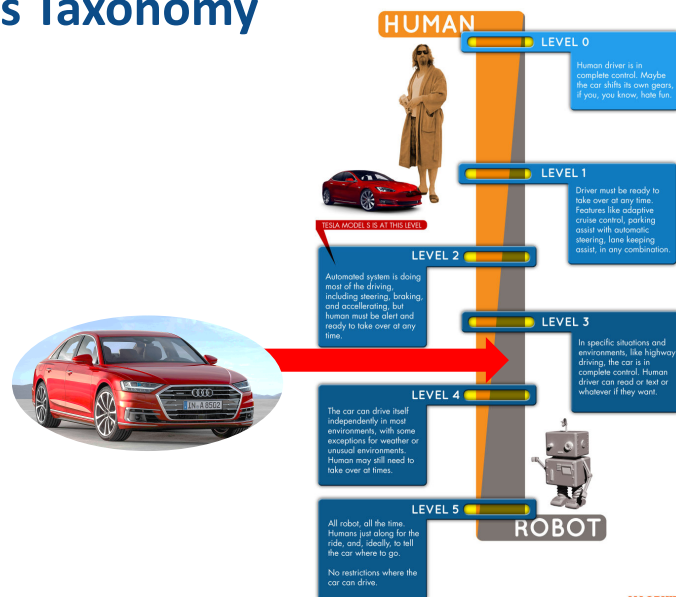
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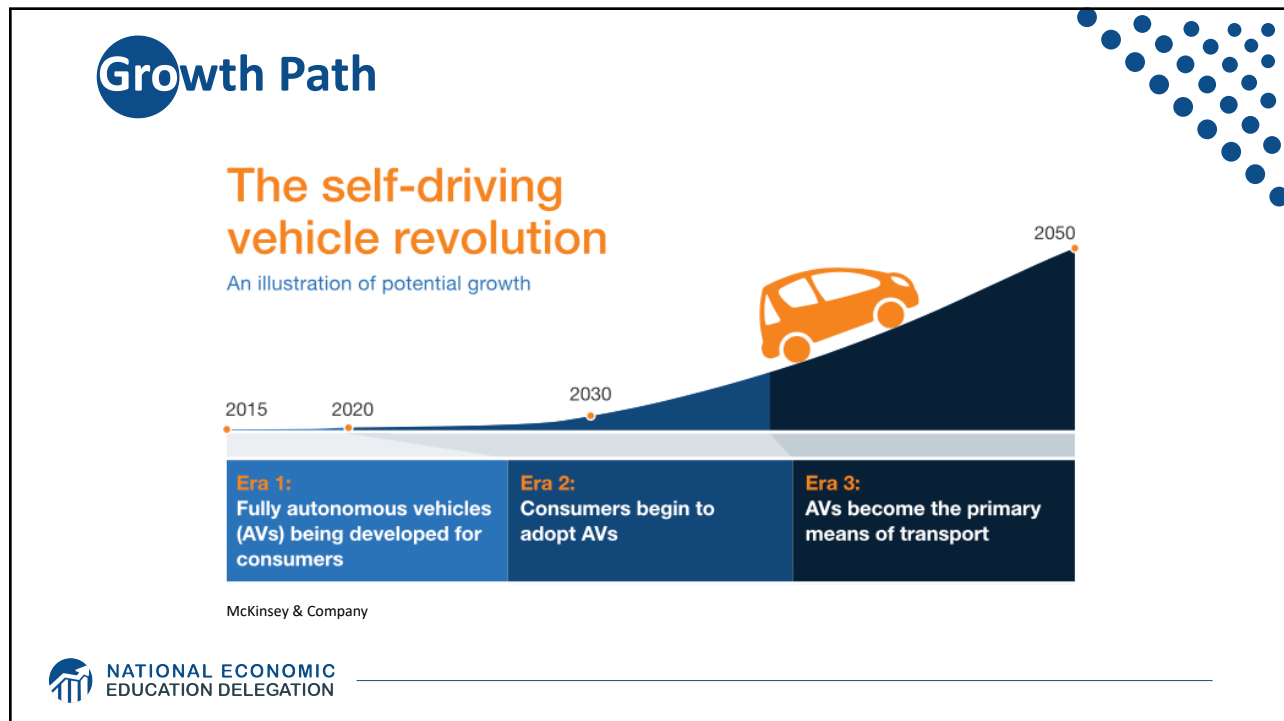
# Outline

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

# 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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# Two Important Questions:

1. When will Transportation as a Service (TaaS) be available?
2. How quick will the transition be?

# 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

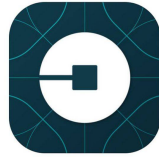


**TESLA MOTORS**

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

## Wildly Optimistic, But...

### 40+ Corporations Working On Autonomous Vehicles



WAYMO



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## WHEN?

