Opportunities and Risks on the Road Toward Shared AVs

Automated Vehicle Symposium

Sharon Feigon, Executive Director
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Connect public agencies and transit, community and private sectors to scale benefits of shared mobility for all

Serve as a clearinghouse through conducting innovative research with practical results

Create tools for cities to share policies and best practices

Provide technical assistance for cities creating & testing shared mobility pilot projects

Convene the public and private sectors through workshops and conferences

Expanding the ecosystem of transportation choices by creating a multimodal transportation system that works for all
• The more people use shared modes, the more likely they are to use transit, own fewer cars, and spend less on transit overall (TCRP Report 188)

• People that use 3+ shared modes, coined “supersharers” report greater transportation cost savings, and own half as many cars as people who use transit alone (TCRP Report 188)
Key Research Findings, Continued

- Typical TNC trips are between 2-4 miles long (TCRP J11 Task 25)
- Usage mostly concentrated in core areas with short trips
- Across all major US cities, TNC use is heaviest during evening hours and weekends (TCRP J11 Task 25)
- Airports and entertainment districts are important generators
- Individual Trips widespread across all incomes
Why Should A/V’s be Shared Vehicles and what are the policies to get us there?
Key Scenarios: **Dystopia**

- Zero occupancy vehicles in abundance (Zombie cars)
- Major unemployment of drivers
- Increased dependence on private cars
- Greater social inequality in transportation
- Vehicles for the Rich
- Increased congestion and GHG emissions
- Loss of public transit and accessibility
- More urban sprawl
- Greater alienation and isolation
- More health challenges
Key Scenarios: **Utopia**

- Shared, Electric, and Autonomous Vehicles
- More street space dedicated to people
- Less dependence on private automobiles
- Greater transportation access for all
- Reduced GHG emissions and congestion in cities
- More walkability and active transportation
- More flexibility and choices
- AV used to optimize public transport
What’s required for this to happen?

Create supportive regulation for shared and electric autonomous vehicles
Regulations to deter ZEV “zombie” cars through pay per mile fees
Public private partnerships across OEM’s, shared mobility providers, and transit agencies
Testing and investment in shared modes, such as AV shuttles and transit
Land use regulations that support road diets and streets to prioritize active transportation
Possible applications of autonomous vehicles (AVs) as part of a diversified public transport system

- High capacity core network with fixed line service
- Swarm of AVs as Robo-Taxis and on-demand shuttles
- AVs used as feeders to public transport stations
- Area-based on-demand autonomous mini-buses
- Autonomous car-sharing vehicles

Source: UITP Liége
Looking Forward: Cities and Regions as Mobility Managers And Brokers

Recommendations:

• Public entities need to ensure that benefits are widely and equitably shared.

• Allow the use of driverless shuttles on public roads, in trials
• Let public transport operators test AV’s & take advantage of innovation
• Support research to understand the citizen’s acceptance of autonomous (shared ) vehicles
• Encourage more synergies needed now with public & private shared mobility actors
• Encourage shared mobility to increase shared AV in the future
Big Issues to Solve

Land Use:
• Prioritizing reallocated street space, highway space
• Who Gets What and When? Who gets access to the curb?

Future of Jobs and Equity:
• What happens to all the drivers?
• What happens to access to jobs and mobility?

Transitioning:
• How do we scale up and address increasing mix of A/V, non A/V environment?
• How do AV’s and Shared Mobility fill in gaps while strengthening transit network and flexibility

Partnerships:
• How do we face challenges of partnerships and keep public interest?
• How do we manage integrating modes with agreements across many stakeholders-public and private?
Thank you

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Path to Shared Autonomous Vehicles

Opportunities

Risks

Societal Outcomes
The Origins of “Ride Sharing”

- ExclusivE Ride
- Density
- Shared Ride Services

- Fill empty seats
- Take cars off the road
- Reduce carbon footprint
- Set up transition to SAV
On the Road?
Evidence

More VMT

Shift to TNCs is mainly from taxi and transit

Pooling not the solution
TNC increase net of decline in yellow cab trips, per hour per sq. mile

