

Rotary Club of Los Altos

Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

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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.



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2

2

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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3

3

Credits and Disclaimer

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

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- **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).



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4

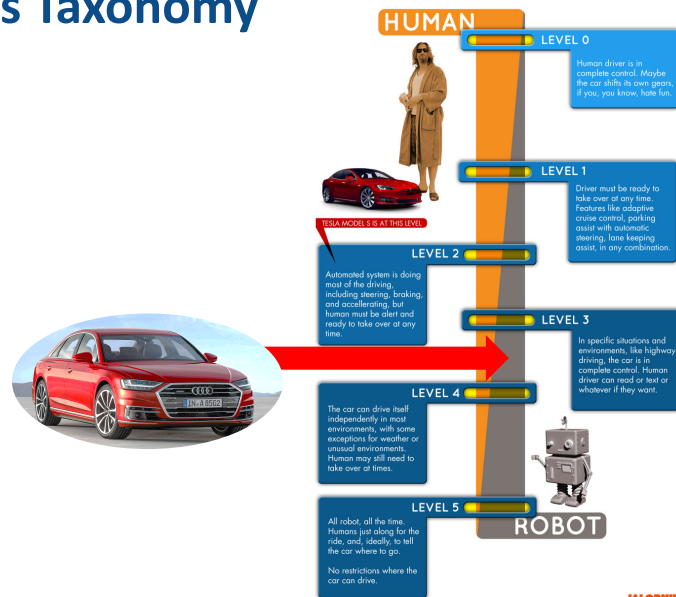
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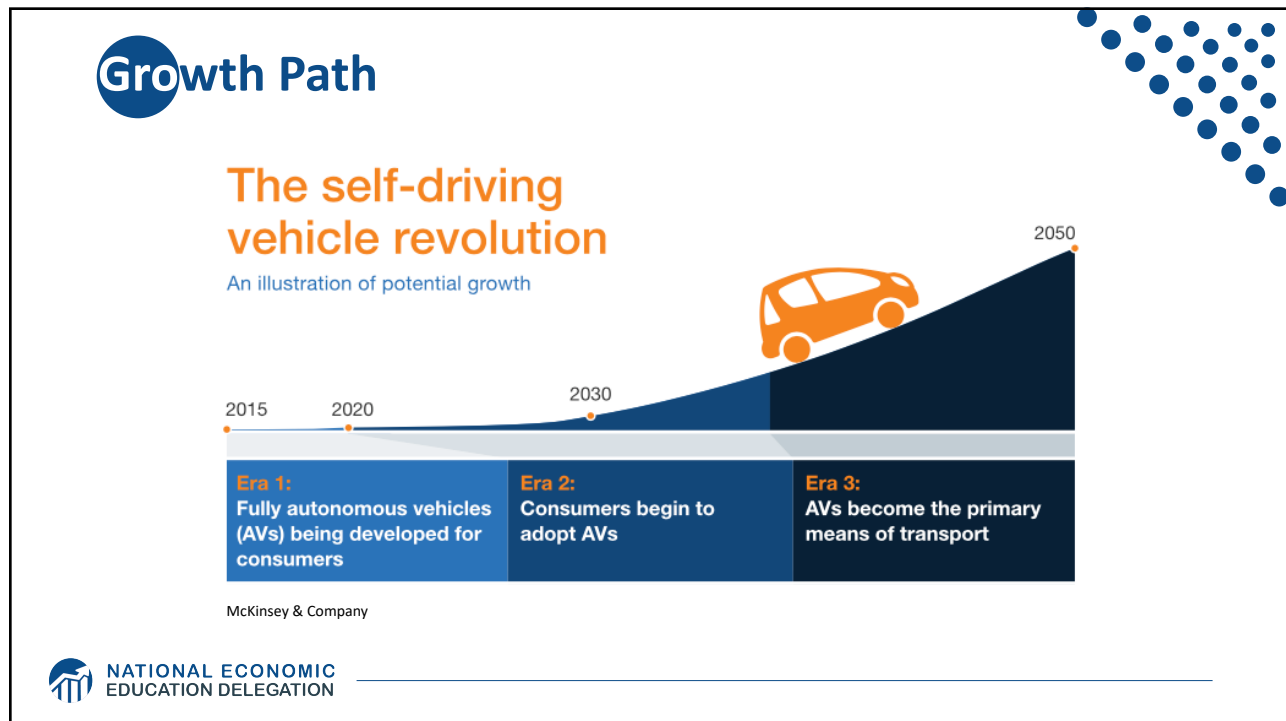
Outline

