The Future is Now: Driverless Vehicles, Architecture & Planning

Course Number SA408
Day, Date, and Time Saturday, June 23, 2018 1:45 PM – 3:15 PM
Learning Units 1.50 LU: 90 minute seminar

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June 21-23, New York City

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Speakers List

- Jeffrey Tumlin – Principal, Nelson\Nygaard
- Shannon Sanders McDonald, AIA, Southern Illinois University
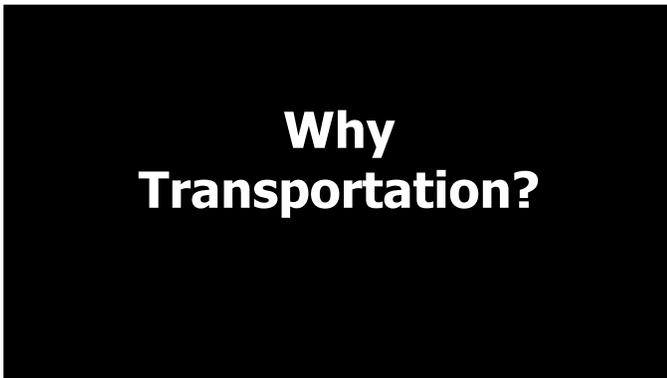- Don L. Elliott, FAICP, Clarion Associates

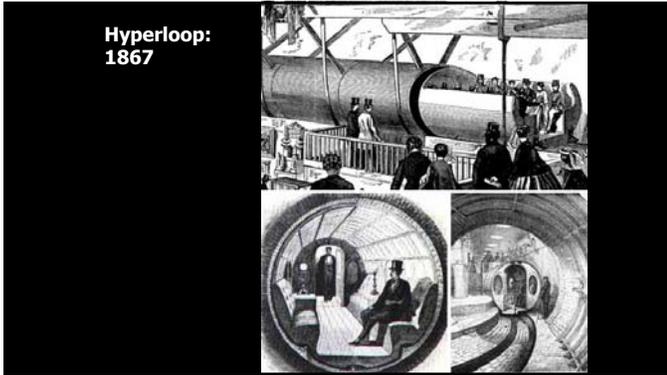## Course / Learning Objectives

- By the end of this presentation, the participants will be able to identify the different automated vehicle technologies and their how each individual approach can impact our planning and design decisions.

- By the end of this presentation, the participants should be aware of the potential zoning and development regulations may be impacted by these new technologies.

- By the end of this presentation, the participants will discover the positive synergies that these new automated technologies have to offer for better mobility for all, multi-modal connectivity, sustainability, land use, and strategies for Vision Zero.

- By the end of this presentation, the participants will be able to identify challenges that automated vehicle technologies could bring as they become a reality in our built world.

EXPLORING THE OPPORTUNITIES AHEAD

- What market research tells us about the potential size and distribution of driverless vehicles, and how they will likely be owned, operated, or managed

- What new transit technologies are emerging and how they may affect our cities streets, buildings and patterns of mobility

- What is the relationship to sustainability and the 2030 challenge and beyond

- What research tells us about how driverless vehicles will affect traffic circulation, parking behavior and management, residential preference patterns, and the need to plan for support services

- What areas of zoning, subdivision, and development controls will need to be revised to respond to the challenges posed by driverless cars

Mobility
For a more Sustainable Future

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Jeffrey Tumlin
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Why Transportation?

Hyperloop: 1867

Why is Mobility Changing?

Personal Mobility: Most Inefficient Sector

- Cars used only 5% of useful life

- Only 25% of capacity used

Transportation Demand Management

- Making more efficient use of existing infrastructure
- Making sure mobility is always available, whenever needed