Weekdays, 4-7 pm

Change in taxi/TNC trips 2013 to 2016

Large increases in trips during PM peak

More VMT
Congested core:
353 million miles
7% of VMT

Citywide
600 million miles
3.5% of VMT

Increase in taxi/for-hire vehicle mileage
2013 to 2016
Shift to TNCs is mainly from taxi and transit

National survey (TNC users)
- 68% use taxi less often
- 38% use transit less often
- 21% use personal auto less often

San Francisco
- 50% would have used taxi or other ride service
- 33% would have used transit
- 7% would have used personal vehicle instead of TNC

Source: Reuters Spring 2017 survey

Denver area
- 28% transit or carpool
- 19% taxi or other TNC
- 31% would have used personal vehicle or rental car
- 12% walked or biked

(2014 UC Berkeley study)
(2016 Alejandro Henao Ph.D. dissertation)
Growth in Non-auto Travel in NYC

2015 to 2016

- Taxi/for-hire
- Bike
- Ferry
- Subway
- Bus

Change in Ridership (Annual, millions)

New York
Pooled Trips
As percent of total trips, by origin

May-June 2016
Pooled Trips
As percent of total trips, by time of day

May-June 2016
Pooled Trips
As percent of total trips
8 am – 6 pm, weekdays
May-June 2016
Use of UberPool and LyftLine (U.S. TNC users)

- 90% never used
- 10% have used
- Most only occasionally
- Estimate that <5% of TNC trips are pooled

Customer is saying

- Save time
- Reduce stress
- Save money
- Be safe
What Customers Want: Revealed Preference

- **Taxis**
  - Readily available
  - Reliable
  - Transparent
  - Comfort
  - Ease of payment

- **Transit**
  - Readily available
  - Reliable
  - Transparent
  - Comfort
  - Ease of payment
  - Lower cost

- **Personal auto**
  - Parking cost
  - Avoid drinking and driving

- **TNCs**
  - Readily available
  - Reliable
  - Transparent
  - Comfort
  - Ease of payment
What Customers Want: Revealed Preference

To promote pooled services:
- Offer shuttle on fixed routes (Lyft)
- Walk to designated stop (Lyft and Uber)
- “Dynamic drop-offs” (Uber)
What Customers Want:

Two Venerable (but Improved) Service Models

Better taxi
- 5-10 minute waits → Match supply and demand
- Point to point
- Transparency → App
- Comfort
- Premium fare
- Ease of payment

Better Transit
- 5-10 minute waits → Demand response
- Minimize travel time
- Transparency → App
- Comfort
- Value for money
- Ease of payment
Path to Shared AVs

Risks

- Proliferation of vehicles/traffic
- Bleed from transit
Opportunities

Exclusive ride/premium fares

Everywhere

Sedans
• Taxis
• TNCs
• Sedans/limos
Opportunities

Exclusive/shared subsidized fares

Transit replacement (Thin trip density)

Sedans

Vans

Replacement to bus:
- Altamonte Springs, FL
- Centennial, CO
- Innisfil, Canada
- Bishop Ranch, CA

ADA Paratransit:
- Boston
- DC
- NYC
Opportunities

Shared ride → Feeder to Transit

Sedans Vans
- Pinnellas County, FL
- Summit, NJ
- Dublin, CA
- San Clemente, CA
Opportunities

Shared ride → High capacity transit

Vans - Buses

On-demand shared van:
- Chariot (SF, Austin)
- Via (Austin, for Cap Metro)
Path to Shared AVs

1. Exclusive ride/premium fares
   - Everywhere
     - Sedans
2. Exclusive/shared subsidized fares
   - Transit replacement (Thin trip density)
     - Sedans
     - Vans
3. Shared ride
   - Feeder to Transit
     - Sedans
     - Vans
4. Shared ride
   - High capacity transit
     - Vans - Buses
What is Service Model?

What is Business Model?

What Public Policy Gets There?

