Associated General Contractors of California

Driving Change – Autonomous Vehicles' Big Impact

Marin Economic Consulting
Jon Haveman, Ph.D.

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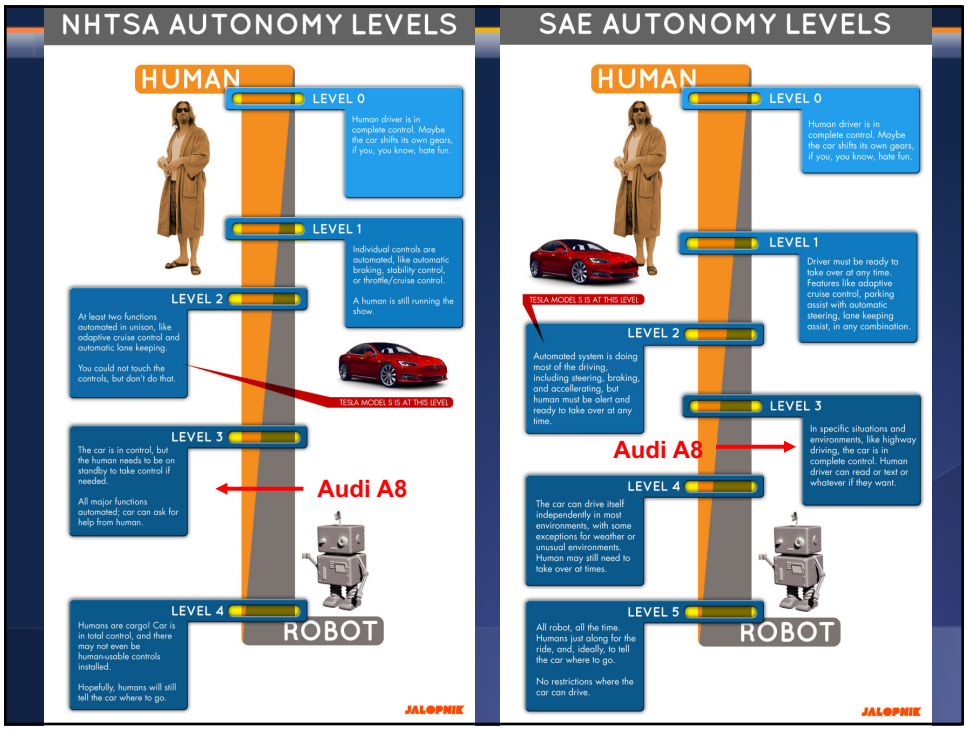
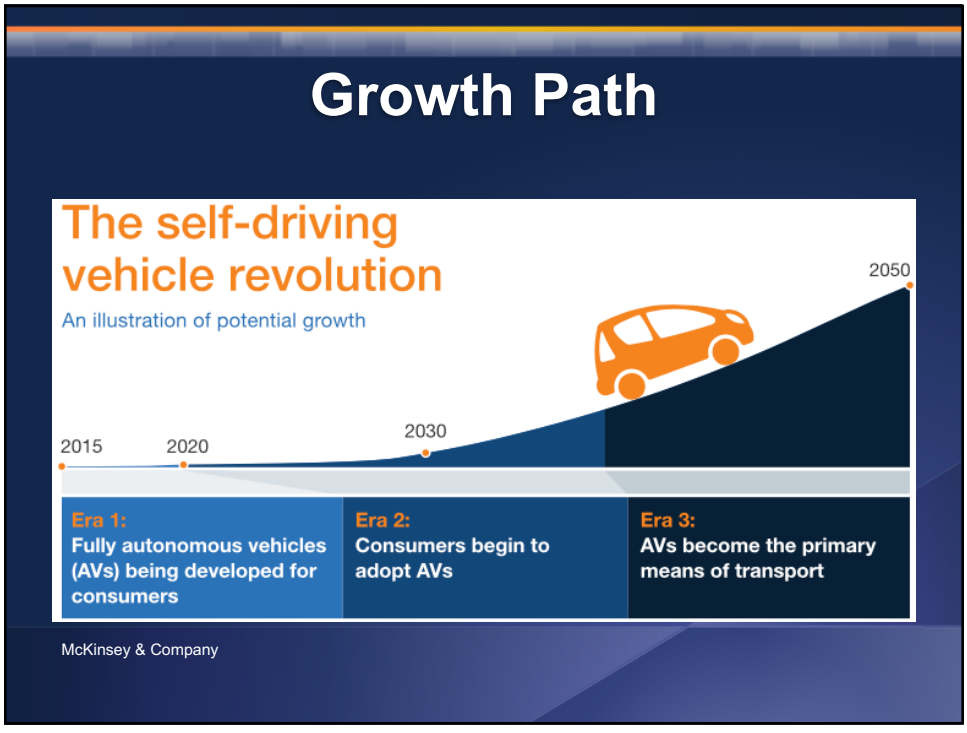
Outline