Induced and Latent Demand

Congestion

More People Drive

Widen Roadway

Faster Driving
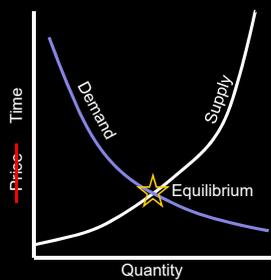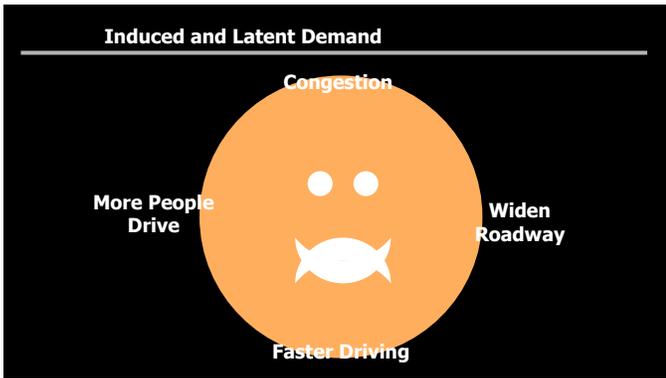
Congestion
is an
economic problem,
not a technology or
infrastructure problem

Geometry
Not Ideology

Space required to transport 60 People

Car   Bus   Bike

Press-Office City of Muenster, Germany/via

PRIVATE MOTOR VEHICLES
600–1,600/HR

MIXED TRAFFIC WITH FREQUENT BUSES
1,000–2,800/HR

TWO-WAY PROTECTED BIKEWAY
7,500/HR

DEDICATED TRANSIT LANES
4,000–8,000/HR

SIDEWALK
9,000/HR

ON-STREET TRANSITWAY, BUS OR RAIL
10,000–25,000/HR
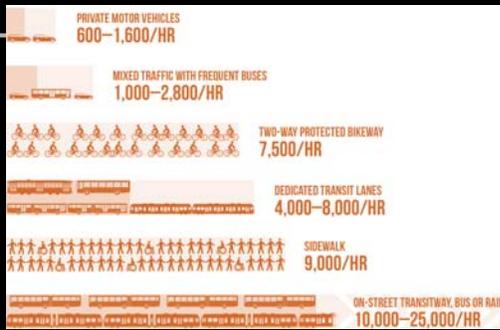
Image: NACTO

As cities grow, they have no choice but to reallocate space to more space efficient modes.

In order to make it possible to drive for those who need to, make it easy to not drive for those who don't.

But
Autonomous Vehicles
Will save us, right?

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Pop Quiz:

Who's investing the most in autonomous vehicle technology?

Pop Quiz:

What's Google/Alphabet/Waymo's revenue model? Selling information, right?

~96%
of Google's revenue is
Advertising

Source: Investopedia

Minority Report

space required
to transport **60 people**

car   uber   autonomous car

Image: Jon Orcutt

**So What Should Cities
be doing Now?**

Manage the street

- Manage public right-of-way for public good
- Dedicate space for most efficient modes
- Price congestion
- Price wasted space

Price Wasted Space for Efficiency and Equity

Manage the curb

- Design standards for curbside dropoff
- Fees for curbside access
- Promote shared use
- Eliminate dropoff/bike conflicts

Modernize parking regulations

- Price for availability
- Eliminate minimums
- Establish maximums
- Unbundle
- Share
- Promote adaptability

Establish data protocols for public good

- Data should inform transportation system
- Barriers to flow of data between public and private sector
- Disaggregate data by race, income, and other demographic categories.
- Explain the problem that data will solve.
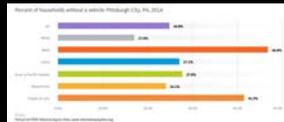
Quantify and Promote Equity

- Focus on outcomes:
  - Health
  - Access to employment and services
  - Share of income and time spent on mobility
- Consider ethnicity, income, age, ability, gender
- Price least efficient modes to subsidize mobility for those with the fewest choices
- Private profit motive will ignore those with greatest need

Reorganize government around mobility

- Be decisive about public transit agency survival
- Realign taxation: replace gas and parking taxes with VMT and congestion fees
- Align public right of way ownership (state, county, local) with operations
- New regional mobility authorities?

Transit Must Lead

- Best contexts for AVs:
  - Long haul trucking
  - Bus Rapid Transit
- Cities must partner with transit operators: Dedicated right of way in exchange for AV BRT, 24/7 every 2 minutes
- Begin process now to minimize any job loss

Provide a quality future of work

- 4.4 million American workers are drivers
- Partner with labor leadership now
- Future jobs require tech or customer service skills
- Current trajectory jeopardizes public sector pensions

Tell Better Stories

Tell Better Stories

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EXPLORING THE OPPORTUNITIES AHEAD

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

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EXPLORING THE OPPORTUNITIES AHEAD

Benefits of Automation

Safety
Automated vehicles' potential to save lives and reduce injuries is rooted in one critical and tragic fact: 94 percent of serious crashes are due to human error.

