Vehicle Miles Traveled with New Mobility Systems and E-Commerce

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Research and Development Engineer

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Sacramento, CA
Introduction

• Vehicle Miles Traveled (VMT) is a metric of major focus for transportation policy.

• VMT is strongly correlated with major public costs we care about including energy, emissions, safety, and congestion.

• New mobility systems can impact VMT by enabling changes in behavior and vehicle ownership.
National Vehicle Miles Traveled

United States
Moving 12-Month Total on ALL Roads - VMT (Billions of Miles)
FHWA Office of Highway Policy Information
January 1971 to June 2019

Source: FHWA Traffic Volume Trends
National VMT per capita

Vehicle Miles Traveled per Person in the United States
VMT and US Census Population Estimate for July of each Year

Source: FHWA and US Census
Aggregate VMT Measurement is Difficult

- Today, VMT measurement is done by proxy using road sensors, fuel consumption, regional modeling, and other methods.
- The odometer directly measures VMT, but that data is difficult to leverage.
- Localized VMT measurement, the kind that would allow us to monitor overall progress within urban, suburban, and rural environments is challenging.
US Petroleum Consumption & Production

- US Petroleum Consumption
- US Domestic Petroleum Production
- Net Imports as Share of US Consumption

Davis and Boundy, 2019
Estimated Electrical Grid Emissions in California

Estimated CO2 Emissions of California Electrical Grid

4 and 5 - year change in Emissions

CAISO, 2019
New and Shared Mobility Systems Today

• Main Types
  • Carsharing
  • Bikesharing
  • TNCs
  • Microtransit
  • Micromobility
  • Public transit
How will new mobility systems change VMT?

• Travel behavior changes in public transit, walking, bicycling, other shared or active modes, and personal vehicle driving
• Changes in vehicle ownership
• Changes in fuel type
• System vehicle activity
• System logistical operations
Evidence of Impacts from One-way Carsharing

Key Findings:

• Between 2% to 5% of members sold a vehicle due to carsharing across study cities.

• 7% to 10% of respondents did not acquire a vehicle due to car2go.

• Across five cities, car2go took estimated 28,000-plus vehicles off the road (including shedding and suppression) and reduced parking demand

<table>
<thead>
<tr>
<th>City</th>
<th>% Reduction in VMT by Car2go Households</th>
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<tbody>
<tr>
<td>Calgary, AB</td>
<td>-6%</td>
</tr>
<tr>
<td>San Diego, CA</td>
<td>-7%</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>-10%</td>
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<tr>
<td>Vancouver, BC</td>
<td>-16%</td>
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<tr>
<td>Washington, D.C.</td>
<td>-16%</td>
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</table>

Martin and Shaheen, 2016
Micromobility and VMT Impacts

• Micromobility travelers may reduce their VMT through mode substitution.

• But the trips they substitute for are generally short.

• EV-based systems require energy input.

• Vehicle activities facilitate vehicle charging and redistribution and add VMT.
Main Traveler Behavior Components of TNC VMT Change

Change in Personal Vehicle Miles Traveled (PVMT)
- The substitution of PVMT with TNC activity
- Deadheading still adds miles, but pooling can reduce them

Personal Vehicle Shedding
- The reduction in household vehicle ownership due to TNCs
- Some consumer action involved, but results in substantive reductions in VMT

Personal Vehicle Suppression
- The prevention of vehicle ownership from happening in the first place
- Easy to do and results in considerable reduction in VMT

Change in the Use of Other Shared Vehicle Modes
- Changes in the use of taxis, carsharing, and other personal vehicle modes
- Avoid counting VMT just because it is observed in a TNC without considering the mode substitution.
Main Vehicle Activity Components of TNC VMT Change

**Period 0 (Travel to Passenger Market)**
- Some share of drivers travel to the markets they serve.

**Period 1 (Open to Passengers)**
- Vehicles open to passengers, may be circulating, may be stationary.
- Double counting of miles can occur during this period.

**Period 2 (Fetching Passengers)**
- Passenger assigned, vehicle traveling to it
- Double counting likely ceases at this point.

**Period 3 (With Passengers)**
- Vehicle is with at least one passenger
New Mobility System Integration with Public Transit

• There are examples of new mobility systems complementing public transit through natural activity as well as supportive projects in collaboration with public agencies.

• Building on lessons learned, new mobility systems may be able to better integrate and support public transit systems.
LA County and Puget Sound FTA MOD Sandbox First and Last Mile Partnership

Project Overview

- A partnership between LA Metro and Via. Via is providing FMLM connections to transit stations and allow users to pay for rides using the regional TAP card. There is a companion project that is taking place in Seattle that is led by Sound Transit.

