Rotary Club of Newton, MA

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: 51 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: 520+ 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**
- **US Economy**
- **Climate Change**
- **Economic Inequality**
- **Economic Mobility**
- **Trade and Globalization**
- **Trade Wars**
- **Immigration Economics**
- **Housing Policy**
- **Federal Budgets**
- **Federal Debt**
- **2017 Tax Law**
- **Autonomous Vehicles**
- **US Social Policy**

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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
  - 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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Outline

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

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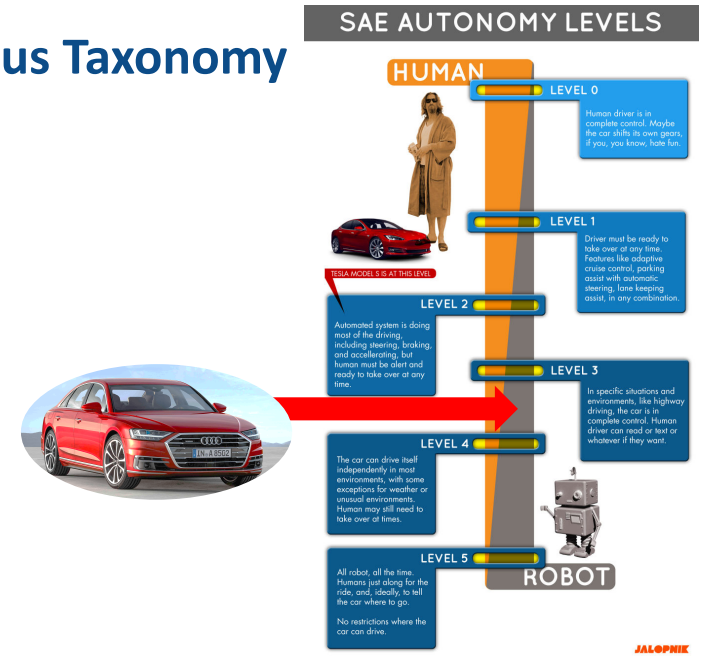
Autonomous Taxonomy



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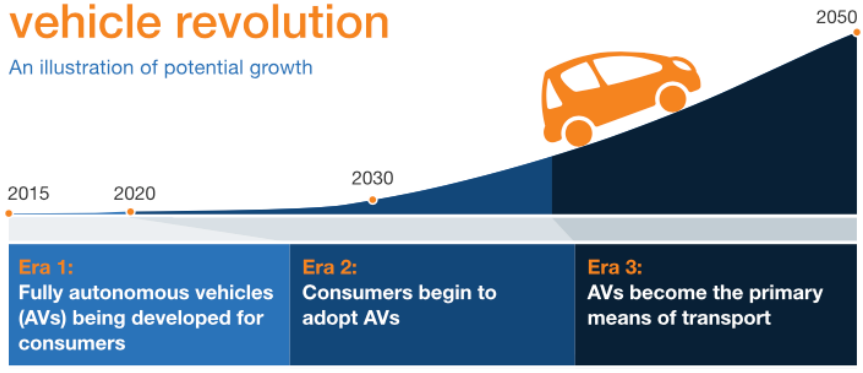
Growth Path



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Two Important Questions:

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

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WHEN?
What do the headlines say?

NVIDIA to introduce level-4 enabling system by 2018

Audi to introduce a self-driving car by 2020

Volkswagen expects first self driving cars on the market by 2019

First autonomous Toyota to be available in 2020

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

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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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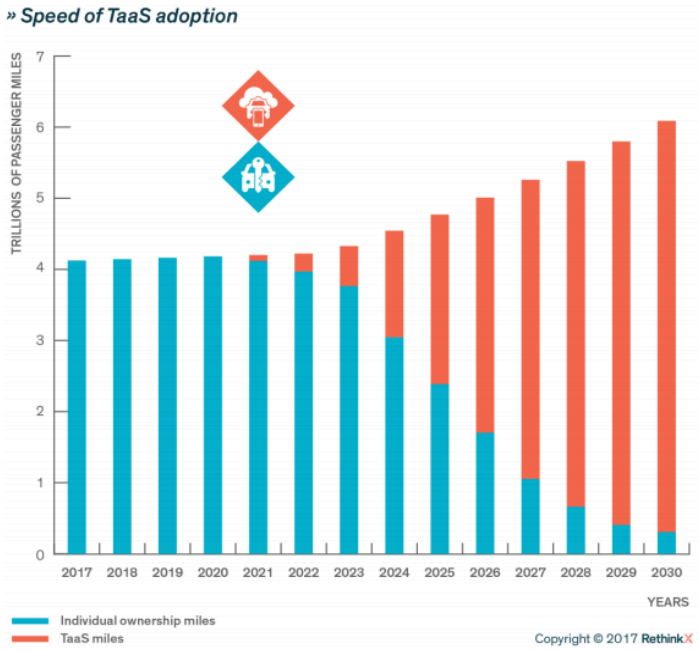
Forecast

