Data and New Directions in Urban Mobility

Henry Kelly
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What’s New?

• Demand (demographics, life-style, online shopping/optimized delivery, telecommuting)
• Vehicle owner/operator -> buying mobility
• Urban design (transit oriented)
• Ubiquitous mobile devices
• New business models—mobility on demand (Uber, Lyft, Bridj, eBay Now, Amazon...)
• New Vehicle types (Connected, Automated, Right sized, Electric)
• Ubiquitous sensors and controls (including video)
• Vast amounts of data and powerful new data tools to describe, predict, and prescribe
Metrics

• Economic (efficiency, supply chain)
• Social (access, opportunity, equality)
• Energy & Environment (cut waste, accelerate electric)
• Health (access, safety, air quality)
• Disaster management (evacuations)
Data

- From personal vehicles and trucks (location, speed, bumps, maintenance)
- From emergency vehicles & transit
- From Infrastructure sensors including cameras
- Weather
- Specially instrumented vehicles
Example Analytical Challenges: Learning

Driver Assist/ Connected, Automated Vehicles
- Hazard detection
- Anticipate driver/pedestrian behavior
- Route planning (people & delivery)

Traffic Management
- Anticipate driver route choice behavior
- Manage traffic under routine conditions
- Manage traffic under emergency conditions

System Planning
- Infrastructure/urban design
- Transit design and anticipated operations
- Simulations
US Vehicle Miles Traveled
Source: Kolko, Terner Center for Housing Innovation, UC Berkeley 2016
Impact of Automated Vehicles on Energy Consumption

Energy Use Impact of Automated Vehicles

<table>
<thead>
<tr>
<th>Study</th>
<th>Metric</th>
<th>Effect Magnitude</th>
<th>Time Frame</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson et al. (RAND), 2014</td>
<td>Fuel Economy</td>
<td>+100% - +1000%</td>
<td>2050+</td>
<td>Based on aggressive vehicle weight reductions</td>
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<tr>
<td>Brown et al., 2014</td>
<td>Fuel Demand</td>
<td>-91% - +173%</td>
<td>90% AV penetration</td>
<td>Range based on scenarios with different effects</td>
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<tr>
<td>Fagnant &amp; Kockelman (Eno Center), 2013</td>
<td>VMT</td>
<td>+9%</td>
<td>90% AV penetration</td>
<td>Estimates also given for lower market share; fuel efficiency gains assumed</td>
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<tr>
<td></td>
<td>Fleet size</td>
<td>-42.6%</td>
<td></td>
<td></td>
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<tr>
<td>Fagnant &amp; Kockelman, 2014</td>
<td>Energy use</td>
<td>-12%</td>
<td>Fleet is all shared AVs</td>
<td>Per shared AV, vs. avg. light-duty vehicle</td>
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<tr>
<td></td>
<td>GHG</td>
<td>-5.1%</td>
<td></td>
<td></td>
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<tr>
<td>Spieser et al., 2014</td>
<td>Fleet Size</td>
<td>-66%</td>
<td>Fleet is all shared AVs</td>
<td>No energy-only outputs modeled</td>
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</tbody>
</table>

Raphael Barcham Goldman School of Public Policy, UCB 2014
Mobility Transformation Center

- Ann Arbor: Up to 9,000 equipped vehicles (cars, trucks, bus, bicycle, pedestrian)
- SE Michigan: 20,000 connected vehicles, 500 nodes, 5000 devices
- Ann Arbor Automated Vehicle Fleet Operational Test in M City
  - 27 square miles of coverage, including surrounding highways as well as city and suburban streets.
  - Equipped infrastructure (Mcity) includes
    - 45+ intersections
    - 3 curve-related sites
    - 12 freeway sites
  - All dedicated short-range communications (DSRC) logged
  - Testing selected vehicle-to-infrastructure functions
Current Research Topics

• Legal and Regulatory Issues CAV
• Cybersecurity Roadmap
• Remote Intrusion Detection
• Transfer-of-Control During Automated Driving
• Drivers' Adaptation Behavior
• Age-related Differences in Driver
• Parking Guidance System in Ann Arbor
• Improving fuel economy of heavy-duty vehicles using vehicle-to-vehicle communication
• Cybersecurity Testing Center
• Simulating vehicle automation
Willow Run: 335 Acres
PRIVACY

SECURITY