Automated vehicles have the potential to remove human error from the crash equation, which will help protect drivers and passengers, as well as bicyclists and pedestrians.

https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

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Benefits of Automation

Economic and Societal Benefits

Automated vehicles could deliver additional economic and additional societal benefits.

A NHTSA study showed motor vehicle crashes in 2010 cost $242 billion in economic activity, including $57.6 billion in lost workplace productivity, and $594 billion due to loss of life and decreased quality of life due to injuries.

https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

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Benefits of Automation
Efficiency and Convenience

Americans spent an estimated 6.9 billion hours in traffic delays in 2014, cutting into time at work or with family, increasing fuel costs and vehicle emission.

A recent study stated that automated vehicles could free up as much as 50 minutes each day that had previously been dedicated to driving.

https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

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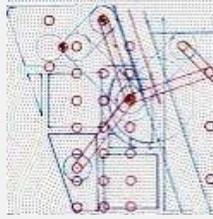
EXPLORING THE OPPORTUNITIES AHEAD

Benefits of Automation
Mobility

Today there are 49 million Americans over age 65 and 53 million people have some form of disability.

In many places across the country employment or independent living rests on the ability to drive.

One study suggests that automated vehicles could create new employment opportunities for approximately 2 million people with disabilities.

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https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

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Transit is being redefined

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Urban infrastructure can be redefined for Resiliency
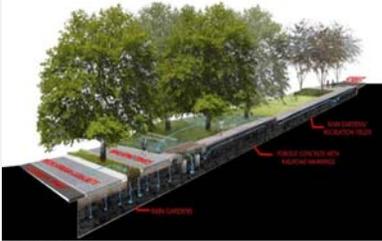
Electric Vehicles will become the norm

"New York has no motor vehicle exhibition such as recently drew all of Paris to its doors, nor does she as yet count the motor vehicles in her streets by thousands, but she has something which even Paris, the mother of the motor vehicle, cannot boast—a complete electric cab installation."

"The Edison Electric Garage, Boston, Mass.," *Horseless Age* 31, no.19 (May 7,1913): 841842

Electric Vehicles will become the norm

Will we wait another 30-40 years to understand the role of electric vehicles in in a sustainable future ? Some are integrating it again now. Using the technology where and when it is appropriate.

Commuting car and transit applications would be a good immediate first use.

Photo courtesy of Shannon Sanders McDonald with thanks to Emory University parking services.

EXPLORING THE OPPORTUNITIES AHEAD

Sustainability and the 2030 challenge

2030 Challenge for Planning

Addresses existing urban districts and cities, calling for a 50% energy and water consumption, *and transportation emissions reduction*, by the year 2030.

EXPLORING THE OPPORTUNITIES AHEAD

Sustainability and the 2030 challenge

An elevated solar powered automated transit network, designed by the engineering students at San Jose State University (SJSU), into downtown San Jose CA connecting the North and South Campuses of SJSU.

EXPLORING THE OPPORTUNITIES AHEAD

The elevated solar powered automated transit network, integrated into downtown San Jose CA connecting the North and South Campuses of San Jose State University.
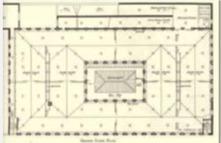
EXPLORING THE OPPORTUNITIES AHEAD

Why do we now need parking?

- A vehicle needs to be somewhere when it is not moving; it needs to be convenient and close to drop-off and pick-up locations.

- Parking protects an asset, whether this asset is privately owned or part of a service company.

- Automated vehicles allow for the dislocation of convenience for the location of the parking facility. Instead of parking facilities consuming the downtown urban areas, drop-off and pick-up areas will now be the most important need and further street congestion may result. Perhaps parking is redesigned as a public meeting place serving this need.

EXPLORING THE OPPORTUNITIES AHEAD

What about parking that can be used for housing when parking cars is no longer needed ? – flat floor plates are all that you need !

New York Taxi Cab Company Garage, 1909
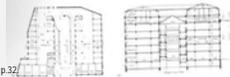
Francesco Andreani, *Garages* (Rome, Italy: Gangemi Editore, 1997), p.32

EXPLORING THE OPPORTUNITIES AHEAD

What about automated parking?