Timing may be off.

But the point is:

RAPID ADOPTION!



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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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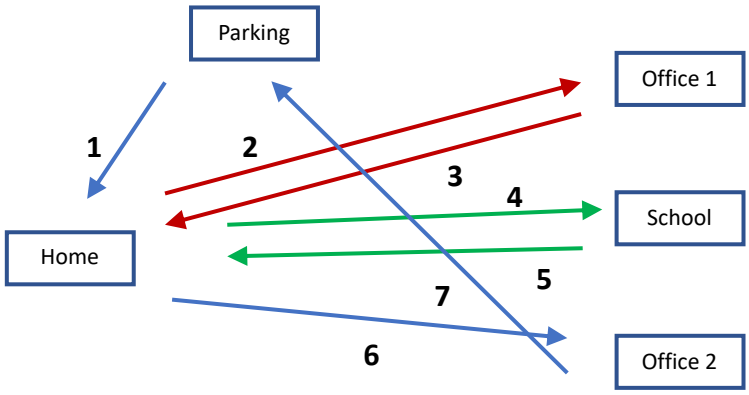
Two Adults and a Child: Morning Miles



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.**

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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
  - Costs of human drivers estimated at $0.8 to $1.3 **TR**illion each year

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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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Responding to the coming changes:

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

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Encourage Change

- **Mobility and equity considerations**
  - Elderly/disabled/impoverished
- **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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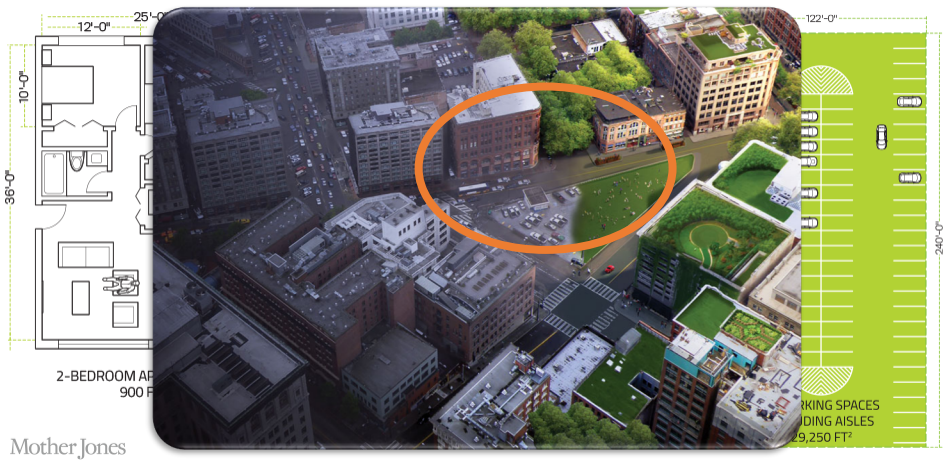
Environment



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What Changes Will This Bring?

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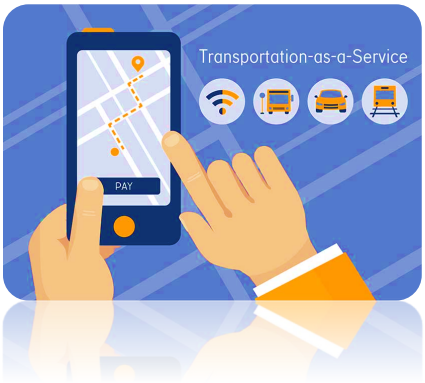
Public Transportation



- **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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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.**
- **Coming soon, to roads near you!**

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Thank you!

Any Questions?

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