Key Objectives

- Improve mobility and accessibility across all populations, including travelers with disabilities
- Expand the number of unique public transit users and increase overall ridership for both access and egress trips to transit
- Preserve or enhance the environment
- Reduce congestion from personal vehicles
- Ensure travelers feel safe on public transit and at public transit facilities
- Improve cost efficiency of access and egress trips to transit and level of service per user cost

Source: LA Metro and King County (2019)
Via in West Sacramento

• Microtransit operator Via has operated a system in West Sacramento.

• The project runs shuttles that provide service within the city of West Sacramento.
GoDublin

• Local travel within the City of Dublin.

• Flat rates with a promo code and selection of shared ride option

• Covers regions that were served by transit with low ridership.

Source: City of Dublin
E-Commerce and VMT

• E-commerce has been growing significantly since the start of the century.

• E-commerce results in an increase in the number of package deliveries, increasing the number shipping vehicles and miles travelled by them.
E-Commerce Trends

Trends in E-Commerce

- **Retail Sales**
- **E-Commerce**
- **Non-E-Commerce Retail**
- **E Commerce %**

US Census, 2019
Trends in Taxable Diesel Fuel in California

Source: California Department of Tax and Fee Administration
Concluding Remarks

- New mobility and freight systems undoubtedly exhibit impacts on VMT.
- The measurement of VMT and impacts of specific systems on it, particularly over time, is challenging.
- Impact assessment needs to consider not only VMT we see, but also the VMT we would have seen in its absence.
- New methods of local and regional VMT measurement would help advance understanding of how large systems impact local environments on an aggregate scale.
THANK YOU,
QUESTIONS?
Transforming the Way We Travel: Strategies for VMT Reduction

Jennifer Gress
Reducing VMT is key to climate, air quality and health goals.

Trends in California GHG Emissions

Growth in VMT is outpacing technology gains

(Source: California Greenhouse Gas Emission Inventory - 2018 Edition)
Transportation GHG emissions reductions are not on track to meet State targets.

Solving our transportation challenges requires taking action in key areas.

(Source: CA Dept. of Tax & Fee Admin.)
Solving our transportation challenges requires taking action on the housing crisis.

Change in Housing Cost Burden by Income (2016 vs. 2010)

This bar plot shows percentage of household overburdened by rent in California. Overburdened is defined as spending >35% of income on housing costs.

(Source: American Community Survey)
Solving our transportation challenges requires making investments in alternatives to driving alone, but there has been remarkably little shift in RTP spending by mode.

Source: CARB analysis based on MPO submissions and RTPs. All budgets in Year of Expenditure except for SACOG. All icons made by Freepik from www.flaticon.com. MTC includes bike/ped spending in the roads category.
Solving our transportation challenges requires partnerships to pilot test innovative ideas.
Solving our transportation challenges requires developing fiscally sustainable & equitable pricing policies.
Clean Miles Standard (Senate Bill 1014)

SB 1014 requires CARB and CPUC to adopt and implement a program to reduce GHG emissions from transportation network companies (TNCs).

The new regulation will encourage zero-emission vehicles and VMT reduction strategies and account for automated vehicles in TNC fleets.
• CARB establishes base year emissions

January 2020

• CARB adopts annual targets via regulation

January 2021

• Each TNC proposes GHG reduction plan every 2 years

January 2022

• CPUC implements program & tracks compliance

January 2023
CARB’s Guiding Principles for the Clean Miles Standard

Regulation Design
• Decrease GHG emissions and increase zero-emission miles
• Encourage pooling, active transport, and transit usage
• Forward-looking with automated vehicles
• Align with other State policies
• Maximize transportation access and equity

Development Process
• A synergistic process
• Data-driven
• Encourage ZEV infrastructure
• Maximize benefits to low- and moderate-income drivers
We need to work together to make systemic and structural changes to address housing, the economy, and transportation.

Governor Newsom’s Executive Order N-19-19 provides new opportunities for VMT reduction actions.
For more information contact:

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Sustainable Transportation & Communities Division
Jennifer.Gress@arb.ca.gov
Uber Platform Mobility & VMT Insights

UC Center Sacramento -- Capitol Insights VMT
October 17, 2019

Austin Heyworth
Senior Manager, Public Policy
Global Scale

600+ Cities
65+ Countries
11B+ Cumulative Trips
Engaged User Base

Uber

75M+ Active riders
3M+ Active drivers
15M+ Trips per day
We share many of the same goals as the 600 cities we serve, and are committed to addressing the same challenges: reducing individual car ownership, expanding transportation access and helping governments plan future transportation investments.