TNCs
Tech firms
Auto makers

Municipalities
Counties
States
What Public Policy Gets There?

Problem Definition

Policy tools
- Street management
- Address “empty seats”
- Right-size vehicles
- Franchise authority

Political will & action

Societal Outcomes
Opportunities and Risks with AVs: A TNC Perspective

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Where is the Data?

Lyft and Uber Won’t Release Data to Shed Light on How They Affect Traffic

By Aaron Bialick Jun 30, 2015

As ride-hail services like Lyft and Uber have boomed in San Francisco and other cities, proponents claim they help reduce demand for parking and road space by making it easier for people to own fewer cars. But very little data has been released by the ride-hail companies that would allow experts to assess their impact on streets and traffic.

In a panel discussion yesterday, Lyft’s Curtis Rogers emphasized that reducing car ownership is “our end goal that we think we share with the city.”

But when Thea Selby of the SF Transit Riders Union pressed Rogers for data to show whether Lyft might be substituting for transit trips more than car trips, he said he couldn’t provide it. Rogers insisted, however, that Lyft doesn’t want to compete with Muni, walking, or bicycling. “We think we’re just one more piece to the puzzle.”

“We celebrate Muni getting better,” said Rogers. “We’re well aware that if we pulled everyone off of Muni and put them in
Where is the Data?
- Missed Opportunity!!!

Let’s NOT miss the Window of Opportunity!!!

**WE NEED:**
- Quantity and **Quality** of Data?
- Understand Research Questions
➢ Do we have to wait until AVs are in place to start doing research?

➢ What can we do NOW to start understanding the impacts?

- Congestion
- Energy
- GHG
- Mobility & Equity
- Safety
- Infrastructure

- Cost
- Efficiency
- Travel Behavior
  - Vehicle Ownership
  - Mode Shifts
- Others
Autonomous Vehicles (AVs)
Deadheading and ZOV

- **Deadheading**, from the taxi or TNC industry, is when drivers travel around without a passenger in the car.

- **ZOV**, or Zero Occupancy Vehicles, is when AVs won’t have a passenger on the car.
Deadheading

- Driver Commuting
  - Beginning and end of shift
- Cruising for a Ride
- En-route to Passenger Pick-up
Deadheading

The Story Behind Shareece Wright's 540-Mile-Plus Uber Ride —
https://theringer.com/shareece-wright-uber-driver-chicago-buffalo-758a0ae0feb8
Deadheading

The Story Behind Shareece Wright's 540-Mile-Plus Uber Ride —
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Deadheading and ZOV

➢ Let’s measure passengers instead of cars!

➢ Passenger Miles Traveled or PMT

➢ Vehicle Miles Traveled or VMT
space required to transport 60 people

car  bus  bicycle
space required to transport 60 people

- car
- uber
- autonomous car

LESS PEOPLE
Pre-Uber/Lyft, Pre-AVs
Post-Uber/Lyft, Pre-AVs
Post-Uber/Lyft, Post-AVs

PMT: 13

PMT: 90
Efficiency and VMT

Opportunity:
- Support and induce sharing! Moving from TNC-hailing to TNC-Sharing (e.g. UberPool and LyftLine)
- Reduce deadheading/ZOV with an efficient and balance fleet of vehicles
- Increase Vehicle Occupancy! Higher PMT/VMT!

Risk:
- More congestion! ZOV cars circulating around!
- More VMT! Lower PMT/VMT
Q: For this trip, how would you have traveled if Uber/Lyft wasn't an option?

- Public transport: 22.2%
- SOV: 19.0%
- Wouldn't have traveled: 12.2%
- Bike or Walk: 11.9%
- Taxi: 9.6%
- Carpool: 9.3%
- Other ridesourcing: 5.5%
- Get a ride: 4.5%
- Car rental: 4.2%
- Other: 1.6%
Mode Replacement

Opportunity:
➢ Are we going to reduce car-dependence (e.g. vehicle ownership)? Less driving trips? Increase Multimodality & Public Transport?

