Analyzing Automated Vehicle Factors Impacting Energy Consumption, Informed by Current Ride-Hailing Experience

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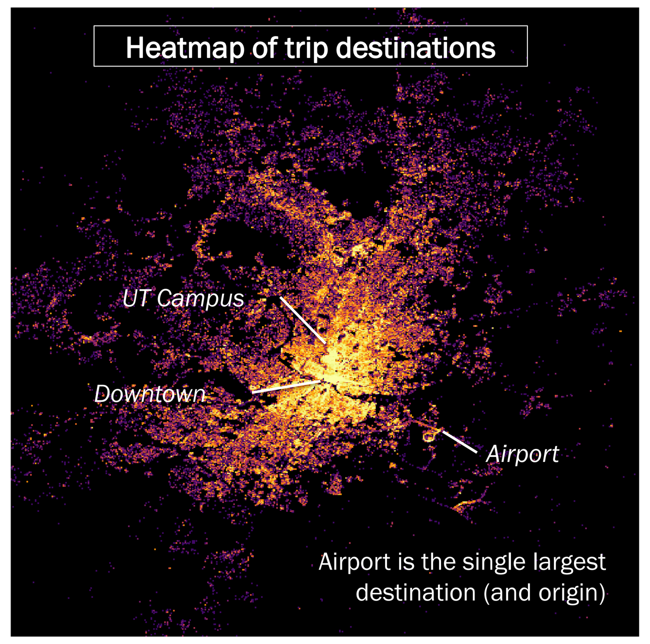
Objective: Explore energy consumption of large-scale Mobility as a Service (MaaS) AVs informed by current ride-hailing research

- Identify topics associated with each of the actors impacting energy consumption from MaaS AVs
- Examine potential energy impacts – both positive and negative – of MasS AVs
- Highlight relevant data and data needs

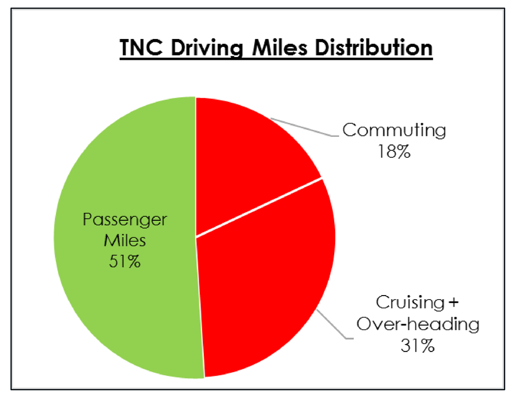
	TOPIC	SUB-TOPIC/RESEARCH QUESTIONS	POTENTIAL IMPACTS
Suppliers (Mobility as a Service providers)	**Vehicle Fleet**	Will future AV fleets (including EVs) be more fuel efficient?	+
	Supply & Demand	Number of AVs in the fleet per MaaS demand	+ −
	Operations & Style	Location of AVs and driving behavior (e.g., smoothed acceleration/deacceleration)	+
	Deadheading & Idling	Deadheading & idling (i.e., zero occupancy vehicles or ZOV)	−
Consumers (Passengers)	**Mobility Behavior Changes**	Mode replacement and modality style changes	+ −
		Vehicle ownership reduction	+ −
		Increase true ridesharing (i.e., pooling with strangers)	+
		Induced travel (increases energy and mobility)	−
		Relocation: residence, travel	+ −
Institutional (Cities)	**Infrastructure, Standards & Regulations**	Support of automated, electric/efficient, and sharing transportation; parking reduction, increases in density, multi-modal infrastructure	+

