APA Speaker Series 2018
Future of Mobility: Planning for Transportation Amidst Rapidly Changing Technology

Presenters: Adam Stocker, Transportation Sustainability Research Center
Chris Schmidt, Division Chief of Transportation Planning, Caltrans
Moderator: Brigitte Driller, Caltrans
TRANSPORTATION IS CHANGING
California’s Rapidly Changing Transportation Landscape

- **Overarching Trends**: Future of Mobility White Paper highlights
  - Shared mobility on-demand
  - Connected and automated vehicles
  - Progressive transportation technologies
  - Statewide systems and infrastructure

- **Overarching Challenges**:
  - Equity, sustainability, climate variability, public health, finance
  - Synthesis and interoperability across sectors and agencies
Landmark Change Through 2050

Current state of knowledge about these topics and others, and how they will affect California’s transportation system through 2050 varies greatly. Trends and innovations are crossing boundaries and creating new opportunities for impact.

Key developments and market predictions include:

**Shared Mobility**
- Bikesharing
- Carsharing
- Ridesourcing/Transportation Network Companies (TNCs)
- Alternative Transit Services
- Shared Mobility Public-Private Partnerships and Data Sharing

**Transportation Technology**
- Connected and Automated Vehicles
- Zero Emission Vehicles
- Information and Communications Technology
- Cybersecurity Risk
- 3D Printing
- Blockchain
- Drones and Unmanned Aerial Vehicles (UAVs)
- On-demand Trucking/"Uber for Freight"
- Hyperloop

**Overarching Trends**
- Climate Change and Sustainability
- Demographics
- Economics
- Transportation Equity and Public Health

**Statewide Systems**
- Freight and Goods Movement
- California’s Passenger Rail System

Shaheen et al., 2018

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Future of Mobility White Paper Topics

**Statewide Systems**
- Freight and Goods Movement (14)
- California’s Passenger Rail System (15)

**Shared Mobility**
- Bikesharing (8)
- Carsharing (7)
- Ridesourcing/TNCs (9)
- Alternative Transit Services (11)
- Shared Mobility Public-Private Partnerships and Data Sharing (12)

**Transportation Technology**
- Connected and Automated Vehicles (5)
- Zero Emission Vehicles (6)
- Information and Communications Technology (13)
- Cybersecurity Risk (16)
- 3D Printing (18)
- Blockchain (17)
- Drones and Unmanned Aerial Vehicles (UAVs) (19)
- On-demand Trucking/“Uber for Freight” (20)
- Hyperloop (21)

**Overarching Trends**
- Climate Change and Sustainability (3)
- Demographics (1)
- Economics (2)
- Transportation Equity and Public Health (4)
### Demographics

- California is projected to grow from 39.4 million to 51.1 million, at 0.6 percent per year on average, between 2016 and 2060
- Central Valley, San Francisco Bay Area, Inland Empire, and greater Sacramento regions growing at a greater rate than the statewide average
- Predictions of Generation Z and Baby Boomer changes in travel behavior are scarce

### Economics

- Between 2016 and 2021, California total employment is expected to increase one percent per year on average
- Per capita income is projected to rise by an average of 1.8 percent per year
- It is unclear whether telecommuting and online shopping will contribute to an overall increase or decrease of vehicle miles traveled (VMT)

### Transportation Equity and Public Health

- Five of California’s smoggiest cities are also locations with the highest projections of ozone increases associated with climate change
- 34 percent of urban U.S. African Americans and 27 percent of Hispanics report taking public transit daily, almost daily, or weekly, compared to 14 percent of whites

Shaheen et al., 2018 © UC Berkeley, 2018
Defining Shared Mobility

Shared mobility—the shared use of a vehicle, bicycle, or other travel mode—is an innovative transportation strategy that enables users to have short-term access to a mode of transportation on an as-needed basis.

Shaheen et al., 2016
According to different predictions, 25 to 95 percent of VMT could occur in shared, automated vehicles by 2030.

**Shared Mobility: Carsharing**

<table>
<thead>
<tr>
<th>Carsharing Service Model</th>
<th>Roundtrip</th>
<th>One-way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles Removed Per Carsharing Vehicle</td>
<td>9 to 13</td>
<td>7 to 11</td>
</tr>
<tr>
<td>% Reduction in VMT</td>
<td>27% (on average)</td>
<td>6 to 16%</td>
</tr>
<tr>
<td>% Reduction in GHG</td>
<td>34 to 41%</td>
<td>4 to 18%</td>
</tr>
</tbody>
</table>

**Total Active Carsharing Growth in the U.S. and Canada, 2008 – 2017**

Source: Shaheen et al., 2017
Nationwide, TNCs transported an estimated 2.61 billion passengers in 2017, a 37 percent increase from 1.90 billion in 2016.