Dara Khosrowshahi
CEO, Uber
How do we shift movers toward more efficient, shared, & active modes?

Emissions per passenger-mile comparisons across modes

SOURCES: US government agencies including BTS, DOE, EIA, ORNL and EPA
Even in cities with good transit, most people still drive. Pushback on our growth has started very early

“Taxis plus ride-hailing plus carsharing account for just 1.7 percent of miles travelled by urban dwellers”
--CityLab, June 2018

Source: Federal Highway Administration (David H. Montgomery/CityLab)
A mobility system based on individual private car use is incredibly **inefficient**

1.2B cars globally...

...idle 95% of time...

3.4 - 8 parking spaces per car, in typical US cities

...~1 person each when moving...

>60% of car miles in US by the driver alone

...eating >50% global oil

Global fuel economy progress slowing as car sales erode gains

Not to mention, 135M motorcycles
Sharing by design
Uber’s business works best when we **ENABLE MORE PEOPLE TO MOVE WITH...**

- FEWER
- FULLER
- MORE EFFICIENT

...VEHICLES & TRIPS
EXTERNAL RESEARCH ON CAPACITY UTILIZATION

FEWER  FULLER  MORE EFFICIENT

Figure 1: Capacity Utilization Rate (Percent of Miles Driven with a Passenger) for Taxi and UberX Drivers in Los Angeles and Seattle

Source: Uber Technologies, Inc.; LA DOT, City of Seattle, Regulatory Compliance and Consumer Protection Division; Authors’ calculations.
Notes: LA and Seattle are 2013-14 and Uber is the 12 months ending December 1, 2015, see text for further details.

MOVING MORE PEOPLE WITH FULLER VEHICLES

FEWER

FULLER

MORE EFFICIENT

PMT / VMT FROM UBER TRIPS, US-BASED CITY
What if?
Making shared, electric mobility the default
JUMP: 6+M trips on bikes & scooters

<table>
<thead>
<tr>
<th>North America</th>
<th>Europe</th>
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<tr>
<td>Austin, TX (+S)</td>
<td>Berlin, Germany</td>
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<td>Chicago, IL (+S)</td>
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<td>Denver, CO</td>
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<td>Los Angeles, CA (+S)</td>
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<td>New York City, NY</td>
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<td>Washington, DC</td>
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- [Graph showing trip counts from 2013 to 2017 for North America and Europe]
What’s more popular than Uber? Shockingly, Jump bikes

BY TONY BIZJAK
FEBRUARY 25, 2019 02:40 AM, UPDATED FEBRUARY 25, 2019 11:07 PM
Uber gave its Denver-area users easy access to transit info and tickets, and now more are using RTD

City was test market for integration of transit schedules in ride-sharing app
Potential Transit Benefits

Uber’s unique value proposition

Increase ridership
Tap into Uber’s extensive active rider base to offer innovative transit solutions via the Uber app.

Leverage Uber’s dedicated marketing team has significant experience growing a B2C brand and building awareness for new products.

Lower your costs
Tap into Uber’s ability to increase or decrease supply providing services based on demand to reduce the cost of underutilized vehicles.

Use Uber’s existing technology to reduce spend on transit software.

Improve customer experience
We’ll work with you to meet customer needs,

with a dedicated Account Manager to help implement a great transit program.

By partnering with us, you’re getting access to a product team who are focussed on iterating on transit products to better suit your requirements.

Extend the reach of transit
Provide services where transit currently isn’t available, or at times when it’s not available.

Leverage data from a partnership with Uber to feed into future transit planning and better reach customers in future.
### Driving platform efficiency & SB 1014 (Skinner)

<table>
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<tr>
<th>FEWER</th>
<th>FULLER</th>
<th>MORE EFFICIENT</th>
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<tr>
<td>Rider Trips / Vehicle</td>
<td>Rider Miles / Vehicle Miles</td>
<td>Fuel / Vehicle Mile</td>
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**Impact**

- Rider-driver GPS matching
- "Forward dispatch"
- Trip swap technology
- Pre- & rematch technology
- JUMP

- Pool
- Express Pool
- UberXL
- High-capacity Vehicles
- Split-fare
- Multi-destination trips

- Smart routing
- Aggressive driving notifications
- Vehicle-to-trip right-sizing
- Driver TCO optimization
- Vehicle upgrade initiatives
- Zero-tailpipe modes: EVs, e-bikes and e-scooters

