Future Mobility: Handing Cities over to the car for a second time?

Report of the Transit Choices Workgroup AV
Renata (Ren) Southard, Brian Seel, Cole McCarren, Tim Wilke.
1. The transportation problems
2. Current programs and solutions
3. Definitions
4. Technology
5. AV uncertainties
6. Priority strategies
7. AV Potential
   • AV Transit
   • Mobility as a service
   • Ridesharing
   • Restrictions
   • Parking
   • Environment
8. Scenarios & Strategies
• Low transit ridership
• Rising VMT
• Low job access rate via transit resulting in inequities
• High cost of owning a car
• High levels of congestion
• Much public space devoted to vehicle storage
• High air pollution levels from transportation
• High fatality and injury rates
1. definitions:

AV Levels

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO AUTOMATION</td>
<td>ASSISTED DRIVING</td>
<td>PARTIAL AUTOMATION</td>
<td>CONDITIONAL AUTOMATION</td>
<td>HIGH AUTOMATION</td>
<td>FULL AUTOMATION</td>
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**Driver controls:**
- Level 0: all functions, all times, all locations
- Level 1: all functions, all times, all locations
- Level 2: all functions, all times, all locations
- Level 3: driver must be ready to take control
- Level 4: safety driver optional
- Level 5: vehicle controls: all functions

**Vehicle controls:**
- Level 0: vehicle assists multiple functions
- Level 1: vehicle assists
- Level 2: vehicle assists
- Level 3: vehicle controls: all functions
- Level 4: vehicle controls: all functions
- Level 5: vehicle controls: all functions

**Safety driver:**
- Optional

**Location:**
- All locations
“Autonomous” or “Connected”?
“Autonomous” or “Connected”?

"We have quite a good simulation too. But it does not capture the long tail of weird things that happen in the real world.

The real world's really weird and messy, you need the cars on the road.

...the real world is very weird and has millions of corner cases. If someone can produce a self driving simulation that accurately simulates reality, that in itself would be a monumental achievement of human capability. They can't. There's no way."

“High-precision GPS maps for self-driving cars are a “really bad idea,”

“anyone relying on LIDAR is doomed. Doomed. It’s expensive and unnecessary a fool’s errand,”
“Autonomous” or “Connected”: Implications for Cities

“autonomous” needs just the car to be smart.

“Connected” needs the car and the setting to be smart. It needs a lot of new infrastructure for sensors and communication.
# Autonomous Vehicles?

## The Landscape

<table>
<thead>
<tr>
<th>AUTONOMOUS SHUTTLE</th>
<th>AUTONOMOUS CAR</th>
<th>AUTONOMOUS BUS</th>
<th>AUTONOMOUS TRUCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPACITY (PAX)</td>
<td>8</td>
<td>5</td>
<td>30 to 50</td>
</tr>
<tr>
<td>CARGO (CUBIC LITERS)</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>RANGE (KMS)</td>
<td>15</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td>MAX SPEED (KM/H)</td>
<td>25 - 40</td>
<td>250</td>
<td>150</td>
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## AV Applications

- Delivery Robots
In general, the rapid uptake of ride share (TNCs) in cities likely portends the urban response to AVs, particularly shared AV services, once they are available. [...] 

TNCs have demonstrated latent demand for a more user-friendly form of transportation than existing forms, including driving and riding transit.

While offering an appealing service to individuals, TNCs have had a significant impact on cities, inducing more traffic, increasing the demand for curb space, and uncertain implications for public transit.

