Preparing for the Impacts of Connected and Automated Vehicles: (non) Driver of Change?

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Today’s Presentation

• Technology, Adoption and Change
• Planning Goals and CAV Impacts
• Broad Issues about CAV Data
• Scenario Planning
• Conceptual Use Cases
There seems little question that vehicle automation is technologically feasible; however, a tremendous amount of effort in both research and development will be required before a satisfactory automatic system is in operation. This effort must involve not only vehicle-control studies, but also an intensive investigation of the present driver-vehicle complex, since the knowledge gained will be necessary for the proper specification and introduction of the control system components. Further, the need exists for intensive overall system studies so that optimum strategies can be chosen for headway spacing control, merging and lane changing, and the interfacing of automated highways with other modes of future transportation.

July 1969, *IEEE Spectrum*

*The Electronic Highway*, by Robert E. Fenton and Karl W. Olson, Ohio State University

Photo: The Ohio State University
Existing Practice

Potential Impacts?
1900 to Today: What’s Different?

Horses → Automobiles → Autonomous Vehicles

• We aren’t starting in the mud: we have massive infrastructure ready for use
• We don’t have a vast, unlimited landscape to develop
• We have the overriding factor of sustainability and climate change
• Horses lost jobs; now, people will lose jobs
Polling Probable Usage, 2016

- Consumer Technology Association
- The CTA questioned 2,001 people and found that 70 percent of them were ready to test-drive an autonomous car and almost as many were interested in replacing the car they own, lease or rent with a vehicle that drives itself.
Intent to Use, 2015-2016

Houston (N=1532)
- Not at all likely: 17%
- Somewhat unlikely: 18%
- Somewhat likely: 38%
- Extremely likely: 28%

Dallas (N=1039)
- Not at all likely: 17%
- Somewhat unlikely: 19%
- Somewhat likely: 39%
- Extremely likely: 25%

Waco (N=526)
- Not at all likely: 17%
- Somewhat unlikely: 19%
- Somewhat likely: 35%
- Extremely likely: 28%

Austin (N=556)
- Not at all likely: 14%
- Somewhat unlikely: 19%
- Somewhat likely: 36%
- Extremely likely: 32%

TxDOT 0-6848, 2016
Reasons for NOT Intending to Use, 2015-2016

TxDOT 0-6848, 2016
Question

• What autonomous vehicle has been around for >100 years, is used by millions every day around the world, and has an impeccable safety record?
AV/CV Technology is Likely to...

- Dramatically Improve Safety
- Enhance Capacity
- Allow Greater Mobility for Traditionally Mobility-limited Persons
- Change Vehicle Ownership/Cost Structures
- Enhance System Management, including Congestion Pricing
- Reduce Parking Requirements
- ....Potentially Transformative Changes
Automated Personal Mobility Environment

Internet of Things

Connected/Automated Vehicles

Smart Mobility Environment

Personal Communications Technology

Sharing Economy

SHARE
# Automated Mobility Environment

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<td>Expanded Tech Sector Economy</td>
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<td>Fewer On-road Vehicles</td>
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<td>Automated Parking</td>
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<td>Empty Office Space</td>
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List of Shared Things

Buses, trains, airplanes, elevators, escalators, taxis, shuttles, grocery stores, offices, streets, restaurants, water, electricity, land, bicycles, sidewalks, movies, tools, donuts...

We are a cooperative species...
Some Terms...

• Automated vs. Autonomous
• Connected
• Shared Autonomous Vehicle (SAV)
• Zero Occupant Vehicle (ZOV) – Driverless
• Highly Automated Vehicle (HAV)
Time in Cars

• American Time Use Survey, 2015: 1.13 hours per person spent in travel related to activities during the day
• Cars sit 95.3% of the day IDLE in a parking space
• 412 hours per year in our cars
• 42 hours “wasted” in congestion
Work and Employment

- Level of employment: AV/CV is perhaps the most impactful of the “coming of the robots”
- Taxi, TNC drivers
- Truck drivers
- Delivery
- History shows – always a replacement
  - Automated systems managers?
  - But, who gets left behind?
Work and Employment

• Work patterns
  – 8 to 5, “commuting” home to work goes away?
• Lowering disutility of travel – removing the driving task
• Will it matter where or when work is done?
  – Dynamic Workplace becomes prevalent?
Trip and Delivery Patterns

• Today, 9.6 Daily Person Trips per Household
• 15% work, 53% non-work, 32% non-home based
• Automation – Delivery Vehicles come to you
  – Economics of drivers vs. technology vs. brick & mortar stores
• 2016, Expenditures on Retail Food exceeded Grocery Stores for 1st time
  – “InstaCart” and Prepared Meals are popularizing
Fuel

• The economics of running a Fleet of Shared Autonomous Vehicles (SAVs)
  – Leading to Widespread Electrification

• Fuel Delivery changes from Rail/Trucking to Wire
  – Significant supply chain impacts

• Land use for Refueling?
Parking and CAV Effects

- Land space in core of cities: doubled?
- Could be more dense if built vertically
- Could be used for open space
  - “Heat Island” effect
- If built:
  - Re-Orientation of work commuting
  - Adjustment to cost of land -> residential location choice
Parking Impacts

• Several Changes, Depending on Auto Ownership Trends
• Searching for Parking
• Revenue Impacts to Cities
• Reduced Land needed for Parking (Huge!)
• Zero Occupant Vehicles (ZOVs) – added Vehicle Miles of Travel?
Parking: A Land Gobble

• Studies Show up to 60% of Vehicles in CBD searching for parking
• Between 2 and 6 Spaces per Vehicle
• Land Required for Parking? 10% - 50%?
• Much Variability in Data and Research Study Results
Residential Location Choice?

• As disutility to travel declines...
  – Will we live further out, since the commute is “easier”?
  – Will land prices drop, from conversion of parking land uses (increasing inner-city land supply?)
    • Prompting an already trending urban residential growth
Adding to Vehicle Miles of Travel?

• Age 12-16 cohort
• Age 75+ cohort
• Mobility-limited Persons
• Shift from Shared Ride/Transit to SAV
• Transportation Equity – will automation bring a leveling of accessibility to healthcare, jobs, goods, food, and services?
Perhaps the least discussed issue...

• CAV brings about a fundamental change: Moving “route plans” and “activity plans” from our heads to a common-access system

• The conglomereration of infrastructure, vehicles, and activity needs can be coordinated

• ...IF we choose to do it...
CAV Route Plans - > Coordinated Arrivals

METROPIA – Incentive based App

Can we solve congestion through automated-coordinated travel?

Ye-Tian@metropia.com

Texas A&M Transportation Institute

TTI | Saving Lives, Time & Resources
Making decisions based on past certainty when faced with knowledge of an uncertain future is folly.
Contact

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