Automated Parking has the ability to park more cars in less space. They are seeing a resurgence in the United States. They also can be repurposed easily for housing, and this has already occurred in Athens, GA with a 1950's garage.

Photo courtesy of ryan.astrup@parkplusinc.com One York, NY, NY
Website: www.parkplusinc.com

Notes from Paris," *Architectural Review* 24 (1908).

EXPLORING THE OPPORTUNITIES AHEAD

The key to pay for infrastructure could be public private partnerships around freight connected to new distribution centers. Revenue may also be raised from VMT pricing and advertising included in different in-vehicle entertainment experiences.
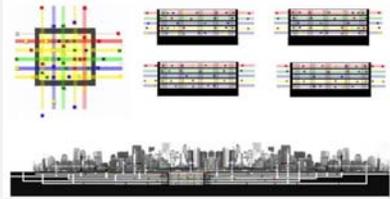

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board

- First summer meeting on July, 2013 – a small group of 100 diverse professionals freely discussing how to focus on the opportunities and challenges with automated vehicle technology entering the built world

- In summer, 2017, the Automated Vehicles Symposium as a joint TRB and AUVSI sponsored event will have over 1,200 diverse professional attendees. (http://www.automatedvehiclessymposium.org/why-attend)

- Workshops in the years, 2014 and 2015 provided focused discussions for Metropolitan Planning Organizations and others specifically on the built environment with over 100 professionals attending each one.

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
   **First Workshop 2014*: Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*
- The workshop focused on 3 specific planning challenges: *Streets and Roadway Design, Neighborhood and District Design, Regional Design*

- 3 movement structures were discussed: Privately owned Automobiles, Transit, and Taxi/Car Sharing

- Workshop Events and documents can be found at (http://its.ucdavis.edu/news-and-events/conferences-2/automated-vehicle/) and published paper with the summary published: (Road Vehicle Automation 2 | Gereon Meyer | Springer)

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
          First Workshop 2014: *Envisioning Automated Vehicles*
          Within the Built Environment; 2020, 2035, 2050

Scenario One: Investment and Redesign of the Freeway System

This system may increase vehicle travel, but congestion will be shallower more distributed. Overtime, VMT pricing could limit vehicle travel (especially by empty vehicles) and households may own fewer cars. The system will be traveled by vehicles of many different vehicle types and sizes.

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
          First Workshop 2014: *Envisioning Automated Vehicles*
          Within the Built Environment; 2020, 2035, 2050

Scenario Five: Parking
Parking does have a great impact on land use and the public realm.
This group identified key questions:
• Will the elimination of public parking make downtown more attractive?
• Will urban downtowns become too valuable for parking?
• Land values will dictate future use of vacated parking lot land (surface lots or parking structures).
• Ultimately, however parking *WILL* still be required for parking vehicles – both Level 5 and lower.

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
          First Workshop 2014: *Envisioning Automated Vehicles*
          Within the Built Environment; 2020, 2035, 2050

Scenario Five: Parking
• Financial incentives and disincentives would, just as in parking, emerge with drop-off and pick-up locations. This may create social equity issues.
• For parking, the positive aspect of level 5 vehicles is that less space would be required for parked vehicles especially if shared vehicles are the norm.

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
      First Workshop 2014*: Envisioning Automated Vehicles*
      Within the Built Environment; 2020, 2035, 2050

Scenario Six- Mitigating Poor Performance
- More automated vehicles may lead to more mobility and access, which may lead to more sprawl.
- Congestion could worsen and downtowns could therefore suffer.
- People may choose to live in their automated motorhomes, constantly cruising around popular activity centers, but causing even more traffic.

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Photograph courtesy of 2getthere Corporation. http://www.2getthere.nl/

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EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
      First Workshop 2014*: Envisioning Automated Vehicles*
      Within the Built Environment; 2020, 2035, 2050

Scenario Six- Mitigating Poor Performance

- Pedestrians could walk into the streets stopping automated vehicles and causing gridlock.
- People's health may deteriorate as shot walking trips are increasingly made by automated vehicles.
- Many people's livelihoods will be disrupted (e.g., professional drivers and possibly mechanics).