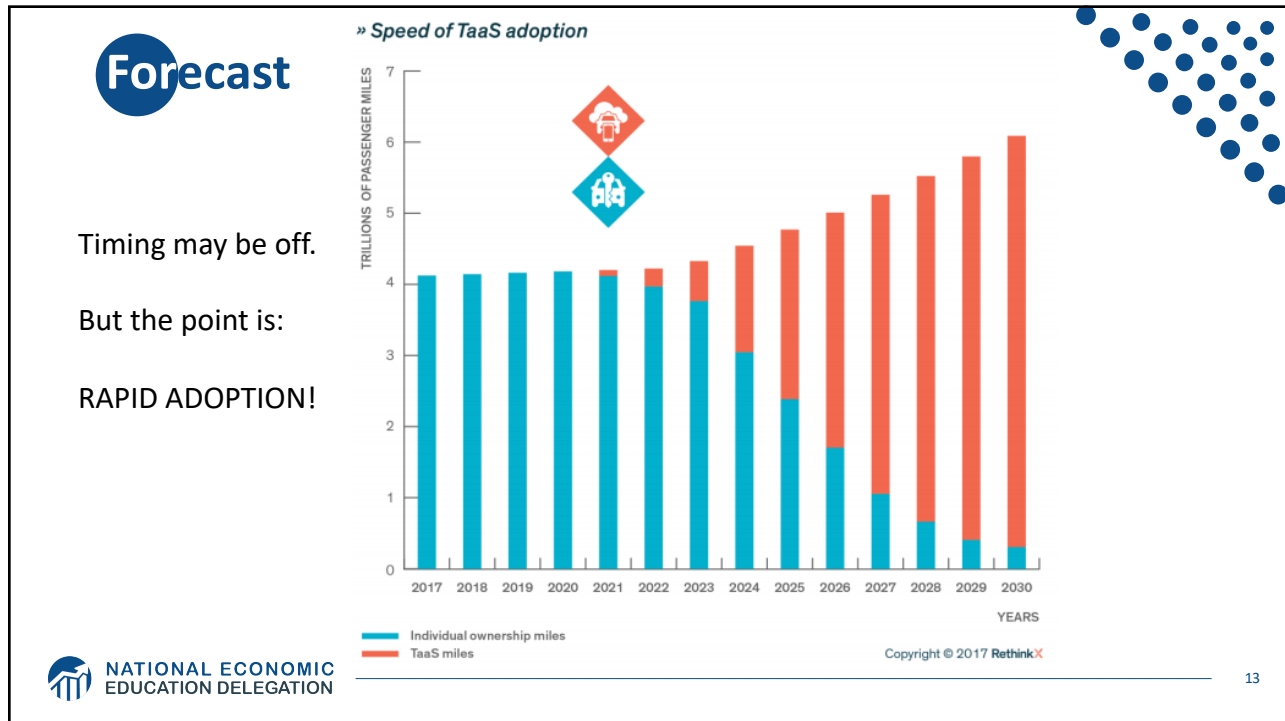
### What is possible?

- 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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# 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
- **Combustion engines**
- **Why Hell?**
  - Dramatically increased VMT and pollution
  - Potentially increased congestion
  - Parking

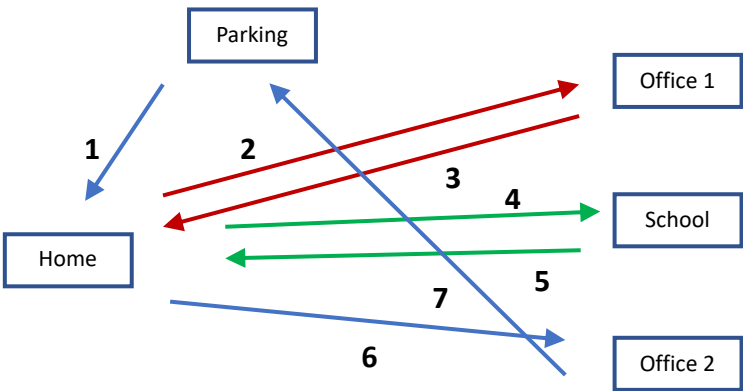





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# Two Adults and a Child: Morning Miles



*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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## 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 Bay 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
  
  - 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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## Planning

- **Respond to the coming changes**
  - The planning horizon for any investment in transportation infrastructure based on today's predominant technology has changed.
    - It may have gotten **MUCH shorter**.
- **Encourage the changes to happen more quickly**
  - Mobility, safety, productivity, and environmental benefits abound.



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# 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



## 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?

- |                                |                                |
|--------------------------------|--------------------------------|
| • <b>Disposable Income</b>     | • <b>Public Transportation</b> |
| • <b>Housing</b>               | • <b>Infrastructure</b>        |
| • <b>Government Finances</b>   | • <b>Employment</b>            |
| • <b>Transportation demand</b> | • <b>Parking</b>               |

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



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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...

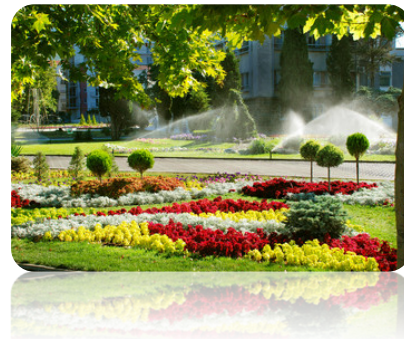


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## Parking

- **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
  - 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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## 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.**



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**Thank you!**

## Any Questions?

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