Risk:
➢ Or, Are we going to cannibalize more sustainable modes such as public transportation, biking or walking?
Parking

High potential to decrease car dependency:

➢ TNC trips when replacing driving modes, reduce the need for parking

➢ Parking difficulty/expense one of the main reasons for passengers to use TNCs instead of driving.

Very similar to AVs!
TNC Data Landscape
- Guide Cities on Type of Data and Research Questions Needed
- Data Collection Strategies

TNC & Impacts:
- Vehicle Ownership
- Energy Impacts in Four Main Areas:
  - Vehicle Fleet
  - Deadheading
  - From TNC-hailing to TNC-sharing
  - Travel Behavior

Current Projects with NREL
Wake-up Call (TNC, AVs, MaaS)

HELL or HEAVEN?

➢ Data
  – AVs Collection from Day 1

➢ Research
  – Better Inputs for AVs modeling

➢ Policy & Regulation
  – ZOV Congestion Charge
  – Cap & Trade based on efficiency (e.g. PMT/VMT)
Opportunities and Risks with AVs: A TNC Perspective

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Lyft
Uber

Autonomous Vehicles (AVs)

AV Symposium, San Francisco
July 11-13, 2017
FTA Transit Automation Research Program

Opportunities and Risks on the Road Toward Shared AVs

Steve Mortensen
July 11, 2017
Research Program Process

Identify use cases
• Identify, analyze, and prioritize use case scenarios for automating transit bus operations

Engage stakeholders
• Interviews, workshops, and presentations

Develop a plan
• For future transit automation development and demonstration projects

Accelerate deployment
• Identify knowledge transfer opportunities and ways to accelerate deployment

Major Project Tasks
• Literature Review
• Risk/Barrier Assessment
• Stakeholder Engagement
• Benefit-Cost Analysis
• Research Plan
• Knowledge Transfer
Use Cases

**Transit Bus Advanced Driver Assistance System (ADAS)**
- Smooth Acceleration and Deceleration
- Automatic Emergency Braking and Pedestrian Collision Avoidance
- Curb Avoidance
- Precision Docking
- Narrow Lane/Shoulder Operations
- Platooning

**Automated Shuttle**
- Circulator Bus Service
- Feeder Bus Service

**Maintenance, Yard, Parking Operations**
- Precision Movement for Fueling, Service Bays, and Bus Wash
- Automated Parking and Recall

**Mobility-on-Demand (MOD) Service**
- Automated ADA Paratransit
- Automated First/Last-mile
- Automated Bus Rapid Transit
- On-Demand Shared Ride

FTA Transit Automation
## Potential Risks

### Safety and security
- Software and hardware failures or limitations
- Human factors
- Security and cybersecurity considerations
- Emergency response
- Quiet operations and interactions with other road users

### Operations and cost-effectiveness
- Unplanned technology and transition costs
- Workforce costs
- Obsolescence
- Costs of new service patterns
- Congestion and emissions
- Increased competition from other modes and transit providers

### Passenger experience
- Travel times and reliability
- Convenience and access
- Customer service
- Ride quality, comfort, and privacy

### Equity
- Payment
- Accessibility
- Service changes
## Potential Barriers

<table>
<thead>
<tr>
<th>Category</th>
<th>Potential Barriers</th>
</tr>
</thead>
</table>
| **Product availability**         | • Limited market size  
• Complex operational requirements  
• Certification                      |
| **Labor relations and human resources** | • Opposition from labor  
• Training and workforce needs                     |
| **Financial constraints**        | • Procurement  
• Buy America                                                   |
| **Risk aversion**                | • Transit agencies are risk-averse                                                   |
## Potential Barriers (cont.)