Meanwhile, regulatory conflicts have resulted in mixed outcomes for cities. Heeding the lessons of TNCs will be critical for cities and metropolitan areas with the advent of AVs. (Perspective Paper AVs)
Over a two-week period in March 2017, Arup and MTC conducted an online Delphi survey. The survey participants represented government, industry, and academia and all had demonstrated expertise in an AV-related field.¹

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<tr>
<td><strong>TIMING</strong></td>
<td>3 to 13 years until L5 AVs available for use</td>
</tr>
<tr>
<td><strong>SAFETY</strong></td>
<td>+40% to +90% increase in safety</td>
</tr>
<tr>
<td><strong>CAPACITY</strong></td>
<td>0% to +45% increase in roadway capacity</td>
</tr>
<tr>
<td><strong>DEMAND</strong></td>
<td>+5% to +40% increase in VMT</td>
</tr>
<tr>
<td><strong>ENERGY/EMISSIONS</strong></td>
<td>-50% to +100% change in GHGs</td>
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Variation in adaptation timeframes
Behavior

On a 10-year view, the macro socio-economic effects of urban millennial and Generation Z attitudes to car ownership and mobility will have a dramatic effect and yield a motor industry largely based on selling rides, increasingly deploying autonomous mobility, and monetizing miles: an emergent industry that will probably be as large as today’s automotive industry.

Autonomous Vehicles - Thematic Research 3/19
Preparations of Cities:

Promises

- Affordable: Access to housing and jobs
- Connected: Integration with Transit
- Diverse: Provide additional Equity
- Healthy: Vision Zero
- Vibrant: A New deal for Mobility
Risk Strategies

Jeff Speck, Ten rules for cities about automated vehicles, Oct 2017, CNU

1. Be afraid
2. Be realistic
3. Decide how much traffic you want
4. Plan for more sprawl pressure
5. Understand transit geometry
6. Don't rob transit
7. Own the streets and own the data
8. Don't buy any urban vision that forgets urbanism
9. Unify around a set of policy demands
10. Invest in the current technological revolution
Every new transportation technology impacts the geography of our communities and the structure of our lives. Autonomous vehicles (AV) are one such technology. Just as our freeway system or the streetcar network shaped our cities and lifestyles, AV will remake the metropolis once again. The question is how? And in so doing, with what unintended consequences? As with most technology it depends on how it is used.

AV Potential

Transit: fixed schedule and demand based
Because a first and last mile service makes sense if and only if the fleet is synchronized with the mass-transit system it completes!
Mobility as a service

A multimodal on-demand service providing region-wide access to travel options and payment via a single platform
Attractive Opportunities in the Robo-Taxi Market

CAGR 112.67%

- The robo-taxi market is projected to grow from 2,024 units in 2020 to 3,830,912 units by 2030.
- Increasing developments and investments by companies in autonomous driving, connectivity, electrification, and shared mobility are expected to drive the robo-taxi market.
- Rising demand for ride-hailing, services, vehicle safety, and fuel efficiency by manufacturers and governments is likely to propel the market.
Restricted access for private vehicles

“Congestion Pricing”

The solution to increased efficiency is congestion pricing and greater mobility options—not more highway lanes.

AUTONOMOUS VEHICLE HEAVEN OR HELL?
Less Parking

there are currently 263 million non-autonomous cars on the road, and roughly 2 billion parking spaces in the United States.

“Streets are 25 to 35 percent of a city’s land area... [the] most valuable asset in many ways,” Zabe Bent, principal at Nelson\Nygaard
Clean Air

The transportation sector contributes to the largest proportion of greenhouse gas emissions in the U.S. at 28.5 percent. Powering all forms of autonomous vehicles with renewable energy sources represents an enormous opportunity to curb transportation’s contribution to climate change. AUTONOMOUS VEHICLE HEAVEN OR HELL?/ EPA 2016
If left up to the free market without adequate regulation, we can expect a “hell” scenario dominated by personally-owned autonomous vehicles that are only accessible to those who can afford them, while further congesting our streets and polluting our air, leaving others to cope with worse traffic, longer commutes and under-resourced public transit.