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

Autonomous Taxonomy

SAE AUTONOMY LEVELS






7

Two Important Questions:

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

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8

8

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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Wildly Optimistic, But...

40+ Corporations Working On Autonomous Vehicles



WAYMO



TESLA



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WHEN?

What is possible?

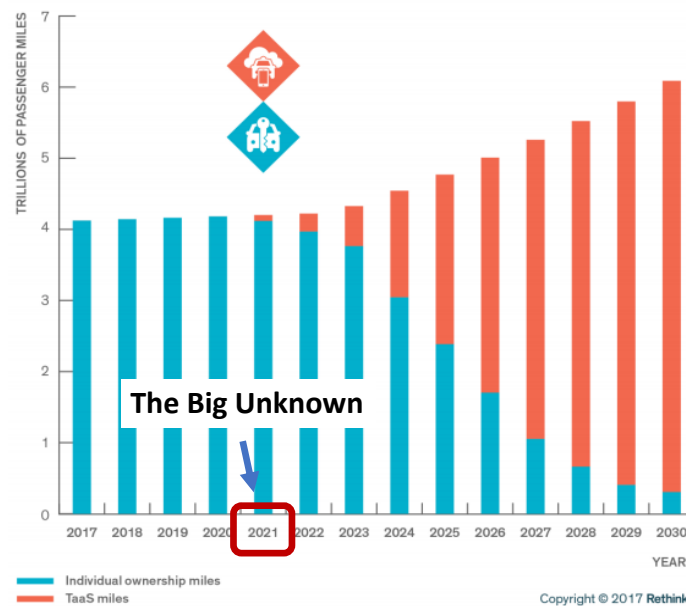
- By 2025 (?)
- Potentially 95% of VMT by 2035.
- Last 5% is going to be very difficult to achieve.
- Is this possible?
 - Horses to cars: 10 years – early 1900s
 - But adoption of EVs is so slow!
 - Adoption of AVs will be rapid.



Forecast

Timing may be off.
But the point is:
RAPID ADOPTION!

» Speed of TaaS adoption



What will the future look like?



13

This:



14

But, will it be:



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15

Hell

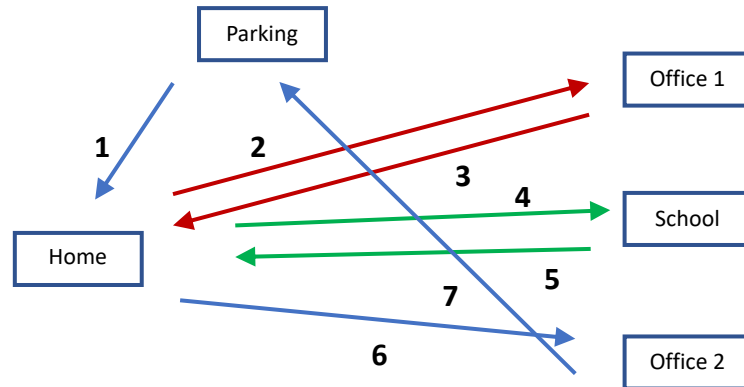
- **Primarily individual private car ownership**
 - Much as today
- **Combustion engines**
- **Why Hell?**
 - Dramatically increased VMT and pollution
 - Potentially increased congestion
 - Parking



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Two Adults and a Child: Morning Miles



And this is just the morning.....

17

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.

18

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/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



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

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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30

30

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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31

Thank you!

Any Questions?

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32

32