<table>
<thead>
<tr>
<th>Accessibility</th>
<th>Law, regulation, liability &amp; insurance</th>
<th>Institutional capacity &amp; planning</th>
<th>Interagency cooperation</th>
<th>Public opposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ADA compliance</td>
<td>• Need to update insurance policies, safety regulations, and state laws for automated vehicles</td>
<td>• Difficult to communicate internal business case • Possibly a lack of long-term planning resources</td>
<td>• Vehicle standards • Supporting infrastructure • Regional planning</td>
<td>• Privacy concerns • Equity concerns • Other policy concerns</td>
</tr>
</tbody>
</table>
Preliminary Findings

• **Potential benefits** include avoiding collisions, lowering operational costs, improving service frequency and flexibility, and enabling new service models

• **Bus transit automation R&D in the United States lags** behind that of Europe and Asia and behind domestic automation R&D for light-duty and commercial vehicles

• **Transit agencies face many potential barriers to automation** (legal, financial, and institutional), in addition to technical challenges

• **Safety and security, operations and cost-effectiveness, passenger experience, and equity** are major risk categories for transit automation
Preliminary Findings

• Initial modeling results show a **generally favorable business case for investment in advanced driver assistance systems (ADAS) on transit buses**. However, ADAS capabilities are not yet widely available in the bus market, and the return on investment will vary based on specific characteristics of the transit service.

• Specific characteristics of a transit service greatly influence the **cost-effectiveness** of automation.

• It is more cost-effective to **implement automated capabilities as a package** than individually.
Next Steps

• Review of Federal, State, and Local Policies (underway)
• Transferability of Light-Duty and Heavy-Duty Automation Technologies to Transit Applications (underway)
• Research Roadmap Webinar (fall 2017)
• Knowledge Transfer to Key Stakeholders & Audiences (underway)
Thank you!

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Transportation Network Companies (TNC’s) and Transit Partnerships: An Overview

Automated Vehicle Symposium

Sharon Feigon, Executive Director
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Expanding the ecosystem of transportation choices by creating a multimodal transportation system that works for all.
A Growing Number of **Shared Mobility Companies** in North America

- **2017**
Shift from the vehicle ownership

to vehicle "usership"
FTA MOD “Innovation Knowledge Accelerator” Project

Compiling best practices and facilitating knowledge exchange between the MOD Sandbox grantees

Lessons Learned from TCRP Studies:
Report 188
Private Transit Study (J11- Task 24)

and
TNC-Transit Study (J11-Task 25)
Autonomous Vehicles + Transit

- **Convergence of shared modes** (ridesourcing, ridesplitting, microtransit, carsharing, etc)
- In turn, shared mobility is **setting the stage and creating demand** for adoption of shared, autonomous vehicles
- **Technologies and partnerships in place** can allow cities to building off innovations in ridesourcing, carsharing, and Mobility as a Service to provide equitable AV models
Public Private Partnerships Types

**First/Last Mile:** Publicly subsidized Uber/Lyft trips and other companies as well working within transit service areas (to/from transit hubs)

**Multi-Modal Service/Payment Integration:** Integration between transit and shared mobility services being tested and implemented in various stages in US cities--

**Carpooling/Ridesharing:** More private models arising for tech based ride-matching on work commutes, voucher programs, shared parking as well through transit-run carpool programs

**Expanded Services:** Concierge services address technology user gaps in niche markets, cash-based payment options
Exciting possibilities for AV’s to fill service gaps:
- People with disabilities
- Senior citizens
- Low-density areas
- Poor job access routes
Transit-TNC Partnerships: Key Examples

Extended Services
• Pinellas County, Florida (PSTA) Transit Disadvantaged Late Night Program

First/Last Mile
• PSTA Direct Connect
• Uber and Summit, New Jersey
• Centennial, Co & Lyft
• Seattle & Los Angeles Lyft partnership

Private Transit and Shuttles
• Via and CapMetro in Austin
• KC Freedom on Demand
• Company Shuttles

• Guaranteed Ride Home
• King County Metro
• Metro Transit (Twin Cities)
Transit-TNC Partnerships: Key Examples

Seniors and Paratransit
- THE RIDE Paratransit pilot projects with Uber in Boston
- Laguna Beach, CA partnership with Uber for reduced cost rides for seniors
- WMATA TNC and Taxi Paratransit pilot

