DOCKETED

Docket Number:	20-IEPR-02
Project Title:	Transportation
TN #:	233864
Document Title:	Presentation - Opportunities and Challenges for the Three Transportation Revolutions
Description:	S2 1. Giovanni Circella, UC Davis
Filer:	Raquel Kravitz
Organization:	Energy Commission
Submitter Role:	Commission Staff
Submission Date:	7/14/2020 11:10:29 AM
Docketed Date:	7/14/2020

Opportunities and Challenges for the Three Transportation Revolutions

DRAFT VERSION - July 16, 2020

Dr. Giovanni Circella

Director, 3 Revolutions Future Mobility Program, ITS Davis

gcircella@ucdavis.edu

UCDAVIS
INSTITUTE OF TRANSPORTATION STUDIES

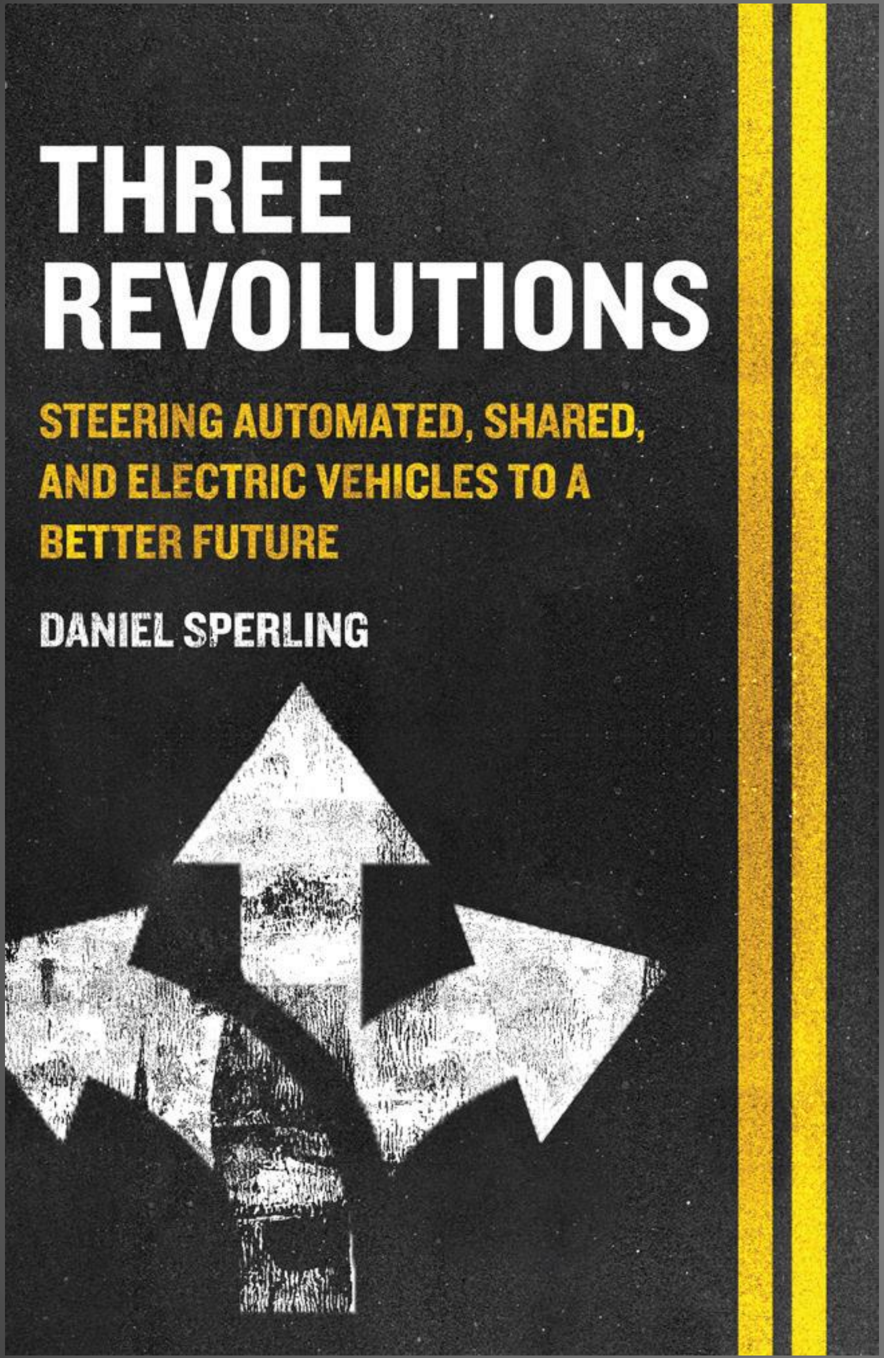
3 REVOLUTIONS
SHARED·AUTOMATED·ELECTRIC

UC DAVIS
INSTITUTE of TRANSPORTATION STUDIES

3 REVOLUTIONS
SHARED · AUTOMATED · ELECTRIC

"People won’t have as many vehicles because they’ll share one and own one."

Jim Hackett, Ford CEO



Sperling, Daniel. ***Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*****. Island Press, 2018.**

https://islandpress.org/books/three-revolutions

Future Mobility:

"Heaven" or "Hell" ?

- ✓ Cars are all electric
- ✓ Energy mix is clean
- ✓ Increased capacity of transportation
- ✓ Better livability in cities
- ✓ Integration with public transit
- ✓ Everybody shares intelligent vehicles

vs.

- ✓ Increased congestion
- ✓ Electricity produced with coal
- ✓ Increased travel demand
- ✓ More car-dependence of society
- ✓ Reduced role of transit
- ✓ "Ghost" vehicles traveling on streets

The future will largely be shaped by the policies that are developed today…

3 REVOLUTIONS
SHARED·AUTOMATED·ELECTRIC

Shared mobility, **electrification** and **autonomous vehicles** are bringing big changes in:

- *Transportation supply*
- *Transportation demand*

Need for rigorous research and impartial policy analysis to understand the impacts of these revolutions, and guide industry investments and government decision-making.