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EXPLORING THE OPPORTUNITIES AHEAD

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      First Workshop 2014*: Envisioning Automated Vehicles*
      Within the Built Environment; 2020, 2035, 2050
Scenario Seven- Sustainable Mobility for All
Three primary sustainability areas identified were ***environmental, social and economic***. Goals were identified for these areas.
- **Environmental** goals were to decrease energy and resource use, reclaim space, and decrease pollution.
- **Social** goals were to increase mobility, increase safety, reduce social inequity, increase social contact, and decrease wasted personal time.
- **Economic** goals identified were to induce economic activity, reduce income inequity, create sustainable transportation infrastructure funding, lower mobility costs, and address demand management.

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EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
　　First Workshop 2014: *Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*
Scenario Seven- Sustainable Mobility for All
Specific ideas for the ***environmental goals***
were to use automated vehicle technology to
- reclaim use of space through reductions in on-street parking and parking requirements for new development
- use of virtual street infrastructure and allocation (e.g. change lane directions at different times of day based and new building approach for vehicles, such as multi-tiered vertical approach and airport style multilane drop-off and pick-up space at first floor of buildings).

Photograph complements of Stan Young, NREL

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EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
　　First Workshop 2014: *Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*
Scenario Seven- Sustainable Mobility for All
Address Social goals by
- reducing the cost of mobility through more time efficient shared rides and establishing subsidized automated food deliveries
- Safety is also a key social concern, which would require regulations, rules, and monitoring of in vehicle behavior to, for example, allow passengers to choose who they ride with and use social networks to rate passengers.
- Access for all would require incentivization of supply to needy areas, and address language and cultural barriers to access.

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Courtesy Martin Lowson;© ULTra Advanced Transport Systems Ltd.

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Transportation Research Board
　　First Workshop 2014: *Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*

Scenario Seven- Sustainable Mobility for All
Economic goals could be achieved
- Through dynamic system demand management. Real time dynamic road pricing could be implemented on all roads with credits for those who share rides.
- Lane directions could be dynamically changed or reduced in size for platoons of smaller vehicles for integrated mode management

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EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
First Workshop 2014: *Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*
Scenario Eight – Revolutionaries
This group defined themselves as wanting to **explore the boundaries of automated visions.**

- An entirely new "transit roadway" system that was solar powered, collected rainwater, and included multiple speed paths for varying purposes, space for bikes, and new automated mobility systems.
- This "mobility system" would be raised above the existing roadway, providing a new green roof surface for all manner of pedestrian activities. It would provide the groundwork for a gradual transition away from anything but ultralight vehicles in the cities.

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
First Workshop 2014: *Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*
Scenario Eight – Revolutionaries
The following key idea was identified by the group:

- ATN (automated transit networks) are only efficient with ultralight electric vehicle cabins, typically segregated from traffic for safety, however the cabins could descend to the street.
- In order for ATN to be accepted it needs to be reliable on demand, segregate people, bikes, ultra-light vehicles, autos, freight, and size the station grid to minimize last mile or allow cabins to drive on the street. It should reduce or mitigate modal shifts (transfers) and have carts for personal belonging. Social changes in transit attitudes are needed: rental, public, and car sharing need privacy and security alternatives.

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
Second Workshop 2015: *Envisioning Automated Vehicles Within the Built Environment; 2020, 2035,2050*

- The workshop focused on **8 different Built Environments** in and around Ann Arbor Michigan: *downtown, midtown, University, first ring suburb, exclusive suburb, shopping mall, and two freight/shipping locations;* **3 movement structures were discussed:** *Privately owned Automobiles, Transit and Taxi/Car Sharing and* **2 specific Scenarios:** *Ownership and Shared* were defined for each location
- Workshop Events and documents can be found at:
  (http://its.ucdavis.edu/news-and-events/conferences-2/envisioning-automated-vehicles-within-the-built-environment-2020-2035-2050/)

EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
      Second Workshop 2015*: Envisioning Automated Vehicles Within the Built Environment; 2020, 2035,2050*

Ownership Scenario

- Higher levels of auto travel and congestion.
- Higher quality vehicle travel comes at a price.
- New low-density land development in outlying areas of the region.
- Less proximate commercial parking and on-street parking.
- New off-street non-residential parking in areas that minimize land costs and relocation travel.

