

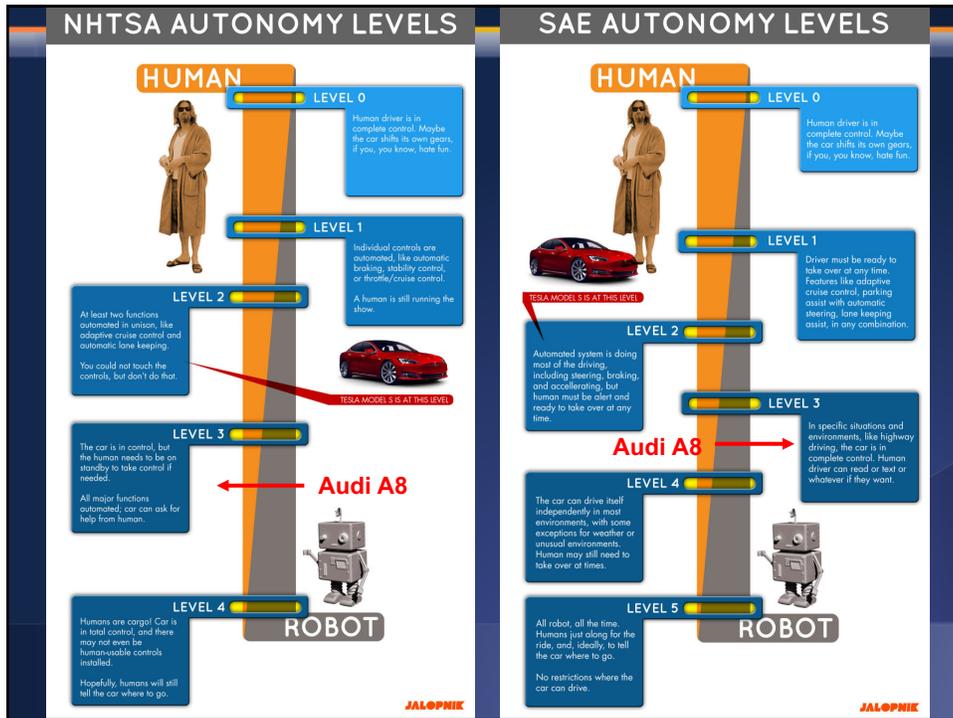
North Bay Leadership Council **Driving Change – Autonomous Vehicles’ Big Impact**

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Outline

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



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 2018, approved by 2021**

What will that look like?

This:



But, Will it be:

- Heaven?
- or
- Hell?



Hell

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



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 the Bay Area



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



Transition

- Short term: Tesla model of highway autonomy
 - Level 2, adaptive cruise control
- Medium term:
 - short period of personal vehicle ownership with level 3 capability
 - introduction of independent private fleets – Uber, Lyft, Google, nuTonomy, etc., with level 4/5 capability
- Long term:
 - Personal vehicle ownership is largely a thing of the past

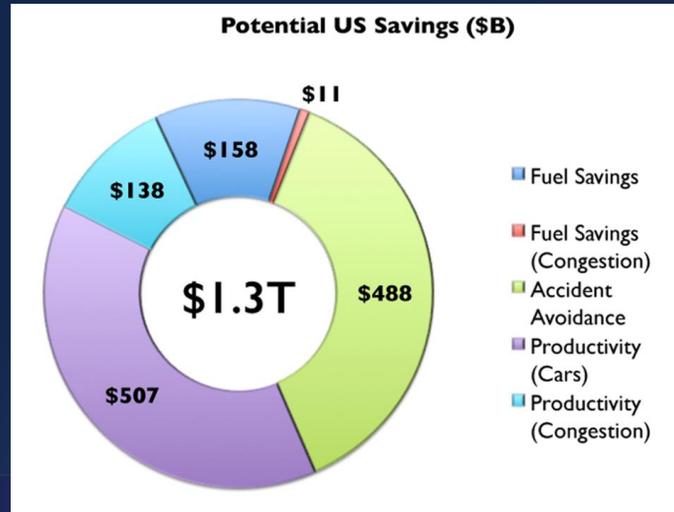
Economics Drives Transition: Private

- Adoption dividend for private individuals
 - Eliminate car ownership
 - Ave annual cost of owning a car: \$8,698
 - 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
- It will become too annoying to drive around all of those autonomous vehicles!

Economics Drives Transition: Public

- Economic and social costs associated with human drivers is enormous:
 - Estimated at \$0.8 to \$1.3 **T**rillion each year
 - Accidents drive 25% of congestion
 - 40,000 deaths from car accidents
 - 2 million injuries
 - 90+% of accidents cause by human error

Potential Savings



Public Policy/Planning Issues

- Government buy-in is:
 - 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?

Planning

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

Responding to the coming changes:

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

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.

Mobility and Equity

- **Mobility**
 - Handicapped
 - Elderly
 - Lower income
- **Equity**
 - Public Transportation often does not work well for low income workers/residential workers.
 - Does not go from residential to residential, but from residential to commercial

Safety and Productivity



Environment



Incentives Through Policy and Planning

- Allow vehicles equipped with ACC into HOV lanes
 - Eventual conversion of HOV lanes to ACC/AV lanes
- Allow ACC equipped vehicles to travel faster in HOV lanes
- Subsidize ACC upgrades
 - Arguably more concrete benefits than electric vehicles
- Sticks: higher costs of vehicle ownership
 - Registration fees, VMT taxes, etc.

Interim Summary

- Transition is coming very quickly!
 - Most reports are extremely conservative
 - Apply generally, but Bay Area is different
- Very important to start incorporating AVs into planning now
 - No more highway lane-miles, please!

What Changes Will This Bring?

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

Disposable Income

- Costs \$8,698 to own a car
- Will cost \$3,000 to use TaaS
- Net increase in disposable income of > \$5,000
- Spread across all households: \$1 trillion in new spending in the economy
- Major boost to economic activity
 - **CREATING JOBS!**

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...

Employment - con't

- What jobs will be created?
 - IT jobs
 - Retail/Production jobs
 - ??
- Always easier to identify things that will go away than to identify what will pop up in its place

Government Finances

- Government finances thrown for a loop:
 - Revenues up and down:
 - Parking revenue, tickets, traffic violation revenues
 - More commercial, retail and residential space
 - Less spending on road development
 - More (maybe less) spent on road maintenance
 - Fewer road miles
 - but perhaps more VMT

Transportation

- Demand for transportation will likely **increase** significantly: price falls, demand rises
 - Commutes may increase in distance, but not necessarily in duration
 - Zero passenger trips will arise
 - Deliveries
- At the same time, demand for roadway lane miles will likely decrease
 - AVs make significantly more efficient use of space
 - Front to back and side to side

Public Transportation

- Ambiguous implications for public transportation
- Extensions may be added through contract with TaaS company
- Demand may shrink because of low cost of TaaS

Infrastructure

- Focus of transportation infrastructure:
 - Currently on expansion
 - Will turn towards maintenance
 - Signage and striping has to be robust
 - Adding technology to infrastructure
 - Stop lights will be digital as well as visual

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

Parking

- With transportation as a service (TaaS), there will be minimal demand for parking lots
- Service providers will own lots in strategic places, but likely 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

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

Marin Economic Consulting

- *Regional Analysis*
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