Autonomous Vehicle Heaven Or Hell? Creating A Transportation Revolution That Benefits All, Jan 2019

1. Land Use

AV OPPORTUNITIES AND RISKS

- **URBAN RENAISSANCE**
  - Parking demand drops, new housing, green space and micro-transit hub sites could emerge

- **SPRAWL RENAISSANCE**
  - Facilitated sprawl, increasing travel costs as people live further from jobs,

PRIORITIZED STRATEGIES

- Repurpose off-street parking for infill development, parks and micro-transit hubs
- Institute parking maximums for both on- and off-street parking supply
- Retain or strengthen urban growth boundaries to control greenfield development
2. Transit

AV OPPORTUNITIES AND RISKS

- **Shared AV service could introduce a transit renaissance with improved on-demand services**
- **AVs could worsen congestion with more induced travel and empty vehicle circulation**

CHEAPER TRANSIT

AV CAR-SHARE "EATS" TRANSIT

PRIORITY STRATEGIES

- Double down on high-capacity bus and rail corridors
- Innovate suburban transit with autonomous, on-demand micro-transit
- Develop a mobility-as-a-service platform to provide a unified equitable gateway to services and information
The geometry reason for transit

THE IMPACT OF SAEVs

SPACE REQUIRED TO TRANSPORT 48 PEOPLE BY TYPE OF VEHICLE

FOSSIL FUEL  ELECTRIC  AUTONOMOUS  SHARED

Source: Cycling Promotion Found
3. Equity

Mobility Equity: a transportation system that increases access to high quality mobility options, reduces air pollution, and enhances economic opportunity for marginalized populations such as low-income people, people of color, the elderly, and people with disabilities.

AV OPPORTUNITIES AND RISKS

- Better access for those who cannot or do not drive
- Less access, more expensive, added barriers

PRIORITIZED STRATEGIES

- Mandate equitable provision of mobility services with transparent reporting
- Subsidize public transit innovations, replacing fixed route transit in some Communities of Concern
- Prioritize AV mobility service or programs that serve communities of concern
4. Safety

AV OPPORTUNITIES AND RISKS

- FEWER CRASHES
  - Significant reduction in human driving error could save lives. EVs could improve air quality

- MORE SEVERE CRASHES
  - Hacking and cyber-security could introduce new safety risks. Fossil fuel AVs worsen air quality

PRIORITIZED STRATEGIES

- Cap speed limits in downtowns and in neighborhoods
- Mandate that all AVs and EVs invest in the necessary infrastructure
- Develop “boundary program” to reduce hacking vulnerability
AV OPPORTUNITIES AND RISKS

- **Opportunities**
  - Reduction of transportation and logistics operating costs
  - JOBS IN FLEET MANAGEMENT OR MAINTENANCE

- **Risks**
  - AVs could cause rapid job loss or a shift to other occupations
  - LOSS OF TAXI DRIVERS AND TRANSIT OPERATORS

PRIORITY STRATEGIES

- Strengthen the capacity of training programs to expand opportunities for workers
- Target job clusters on industrially-zoned land near population clusters for production, distribution, and repair
- Pilot innovative AV applications that could spur new job opportunities
6. Cost

AV OPPORTUNITIES AND RISKS

- Fleet based transportation saves cost over privately owned car
- AV technology makes vehicles too expensive and drives cost up

PRIORITY STRATEGIES

- Use non geo-fenced technology
- Incentivize fleet use over private use and ownership
- Regulate parking cost and core city access in favor of fleet use
- Support R&D of AV technology
7. Environment

AV OPPORTUNITIES AND RISKS

- **Opportunities**:
  - Fleet based EV-Avs reduce trips, space needs and emissions
- **Risks**:
  - Privately owned AVs increase VMT, need more space, induce sprawl and need more energy

PRIORITY STRATEGIES

- Promote electrification of transportation
- Incentivize fleet use over private use and ownership with tools like taxes, tolls, rebates, etc.
- Prohibit private vehicles in high density core and supplement with micro-transit
- Priority high capacity transit