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EXPLORING THE OPPORTUNITIES AHEAD

Transportation Research Board
      Second Workshop 2015*: Envisioning Automated Vehicles Within the Built Environment; 2020, 2035,2050*
Shared Scenario
- Lower levels of auto travel and congestion.
- Reduced cost of travel for all income groups.
- Travelers pay more for greater travel distances, solo use, and larger vehicles.
- New higher density development in central areas but some sprawl for very high income.
- Huge reductions in the need for parking space, no on-street parking, no residential parking and proximate commercial parking.
- New off-street parking development in areas that minimize land cost and relocation travel.

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      Second Workshop 2015*: Envisioning Automated Vehicles Within the Built Environment; 2020, 2035, 2050*

Life In 2040
- People who are just in the downtown area for pleasure will use car-sharing and automated transit to get to a downtown drop-off zone.
- People living in downtown, but working elsewhere can use automated transit to get to jobs in places like Detroit.
- People coming to the downtown area for work will use car-sharing and automated transit to get to a downtown drop-off zone, and from there they will use automated transit to get to a workplace.

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EXPLORING THE OPPORTUNITIES AHEAD

Before

Babcock Ranch, FL
Torti Gallas + Partners thank you to Principal Brian O'Looney

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EXPLORING THE OPPORTUNITIES AHEAD

After

Babcock Ranch, FL
Torti Gallas + Partners thank you to Principal Brian O'Looney

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EXPLORING THE OPPORTUNITIES AHEAD

Personal Thoughts
- Everyone will want to be dropped off right at the "front door" of their destination – this will create tremendous challenges for our streets
- Parking will not disappear, the parking garage will still be useful, but in new ways are public places, so that streets are still passable
- Or potentially, existing streets find a new use as all mobility other than walking or biking will be on another level

Key Questions
- How will automated vehicles change the suburban – urban – rural dynamic?
- What will be our personal expectations toward mobility?
- Since, automated vehicles will allow for mobility for all, how do we prepare for the new culture/society to emerge?

THE BASICS

A. It's Not One "Thing"

0. Human Drivers by themselves
1. Driver Assistance
   - System helps steer / accel / decel
2. Partial Automation
   - System can steer / accel/ decel
3. Conditional Automation
   - System also monitors surrounding – but can ask for help
4. High Automation
   - System also monitors without human help in some <u>driving conditions</u>
5. Full Automation
   - System can do everything in all driving conditions

Who Monitors?	Driver Prepared to Drive or Take Over?
Driver	YES
_____	
System	_____ NO

THE BASICS

B. It's Coming Fast – But Not All At Once

The Fast Part
- Many makers say they will introduce AVs by 2018-2021
- By 2030 = Maybe 15% of the market is AVs
- By 2040 = Maybe 50% of cars on road are AVs.

You need to start planning TODAY (actually, Yesterday)

The Not All At Once Part
- Now = 263 million non-AV cars, 2 billion parking spaces
- It will take a long time for those to all be replaced or repurposed
- AND we will have to plan for a "mixed AV / non-AV system" for a long time

The answers are within our 20-30 year planning horizons

> At current car sales rates = 40 years to "retire" the current stock of non-AV cars in the U.S.

THE BASICS

C. Ho[w] ... [Bette]r than Rides[h...]

The Dre[...]
- Lowe[...]
- More [...] [t]o be park[...]
- Less [...]

The Nig[...]
- Not [...]
- Not [...]
- The [...] ur office - - so s[...]

© Alamy Stock Photo

C. INDIVIDUAL VS. SYSTEM OWNERSHIP
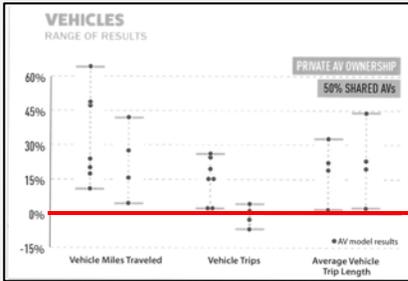
C. INDIVIDUAL VS. SYSTEM OWNERSHIP
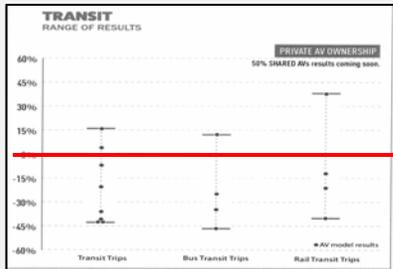
HOW WILL ZONING NEED TO CHANGE?