BMW · DAIMLER · Bay Area Air Quality Management District · VOLVO · lyft · EPA United States Environmental Protection Agency · PG&E Pacific Gas and Electric Company

Ford · Caltrans · UBER · HONDA · NISSAN · faurecia · ClimateWorks FOUNDATION

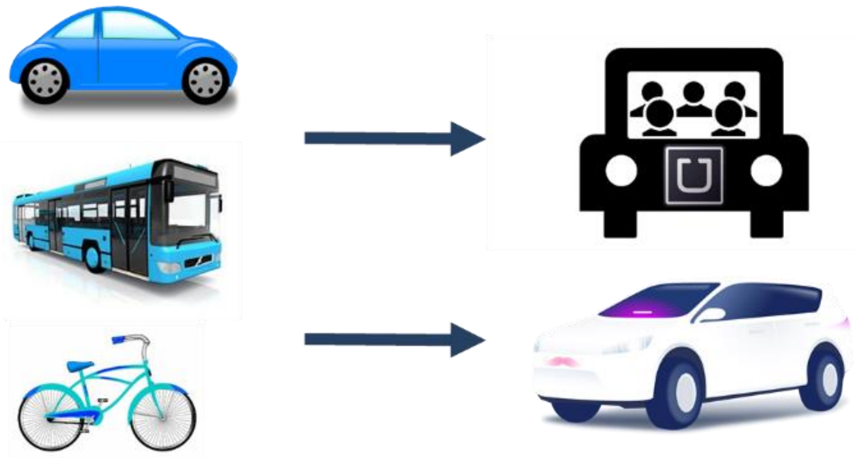
Research Questions

What are the impacts on vehicle ownership and travel behavior?

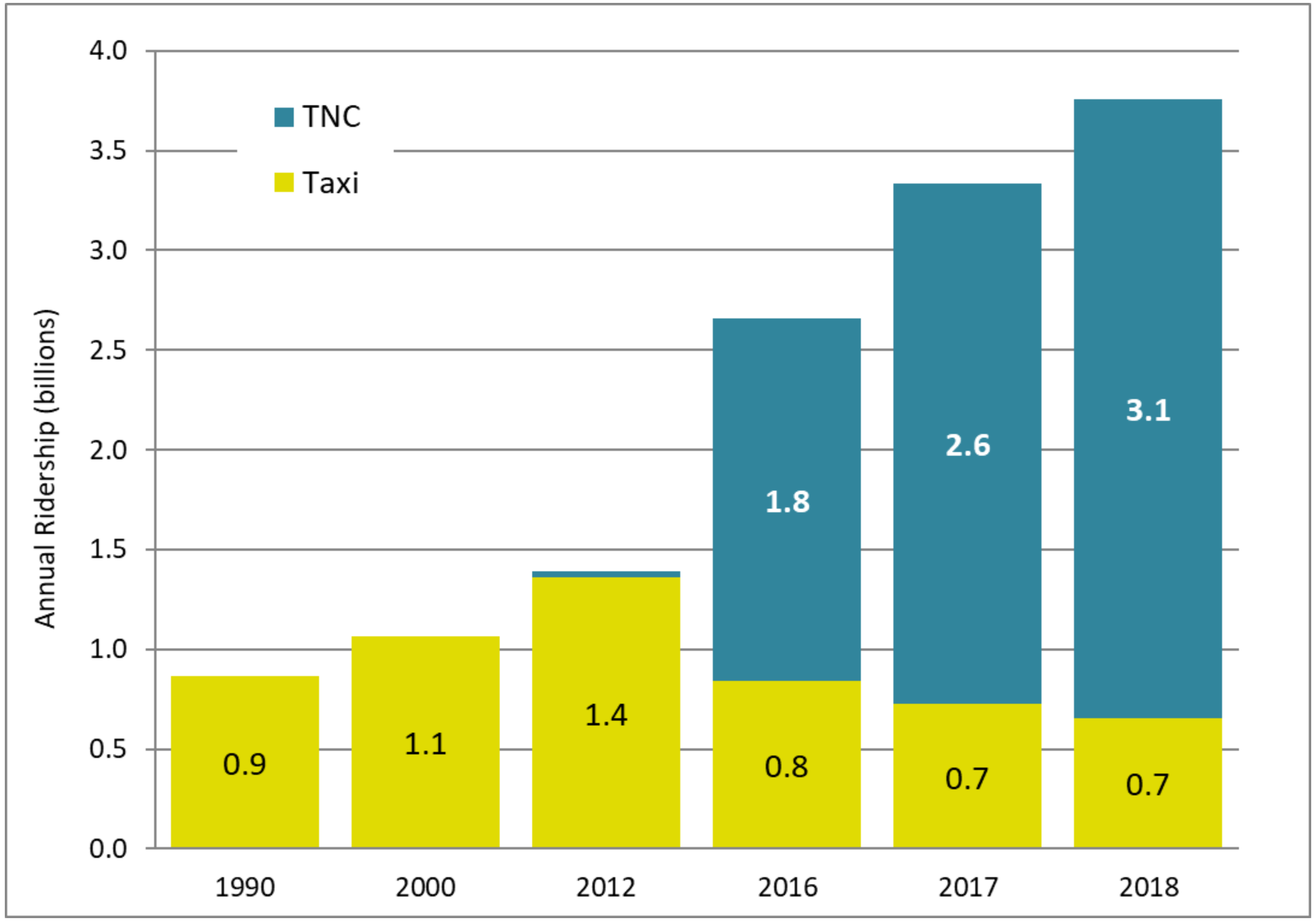
amazon

Car Ownership vs. Shared Mobility?

What Replaces What?