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


NHTSA AUTONOMY LEVELS
HUMAN
LEVEL 0
Human driver is in complete control. Maybe the car shifts its own gears, if you, you know, hate fun.
LEVEL 1
Individual controls are automated, like automatic braking, stability control, or throttle/cruise control.
A human is still running the show.
LEVEL 2
At least two functions automated in unison, like adaptive cruise control and automatic lane keeping.
You could not touch the controls, but don't do that.
TESLA MODEL S IS AT THIS LEVEL
LEVEL 3
The car is in control, but the human needs to be on standby to take control if needed.
All major functions automated; car can ask for help from human.
Audi A8
LEVEL 4
Humans are cargo! Car is in total control, and there may not even be human-usable controls installed.
Hopefully, humans will still tell the car where to go.
ROBOT
JALOPNIK
SAE AUTONOMY LEVELS
HUMAN
LEVEL 0
Human driver is in complete control. Maybe the car shifts its own gears, if you, you know, hate 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.
TESLA MODEL S IS AT THIS LEVEL
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.
Audi A8
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.
ROBOT
JALOPNIK


Growth Path
The self-driving vehicle revolution
An illustration of potential growth
2015
2020
2030
2050
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

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 the future look like?

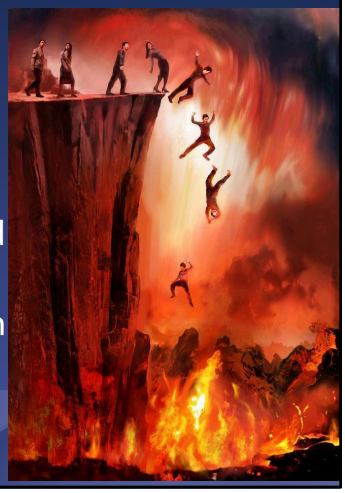
This:

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
- Minimal need for parking

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

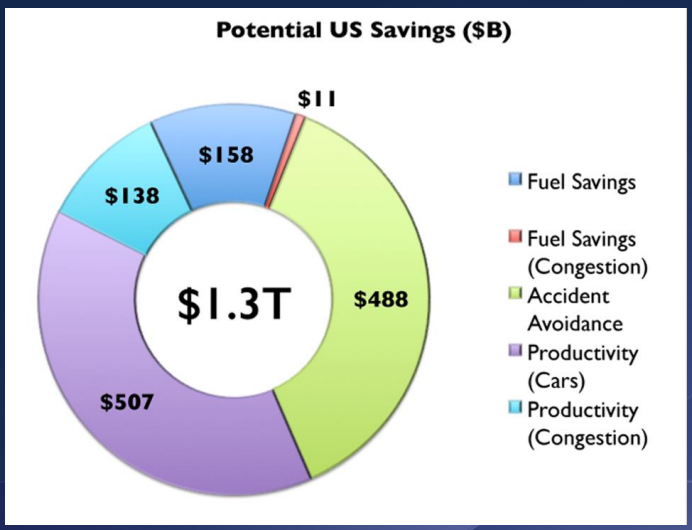
Economics Drives Transition: Private

- Adoption dividend for private individuals
  - Eliminate car ownership
    - Ave annual cost of owning a car: $8,469
    - 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 **TR**illion 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

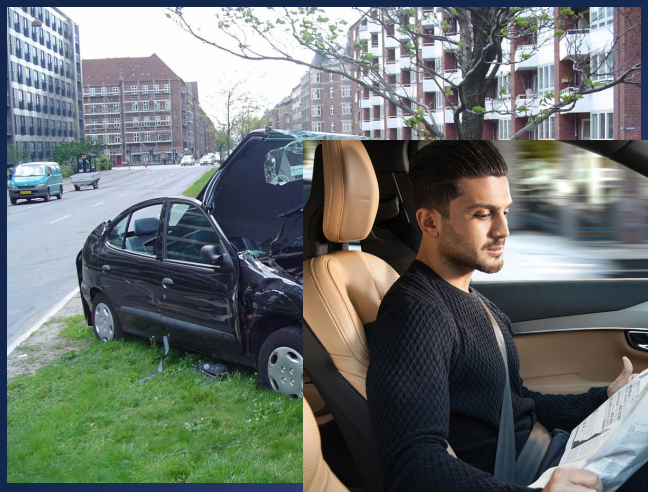
- **Mobility** and **equity** considerations
  - Elderly/disabled/impoverished
- **Safety**: Only way to reduce traffic fatalities is by coordinated effort
- **Productivity**: reduced congestion
- **Environment**: speed transition to electric vehicles

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 $ 8,469 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
- 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

Infrastructure

- Focus of transportation infrastructure:
  - Currently on expansion
  - Will turn toward:
    - Maintenance
      - Signage and striping has to be robust
      - TaaS providers push for fewer potholes?
    - Adding technology
      - 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*
- *Business & Market Analysis*
- *Ports & Infrastructure Analysis*
- *Economic Impact Analysis*
- *Public Policy Analysis*
- *CEDS Support*

Jon@MarinEconomicConsulting.com
415-336-5705