In San Francisco, ridesourcing trips comprised 15% of average weekday vehicle trips and 9% of person-trips in late-2016, accounting for 20% of average weekday intra-SF VMT and 6.5% of total citywide VMT.

Impacts on Traffic Congestion

Ride-hail companies are responsible for about 50% of increased congestion on San Francisco streets between 2010 & 2016.

Impacts on VMT and GHG Emissions

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San Francisco County Transportation Authority, 2018 ; Schaller 2018
Converging Technologies and Business Models

Shaheen et al., 2016

© UC Berkeley, 2018
Shared Automated Vehicles (SAVs)

How do we prevent this...

...from happening with these?
SECA Potential Challenges

- Higher upfront vehicle costs
- Increased VMT (due to lower costs, increased use, modal shift away from public transit, longer commutes, roaming AVs, etc.)
- More convenient and productive travel (can work or sleep in vehicle) increases miles traveled
- Provides convenient vehicle travel to non-drivers (e.g., youth, older adults, disabled populations)
- AV services increase amount of deadheading (zero occupancy) VMT
- Increases urban sprawl due to increased travel convenience

Estimated Range of AV Impacts on Energy Use

Source: Wadud et al., 2016
SECA Potential Benefits

- Reduce GHG emissions and improve safety
- Increase capacity (smaller vehicles, closer spacing, shared rides, etc.)
- Reduce per mile cost (over privately-owned vehicles)
- Reduction in personal vehicle ownership due to uptake of shared AV services
- Automated public transit vehicles improve cost, quality, and desirability of public transit services
- Some reduced vehicle travel, such as looking for parking spaces
- Makes dense urban living more attractive due to reduced parking demand and pedestrian risks

Estimated Range of AV Impacts on Energy Use

Source: Wadud et al., 2016
Personal electric vehicle (EV) sales have grown at an increasing rate since 2013.

California’s Zero Emission Vehicle (ZEV) Mandate includes increasing the number of ZEVs on the road by 1.5 million by 2025.

### Variable ZEV Adoption Dates

<table>
<thead>
<tr>
<th>Description</th>
<th>Projected Date</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.9 million ZEVs on U.S. roads</td>
<td>2022</td>
<td>Rocky Mountain Institute, 2017</td>
</tr>
<tr>
<td>1.5 million ZEVs on California roads</td>
<td>2025</td>
<td>California ZEV Action Plan, 2016</td>
</tr>
<tr>
<td>EVs price competitive without subsidies</td>
<td>2025</td>
<td>Bloomberg New Energy Finance, 2017</td>
</tr>
<tr>
<td>95 percent of VMT will occur in shared EVs</td>
<td>2030</td>
<td>Airbib and Sebab, 2017</td>
</tr>
<tr>
<td>Pure EV sales overtake plug-in hybrid sales</td>
<td>2030</td>
<td>Bloomberg New Energy Finance, 2017</td>
</tr>
<tr>
<td>80 percent of shared AVs are electric</td>
<td>2040</td>
<td>Bloomberg New Energy Finance, 2017</td>
</tr>
</tbody>
</table>

Shaheen et al., 2018 © UC Berkeley, 2018
Future Technologies: Cybersecurity, Freight & Blockchain

- Risk of cybersecurity attacks increasing with greater proportion of vehicles connected to wireless networks
  - Hackers could trick AI systems in AVs by altering physical environment as opposed to hacking vehicle systems themselves
  - Low-cost processors and updates may not include appropriate protection against cybersecurity attacks
- Rate of implementation of 3D printing, drones, “Uber for freight,” and hyperloop technologies could affect last-mile goods movement by shortening supply chains
- Mobility data sharing via a blockchain could allow companies and individuals to share and monetize their own data with very low transaction costs in a secure marketplace
  - A blockchain-based carsharing network could allow for owners to rent their cars on a short-term basis at a potentially lower transaction cost than existing services

Shaheen et al., 2018
Modeling and scenario building should focus on the **direction and likeliness of future trends**, instead of precise measurements

- Public sector should remain aware of technologies that are seemingly far from widespread deployment
Innovative Mobility Highlights, Carsharing Outlook, and Latest Research

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California’s Transportation Vision: Long-Range Planning Amidst Change and Uncertainty

Chris Schmidt
Division Chief, Transportation Planning, Caltrans
November 30, 2018
APA-Sacramento Speaker Series
“It’s a very exciting time to be working in transportation. We’re going through a big revolution in ways that we can’t control or predict, and it’s making people uneasy.”