Uber/Lyft ridership has been growing quickly (before the pandemic…)



2018 Ridership (estimates):

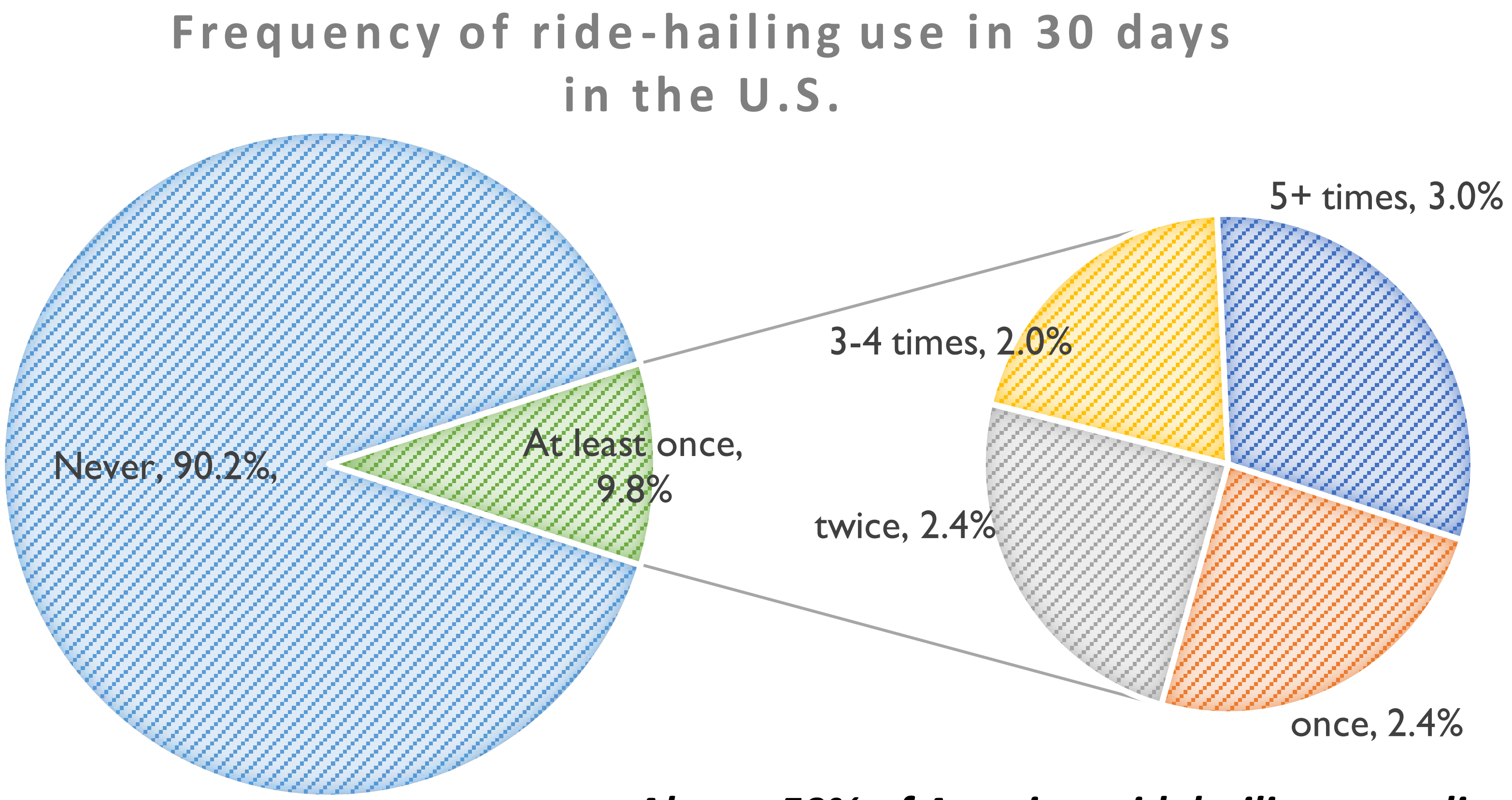
- Local bus 4.7 billion
- Urban rail 4.2 billion
- Taxi/TNC 3.8 billion

(Annual rate)

Source: The New Automobility: Lyft, Uber and the Future of American Cities, Schaller Consulting, July 2018. Revised January 2019.

Ridehailing Users in the U.S.: Insights from 2017 NHTS Data

Only ***10% of U.S. residents*** (aged 16+) reported to have used ridehailing in the past 30 days