Automated Vehicle Factors Impacting Energy Consumption

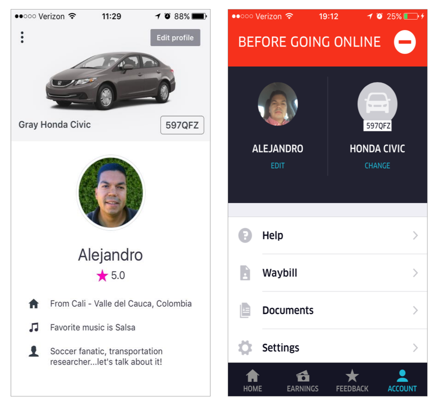
DATASETS

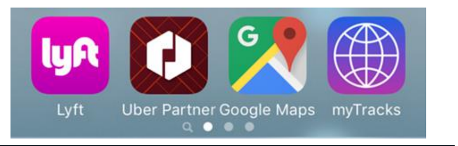


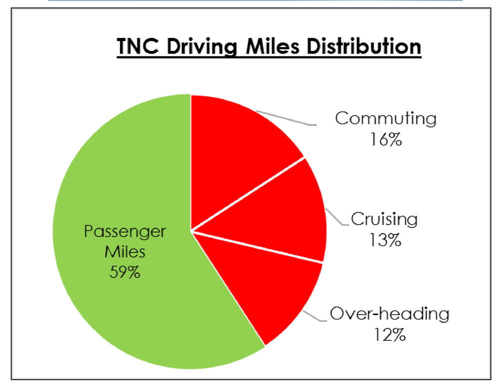
RideAustin data numbers
- Sample duration: 10 months
- Period: June 2016 to April 2017
- 4,961 unique drivers & vehicles
- 261,000 unique riders
- 1.5 million trips