Low Density Areas
- Liberty Mobility Now, a rideshare service that partners with public transportation agencies in rural areas
Our Findings: Lessons Learned in P3’s Across Private and Public Mobility Providers

MOD IKA Project
• Most cities working hard on nuts and bolts of P3’s in new mobility ecosystem, including creating contracts and data sharing agreements – draw on lessons from other partnerships in related areas

TCRP Study 188
• Access to more modes – more likely use transit, own fewer cars, and spend less on transportation. Three or more reduces single occupancy vehicles and increases use of transit

TNC-Transit Study (Phase II)
• In general, TNC trips are short (2-4 miles) and peak times are weekends and evenings
• Access across all income groups
• Usage mostly in core areas. Airports and entertainment other large use areas.
• Lots of awareness but usage varies a lot in different cities
Our Findings: Big Issues for P3’s Across Private and Public Mobility Providers

Partnerships and negotiation
• Choosing the right partners
• Negotiating to protect agency and user needs

Contracting and data sharing
• Challenging to design contracts and agreements
• Need standardization of data requirements

Marketing, education, and outreach
• External outreach to riders important for success
• Internal outreach to other departments / agencies
• Fear of MOD as competition recurring issue
Our Findings: Big Issues in P3’s Across Private and Public Mobility Providers

Behavior change
• Making pilots successful in the long-term

Equity and Accessibility
• pilot context and for long-term- s

Street Space and Land Use
• Addressing public, private needs and negotiating how to balance

Different needs for different geographies
• Scale of transit system
• Size of market
• Car centric vs transit-oriented
Looking Forward: Cities and Regions as Mobility Managers And Brokers

Public entities need to ensure that benefits are widely and equitably shared.
Transitioning Mobility Infrastructure

- Mobility Hubs
- Connected vehicles
- BRT Lanes prioritizing transit and active modes
- Parklets and pedestrian streets
- Smart parking
- On-street WiFi
Thank you

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Mobility, Innovation, and Technology
The Building and Stumbling Blocks of Tomorrow’s Transit Agency?

2017 Automated Vehicles Symposium
Chris Cochran, Senior Planner
July 11, 2017

Pinellas Suncoast Transit Authority (PSTA)
St. Petersburg, Florida
Nicholas Negroponte – A 30 Year History of the Future
Policy and Other Challenges

• Issues at Federal, State and Local levels
• ADA Equitable Service
• Background Checks & Vehicle Maintenance
• Not everyone likes Disruption

Critical Lessons Learned So Far

• Leadership
• Legal and Risk
• Role of Strategies
• **DON’T BE AFRAID TO FAIL!**
Overview

- Direct Connect Program
- TD Late Shift/Daytime Urgent Program
- FTA MOD Sandbox
Direct Connect Outcomes

Successes

• First Ever Program
• Groundbreaking Partnerships
• National Recognition
• Demonstration of Expandable Model
• Successful in applying lessons learned in pilot to expansion

Challenges

• Data
• Technology
• Demographics
TD Late Shift Successes

- Improved safety, service reliability and economic position of participants
- Over 23,000 rides to date
- Avg. Trip Cost reduced by $3.75
- Awarded $982,000 to date

TD Late Shift Lessons Learned

- Previous lessons learned don’t always translate to new programs
- Be ready for unanticipated success and leverage those opportunities
- Strategies are always a work in progress

“Allowed me to work late shifts”

“I don’t have to walk home in the dark anymore.”

“It has been really helpful to me not having a care and all and when I work late after the buses stop running and sometimes I get stranded. Thank you for this program it really helps a lot.”
Collaborative federal research grant focused on the use of our TNC partnership model

One of 11 agencies to receive this grant, and awarded $500,000

Will demonstrate the cost effectiveness and reliability of emerging on-demand technologies

Development of performance measures
Sandbox Project

GOALS

• Improve Transit Efficiency
• Increase Transportation Effectiveness
• Enhance Customer Service

BENEFITS of Real-Time Paratransit

• Cost efficient
• Customers can now make on demand trips instead of scheduling in advance