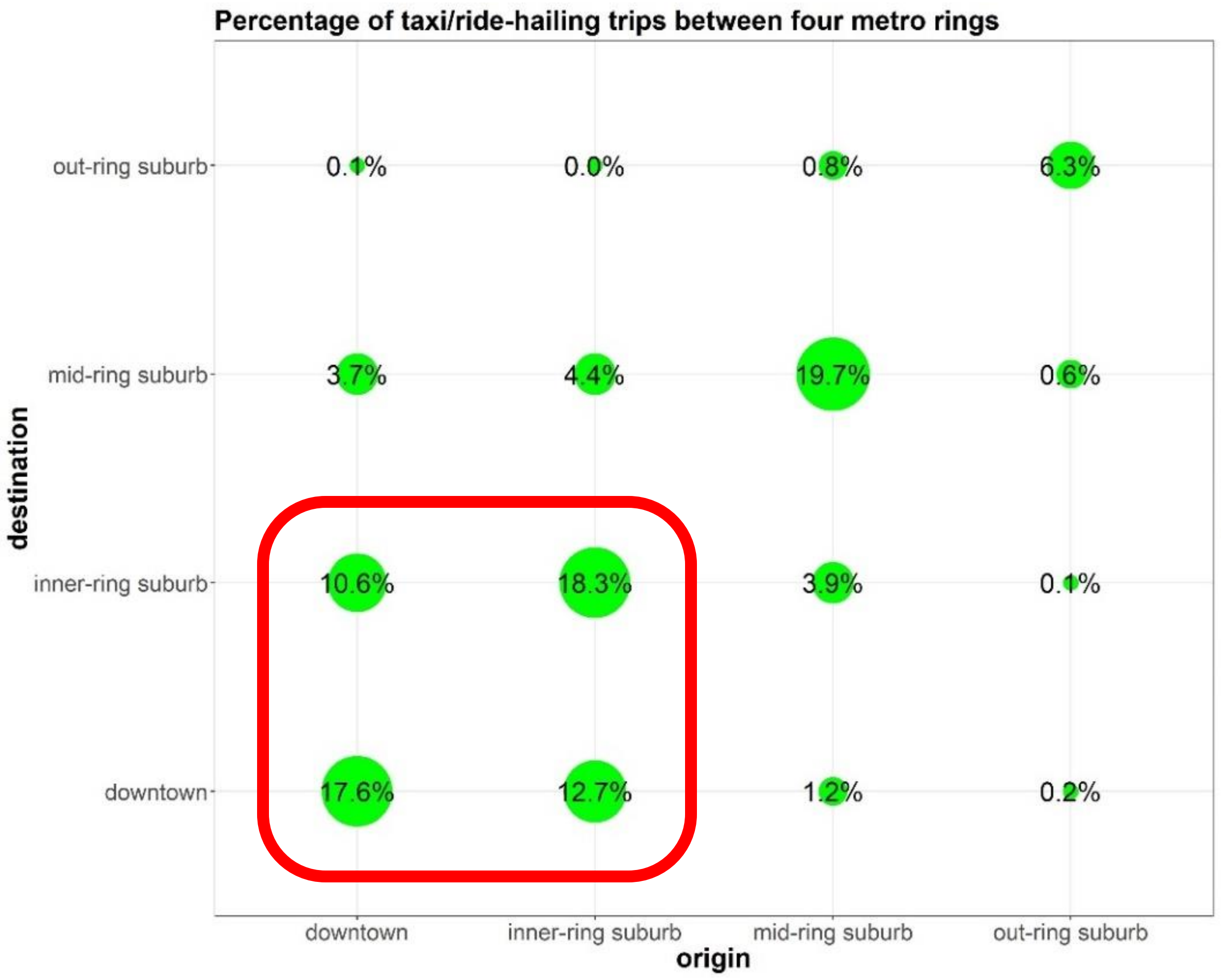
Source: Hongwei Dong, using 2017 NHTS data

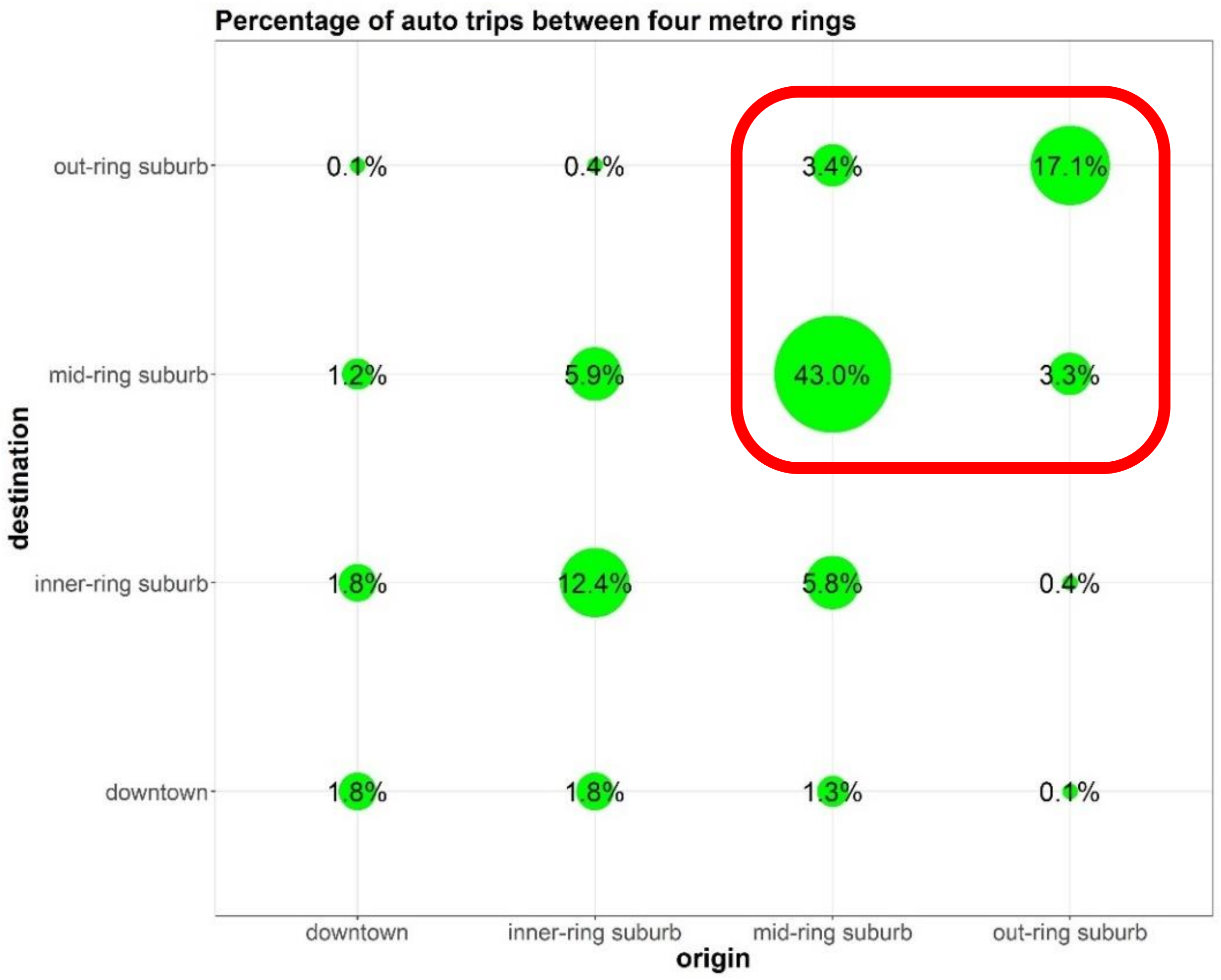
Almost 50% of American ridehailing users live in five states:
California (20%), New York (9.2%), Florida (7.2%), Texas (6.4%), Illinois (5.9%)