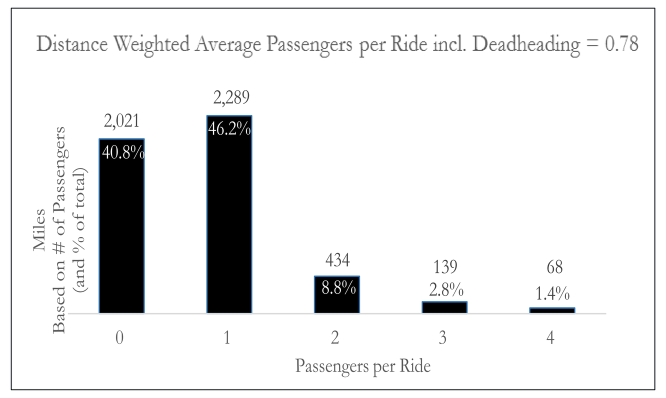


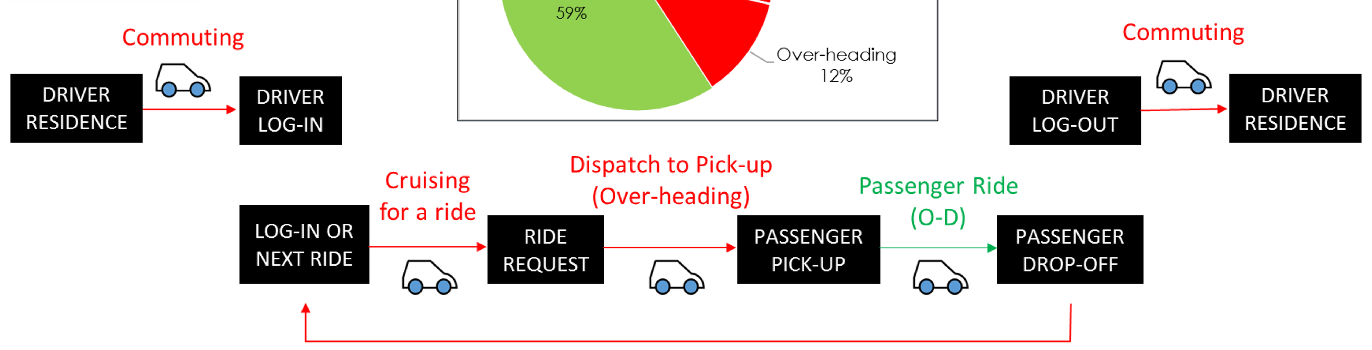
RideAustin Data



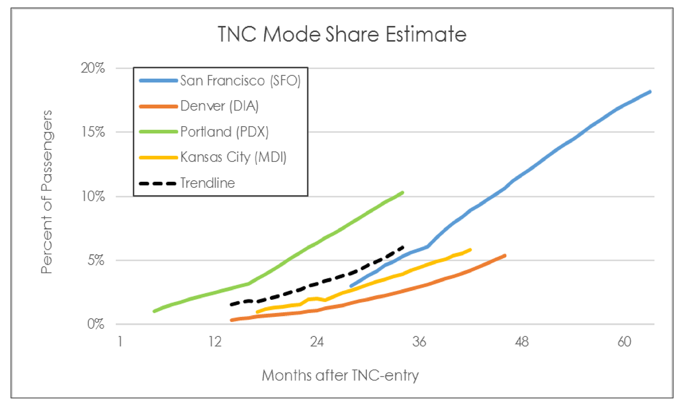


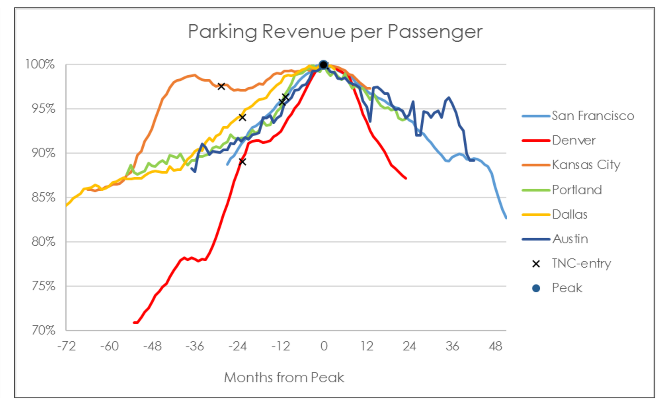






Case Study in Colorado



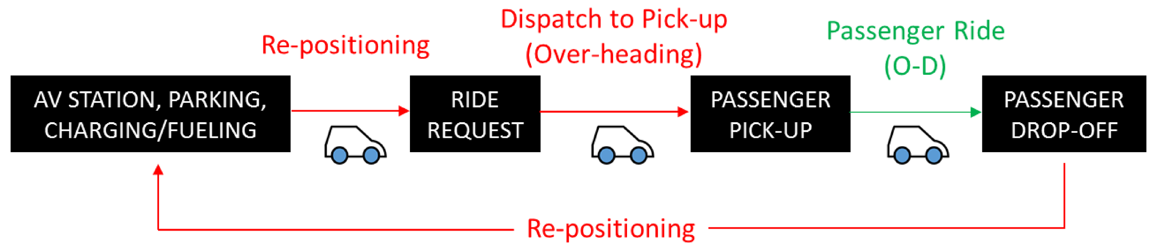


Airport analyses informing new mobility shifts [NREL/CP-5400-71036]

RESULTS

Suppliers (MaaS providers):

- While it is unclear if vehicles (including EVs) used by ride-hailing drivers are more (or less) fuel efficient than the general population and/or taxi fleets, AVs have the potential to be more efficient
- MaaS providers using AVs will have the capabilities to control the number of AVs per passenger demand, location (and re-location) of AVs, and driving behaviors; contrary to ride-hailing where drivers make many decisions
- Estimates of deadheading from ride-hailing is 0.69 – 0.96 miles for every 1.0 mile with passengers (41% to 49% of total VMT). While commuting and driving behavior (e.g., cruising) goes away, AV fleets will still have ZOV miles due to travel from/to stations, parking, charging or fueling, re-positioning, and over-heading (dispatch to pick-up). We estimate that ZOV will go down to 0.32 – 0.60 miles for every 1.0 VMT with passengers from MaaS AVs (24% to 37.5% of total VMT).



Consumers (Passengers)

- MaaS AVs will intensify the mobility behavior changes we are experiencing with ride-hailing
- Negative energy impacts are associated with mode replacement of public transportation, walking, and biking; as well as induced travel
- We identified true ridesharing (pooling with strangers) as positive energy impacts of MaaS
- Reduction in vehicle ownership and driving mode replacement, as well as relocation (both for home/residence and hotel location when traveling) enabled by MaaS AVs could generate both positive and negative energy impacts.

Data & Research Needs:

Measuring vehicle occupancy per VMT and person miles traveled (PMT) is one of the key data gaps in the industry to increase mobility of people (not just vehicles) and understand energy productivity as a critical output of maximizing mobility in ride-hailing and future MaaS AVs!

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