-Laurie Berman, Caltrans Director

Source: Streetsblog, 2018
Why is it important to plan for new technologies?

New tech has the potential to improve our society:

- Safety
- Environment (CA climate goals)
- Transportation options

However, there is also the potential for unintended consequences:

- Increased vehicle miles traveled (VMT)
- Cybersecurity risks
- Equity considerations
How is Caltrans looking toward the future?

State-funded research

Early Truck ‘Platoon’ Tests Show Promise

Advanced Cruise Control Technology Could Yield Safety, Other Benefits
How is Caltrans looking toward the future?

Long-range planning – California Transportation Plan

Email CTP@dot.ca.gov to get updates on the CTP 2050
CTP 2050 Visioning Sessions Key Highlights

- **Political status quo** and outdated agency processes prevent innovation
  - Distrust among public sector, private sector, members of the public
  - Lack of political will and leadership
- **Lack of coordination for mass electrification**
- **Standardize data sharing and analysis frameworks:** what to collect, how to collect, how to share, how to analyze
- **Coupling and integration of existing funding sources**
  - Flow funding into public transit
  - Establish priorities to direct funding efficiently
- **User choice:** resilient, constant, real-time user choice as a priority
  - Seamless integration of modes, routing, payment systems
- **User pays:** Accurately price the real cost of externalities
- **Repurpose existing infrastructure:**
  - Obtain public rights of rail ownership with parallel goods movement
  - Repurpose highway rights-of-way toward non-auto oriented outcomes
  - Establish and implement curb management policies
- **Communication/outreach to the public:** create accessible resources for peer-reviewed studies without jargon; new curriculum
How is Caltrans looking toward the future?

Long-range planning – Modal plans

Fully integrated system = Cooperation among all modes and providers
The 2018 California State Rail Plan envisions integrated, door-to-door rail service. Users will be able to plan a trip and buy a ticket for the entire integrated network in a seamless fashion.

Advances in technological platforms will help inform users of travel options.
How is Caltrans looking toward the future?

New data sources

**District-Level Active Transportation** Plans

- Create a geospatial active transportation asset inventory with facility conditions.
- Identify network gaps in comfort and connectivity.
- Create prioritized route segments/project lists

*Active transportation* includes bicycling, walking, skateboarding, scootering, and other human-powered modes of transportation.
How is Caltrans looking toward the future?

Design and operations

Wider, brighter striping helps drivers today, autonomous vehicles in future
How is Caltrans looking toward the future?

**Interagency coordination**

- CA Multi-Agency Workgroup on Autonomous Vehicle (AV) Deployment
- Sustainable Freight Action Plan
- Zero Emission Vehicle (ZEV) Action Plan
## CALTRANS ZEV PROGRAM

<table>
<thead>
<tr>
<th>Fleet</th>
<th>ZEVs for 100% of all new light-duty fleet purchases by 2025 (where feasible)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>EV chargers and hydrogen fueling stations for light-duty fleet vehicles</td>
</tr>
<tr>
<td></td>
<td>Medium- and heavy-duty ZEVs, such as hydrogen street sweepers</td>
</tr>
<tr>
<td>Workplace</td>
<td>EV charging at 5 percent of the Department’s workplace parking spaces</td>
</tr>
<tr>
<td></td>
<td>Partnerships to install Level 2 workplace chargers</td>
</tr>
<tr>
<td>Freight</td>
<td>Support implementation of the California Sustainable Freight Action Plan</td>
</tr>
<tr>
<td>Public Charging</td>
<td>Identify three Department-owned sites for retail hydrogen fueling stations</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Install DC fast chargers at 37 Department-owned, publicly accessible locations</td>
</tr>
<tr>
<td></td>
<td>Install highway signage for ZEV fueling</td>
</tr>
<tr>
<td>Partnering/Lead by</td>
<td>Participate in the Governor’s Interagency Task Force on ZEVs</td>
</tr>
<tr>
<td>Example</td>
<td>Collaborate with external stakeholders</td>
</tr>
<tr>
<td></td>
<td>Explore partnership opportunities with EVgo, Electrify America, Monterey Bay</td>
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<tr>
<td></td>
<td>Air Resources District, and others.</td>
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</tbody>
</table>
Thank you!

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