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Ridehailing is still a predominantly *urban* phenomenon





Source: Hongwei Dong, using 2017 NHTS data

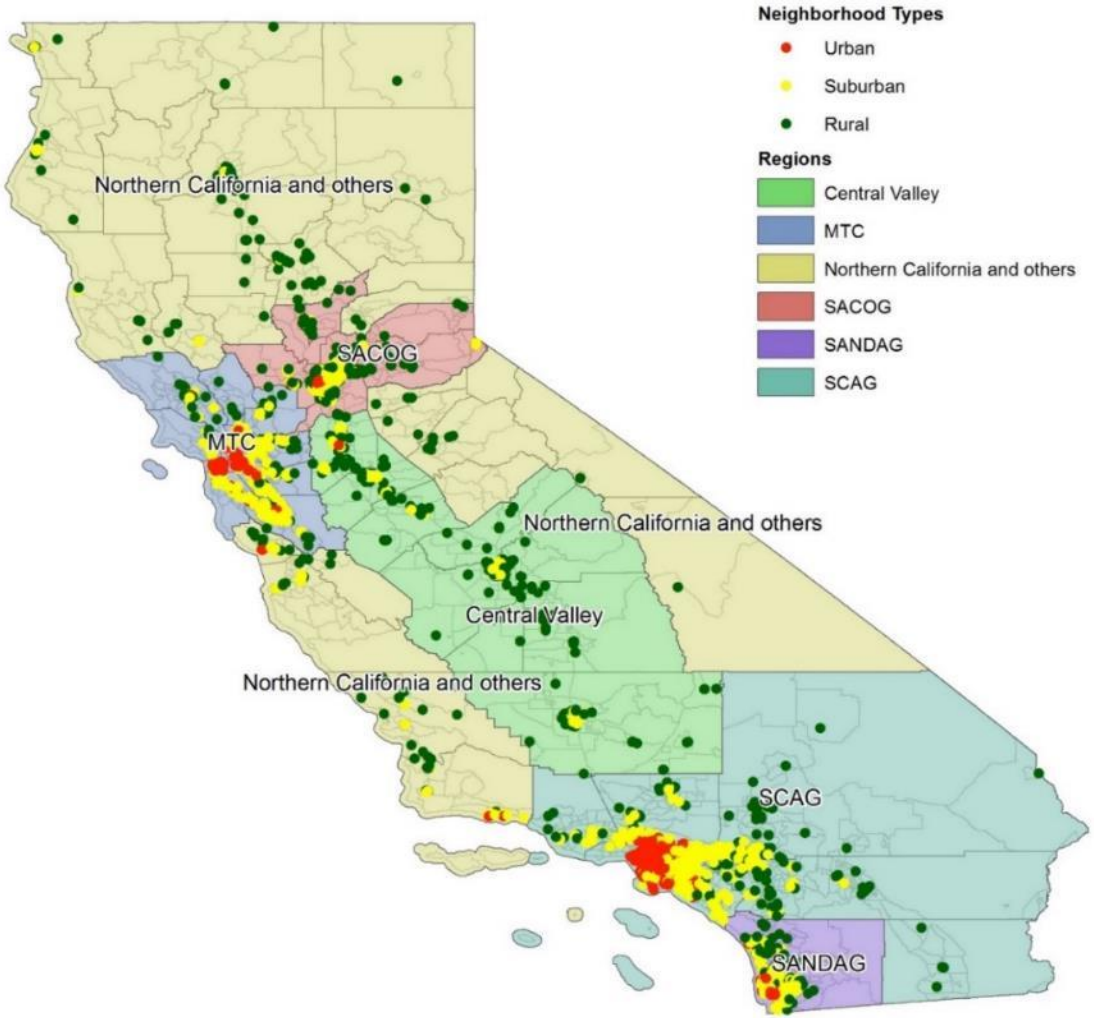
UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Who uses these new mobility services?

California Panel Study of Emerging Transportation Trends

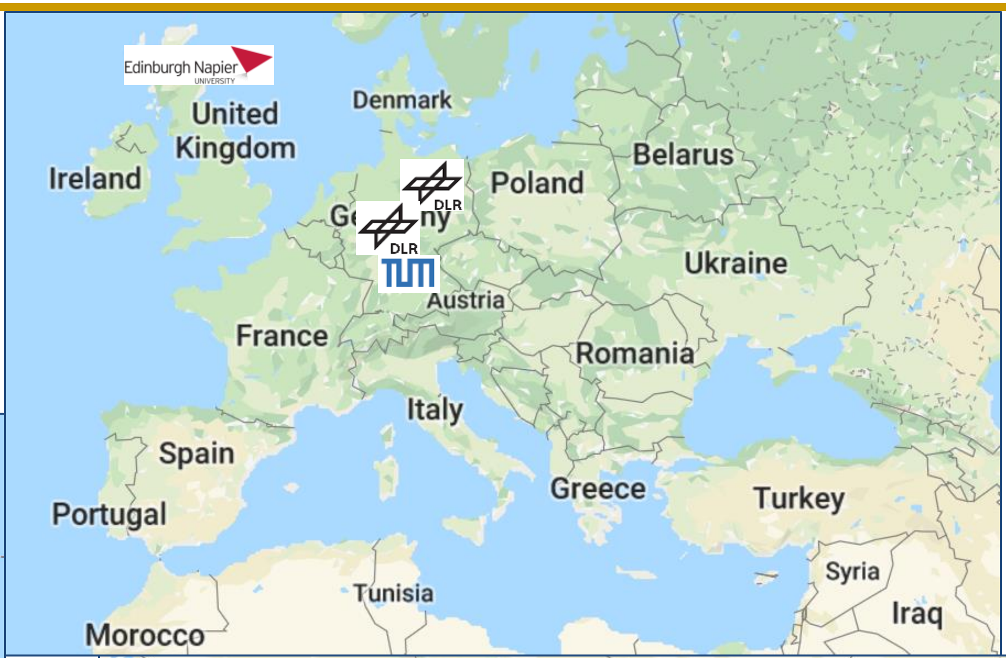
- Statewide longitudinal study with ***rotating panel***
- 2015 survey: ***Millennials*** (18-34) and ***Generation X*** (35-50)
- 2018 survey: ***All age groups***
- Quota sampling by ***geographic region*** and ***neighborhood type***
- Focus on ***changing lifestyles***, ***adoption of shared mobility*** and ***attitudes towards AVs***
- More info at: https://3rev.ucdavis.edu/california-panel