**Driving platform efficiency & SB 1014 (Skinner)**
BASIC CONCEPTUAL CALCULATION OF $gCO_2/PMT$ FOR A TRIP

$$\frac{\text{Grams } CO_2}{\text{PMT}} = \frac{\text{VMT (miles)} \times \text{Fuel Consumption (gal/mi)} \times \text{Conversion Factor (gCO}_2/\text{gal)}}{\text{PMT}}$$

- **Occupancy** affects only the denominator
- Increasing occupancy reduces
  - $TNC \ gCO_2/PMT$
- **Deadheading** affects only the numerator
- Decreasing deadhead VMT reduces
  - $TNC \ gCO_2/PMT$
  - $CA \ Fleet \ GHGs$
  - $CA \ Fleet \ VMT$
- **Fuel economy** $= 1/\text{Fuel Consumption}$
- Affects the numerator only
- Increasing fuel economy reduces
  - $TNC \ gCO_2/PMT$
  - $CA \ Fleet \ GHGs$
  - No affect on VMT

**Fuel Dependent**
- Only period 3 VMT
- Does not include driver
- Not currently substantial

- \text{VMT in periods 1, 2, & 3}
New solutions are emerging to drive a more sustainable future of mobility
At the intersection of great urban design and new mobility technology

- **BEHAVIORAL SHIFT**
  - ...away from solo, private car trips to shared journeys

- **VEHICLE GREENING**
  - ...via turnover to cleaner fuels and higher efficiency technologies

- **COMPLEMENTARITY**
  - ...with public transit and multi-modal mobility on more sustainable modes

- **INFRASTRUCTURE TRANSFORMATION**
  - ...to more human-centric designs as demand from private cars shrinks
Solutions
Opportunities to partner to deliver innovative transit solutions to your customers.

Accessible transit
Uber can provide accessible transportation options for people with disabilities and special needs with scheduled or on-demand sedans or wheelchair accessible vehicles.

- **Paratransit**: we can partner with you to support existing paratransit programs, or work with you to develop a new offering.

Complementary transit
Extend the reach of public transit.

- **First- and last-mile**: help riders get to or from transit stops and hubs.
- **Late-night / guaranteed rides home**: offer riders a TNC alternative when transit isn’t an option.
- **Transit / food deserts**: help riders get to where they need to go where transit isn’t available.

On-demand public transit
Launch microtransit in your city with Uber’s technology powering the trips.

- **Shared rides**: leverage Uber’s carpooling technology to offer an on-demand shared transit option - either in a sedan, wheelchair accessible vehicles or high capacity vehicles.

Analytics and insights
Track how your program is running with trip data.

- **Dashboards**: access key metrics and data via a self-serve dash.
- **Data tools**: highlight the impact of transit, and plan smarter policies with Uber’s open data and interactive tools.

Public transit integration
Help new customers choose transit by including it in the Uber app.

- **Journey planning**: provide real-time transit data and routes in the Uber app
- **Mobile ticketing**: enable riders to purchase public transit tickets in the Uber app (coming in spring)
Supporting road pricing

- We support broad-based road pricing (across all vehicles) because a marketplace for efficiency is an exciting prospect for ridesharing companies.
- Focus on vehicle occupancy and efficient use of road infrastructure.
- Study estimates Toronto could **save $9B** by getting car occupancy from 1.08 passengers/car to 1.20 passengers/car.

**Why Uber Is Promoting Road Pricing**

Cities that charge drivers to use gridlocked roads would play well with the company’s aggressive expansion of carpool options.

LAURA BLISS | @mslaurabliss | Mar 30, 2017 | 2 Comments

There is plenty of road capacity in Toronto and other cities.

**SOURCE:** CPCS (Jan 2017)
Extending Night Tube

LONDON

Decreased pickups  Increased pickups
In May 2017, Uber launched a partnership with Innisfil to create a dynamic transit network (they had no existing transit system). The partnership involves the town subsidizing every 'Innisfil Transit' trip at a price comparable to other transit networks (C$3 - C$5).

Before engaging Uber, the town had hired a consulting firm to help assess their transit needs. They were quoted >$600k annually to set up a single fixed route bus line in the town.

Uber is able to provide a better service that provides access to transportation for more people, at a fraction of the cost ($100k in comparison).

This year the town has signed a deal with Uber to expand their partnership by adding two new flat fare destinations.

Further information: Uber website
Thank you!

Austin Heyworth
heyworth@uber.com