Four Key Areas of Zoning Regulation

1. **Permitted Land Use**

2. **Parking / Loading / Staging**

3. **Street Edges and the Public Realm**

4. **Development Patterns**

HOW WILL ZONING NEED TO CHANGE?

1. Permitted (or Required) Land Use

Review permitted uses and broaden the range of allowed uses for:

1. Parking lots and garages
2. Car dealerships
3. Gas stations (125,000) and repair shops (175,000) in high value locations
4. 125,000 auto repair / auto body shops / wrecking yards

➡ **Require "reuse-ready" designs and broaden the range of permitted use or reuses for these structures**

HOW WILL ZONING NEED TO CHANGE?

2. Parking / Loading / Staging

- Lower auto ownership, smaller vehicles, parking closer together can reduce space devoted to parking
- Shared AVs will be moving more of the time, parked less of the time
- Even if shared AVs are moving more of the time, there will be "downtimes" between rides.
- Shared ride operators will compete on convenience/ response time
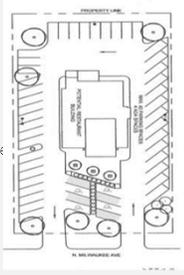
➡ **Lower or remove on-site / in-building parking location requirements as AV use increases**

➡ **Expect more requests for "staging areas" distributed for convenient response and expect operators to try to make them "proprietary" – not open to competitors**

HOW WILL ZONING NEED TO CHANGE?

3. Street Edges and the Public Realm
Drop-of Areas v. Parking Areas

- Reduced need for parking areas (mostly on private property) will be offset by increased need for pick-up/drop-off areas
- Pick-up/drop-off areas will be needed close to almost all destinations
- Some pick-up/drop-off areas will need to be on public r-o-w, but where that will interfere with traffic flow they will need to be on private property
- "Complete Streets" and "Road diets" become easier

➡ **Repurpose parking lanes and create on-site pick-up/ drop-off area standards**

➡ **Revisit street design based on narrower travel lane widths over time.**

HOW WILL ZONING NEED TO CHANGE?

4. Development Patterns

The Big Unknown -- Will AVs increase the pressure for sprawl?

- Since I don' have to drive and I can work in the car, I think I'll live further out

VS

- Since I no longer need to own a car, I'll cut out that cost and decide to move closer in

→ **Prepare for more sprawl pressure and put controls in place now**

HOW WILL ZONING NEED TO CHANGE?

Three Take-Aways on Zoning

1. **Focus on the reduced needs for parking spaces and increased needs for pick-up/drop-off spaces**

2. **Broaden the number of permitted uses of parking / auto sales / gas stations / body repair structures and land uses**

3. **Remember that all these changes will happen gradually over time – there will be a lot of non-AV vehicles on the road for a long time**

HOW WILL ZONING NEED TO CHANGE?
A Few Disturbing Thoughts

- Jobs will probably disappear
  - 4 million professional drivers in US today
- Walking to and from parking will drop
  - Decline in a routine form of exercise
- We need to ensure service equity to low income neighborhoods
- Watch out for "Mobile AV Billboard Spam"
- AV trends will have synergy with increasing drone deliveries
  - Fewer wheeled delivery vehicles
- Existing transit system ridership may fall unless AV programs coordinated to support them

HOW WILL ZONING NEED TO CHANGE?

Resources

http://www.citylab.com/cityfixer/2015/12/why-arent-urban-planners-ready-for-driverless-cars/419346/

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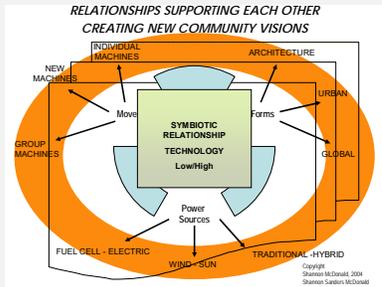
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http://www.scenariomagazine.com/urban-planning-in-an-age-of-driverless-cars/

http://www.sae.org/misc/pdfs/automated_driving.pdf

EXPLORING THE OPPORTUNITIES AHEAD

RELATIONSHIPS SUPPORTING EACH OTHER
CREATING NEW COMMUNITY VISIONS

Thank you!