New Study: "The Pulse of the Nation (and the World) on 3R"

Southern US cities:
- Atlanta
- Austin
- Phoenix
- Tampa

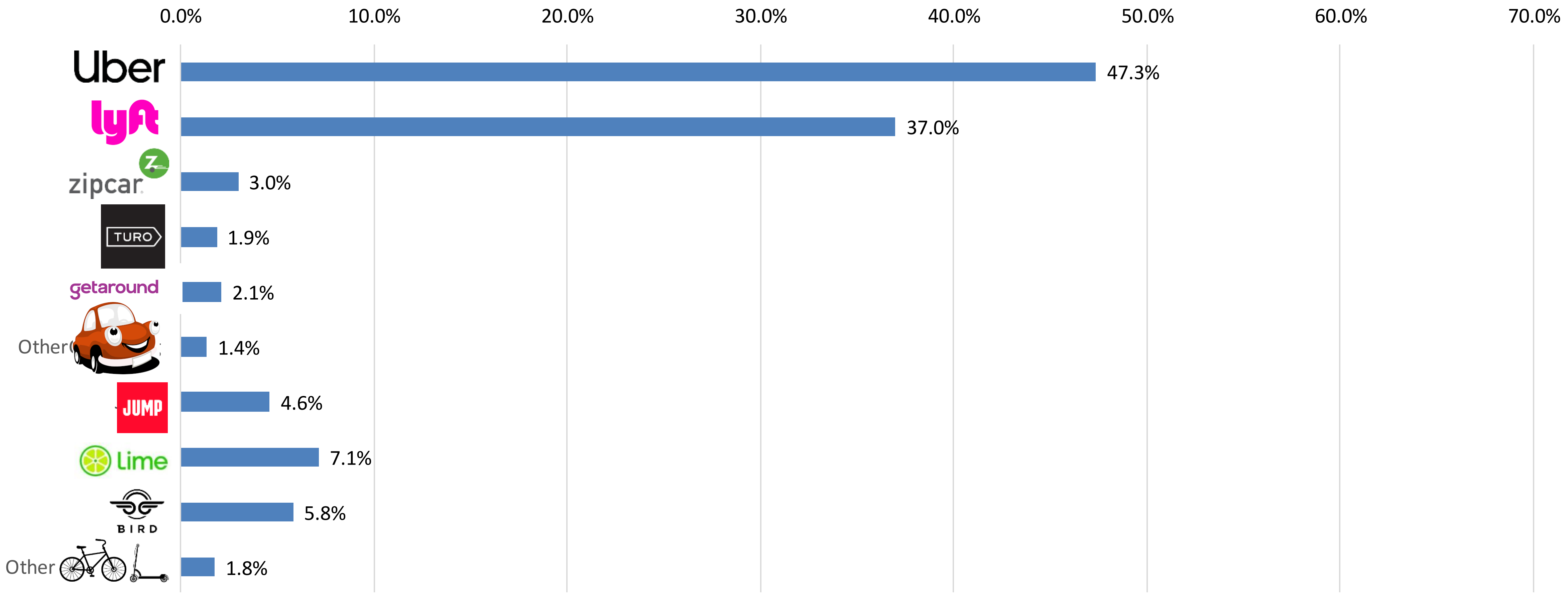
WRI cities:
- Mexico City (Mexico)
- Sao Paulo (Brazil)
- Mumbai (India)
- Beijing (China)



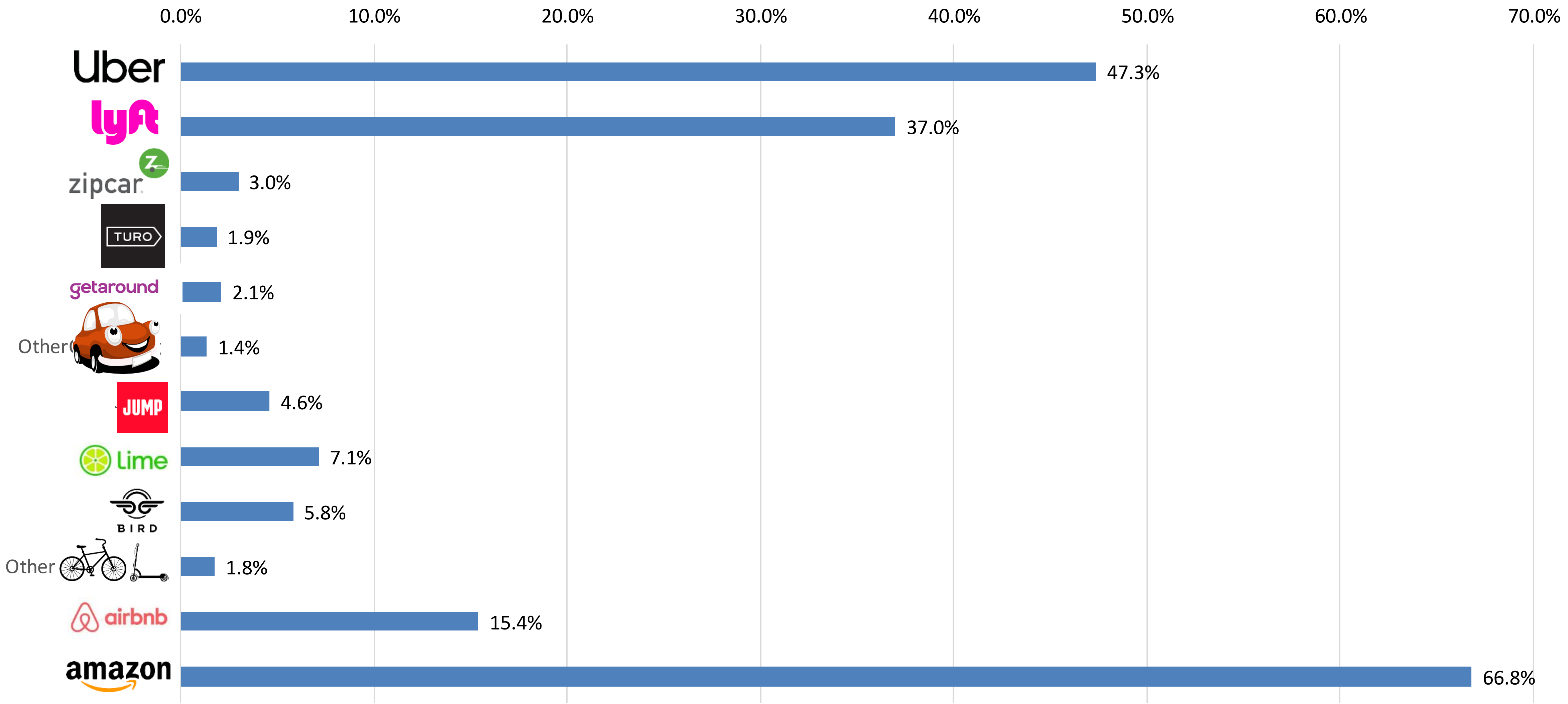
New annual data collection 2019 cities:
- San Francisco
- Los Angeles
- Sacramento
- Washington DC
- Boston
- Seattle
- Salt Lake City
- Kansas City

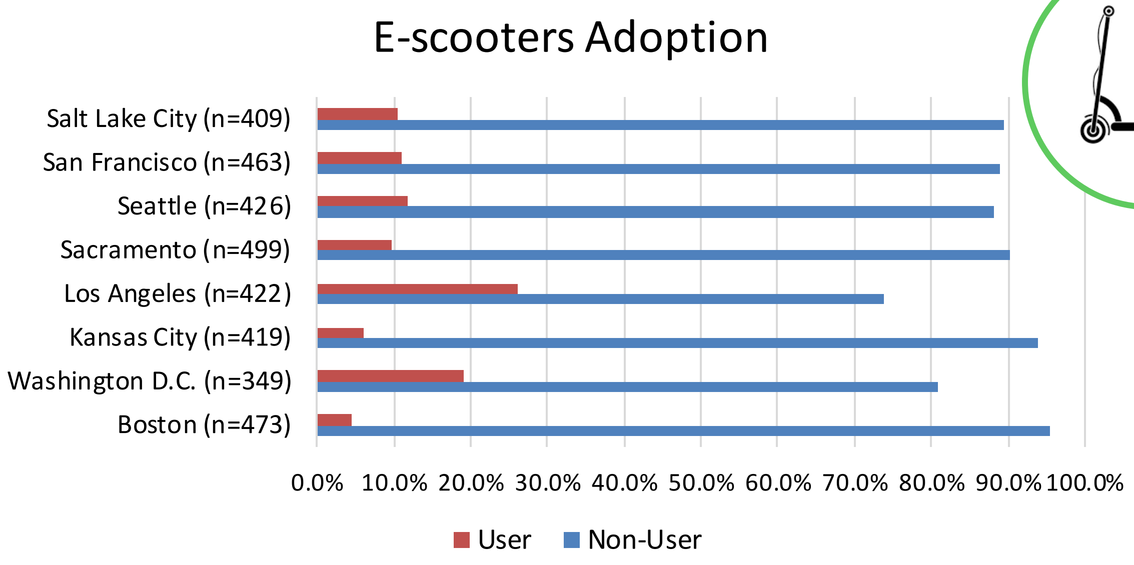
UC DAVIS
INSTITUTE of TRANSPORTATION STUDIES

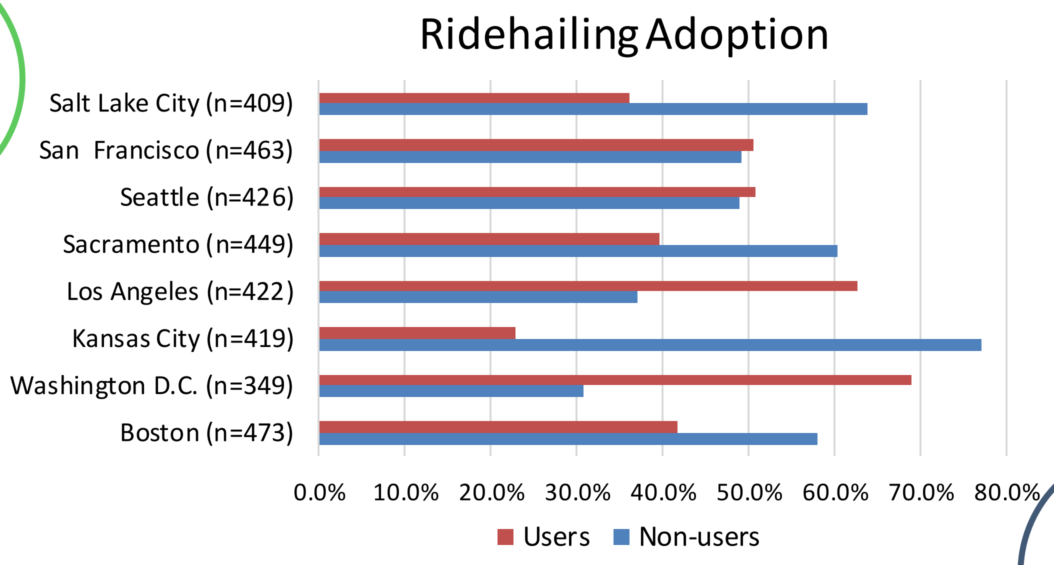
Apps Used on Smartphone

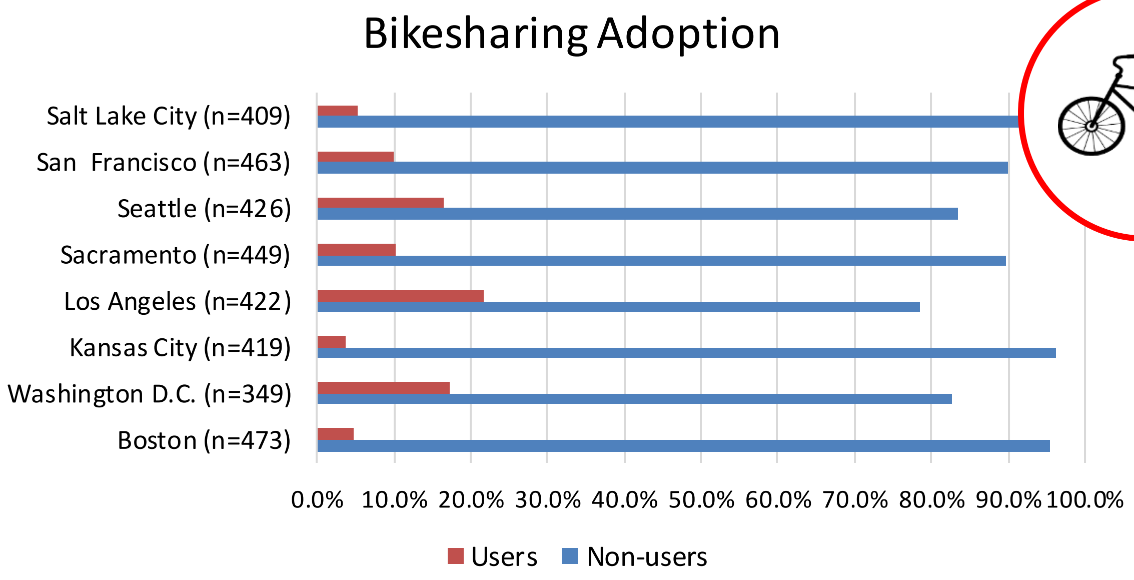


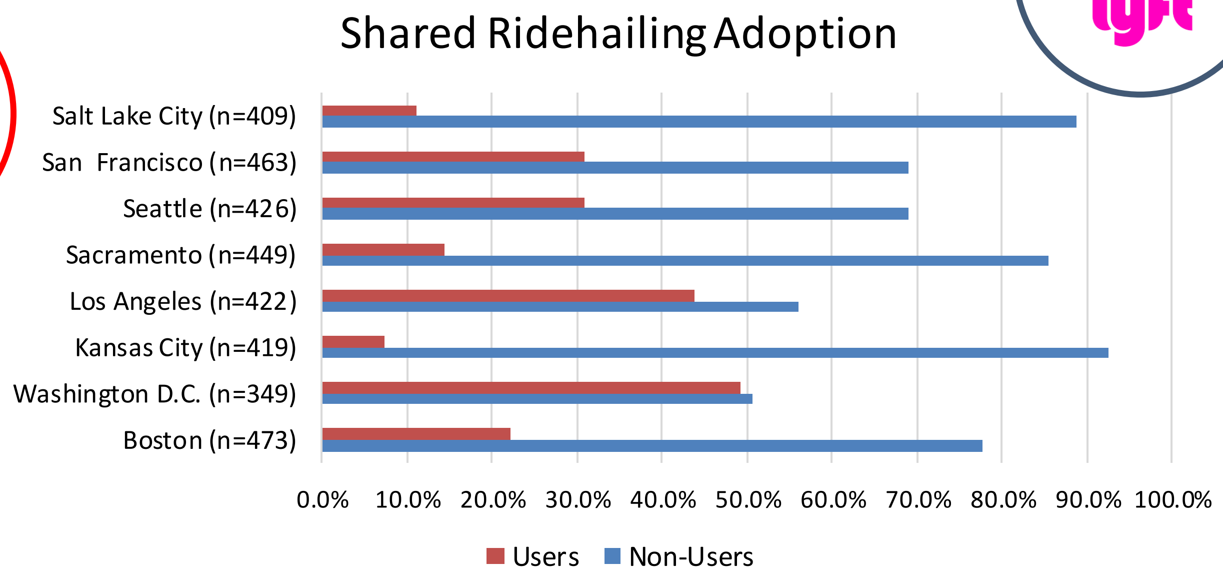
Apps Used on Smartphone




E-scooters Adoption
Salt Lake City (n=409)
San Francisco (n=463)
Seattle (n=426)
Sacramento (n=499)
Los Angeles (n=422)
Kansas City (n=419)
Washington D.C. (n=349)
Boston (n=473)
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0% 90.0% 100.0%
User
Non-User


Ridehailing Adoption
Salt Lake City (n=409)
San Francisco (n=463)
Seattle (n=426)
Sacramento (n=449)
Los Angeles (n=422)
Kansas City (n=419)
Washington D.C. (n=349)
Boston (n=473)
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0%
Users
Non-users


Bikesharing Adoption
Salt Lake City (n=409)
San Francisco (n=463)
Seattle (n=426)
Sacramento (n=449)
Los Angeles (n=422)
Kansas City (n=419)
Washington D.C. (n=349)
Boston (n=473)
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0% 90.0% 100.0%
Users
Non-users


Shared Ridehailing Adoption
Salt Lake City (n=409)
San Francisco (n=463)
Seattle (n=426)
Sacramento (n=449)
Los Angeles (n=422)
Kansas City (n=419)
Washington D.C. (n=349)
Boston (n=473)
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0% 90.0% 100.0%
Users
Non-Users

“Not all users behave the same way”

Latent-class adoption model to investigate differences in the use of ridehailing:

Adoption Rate: 47%

- *Higher-educated independent millennials* who live *in more central areas* and in households *without kids*
- The adoption rate significantly increases as the *rates of technology adoption* and *frequency of long-distance leisure travel by plane* increase.

Adoption Rate: 27%

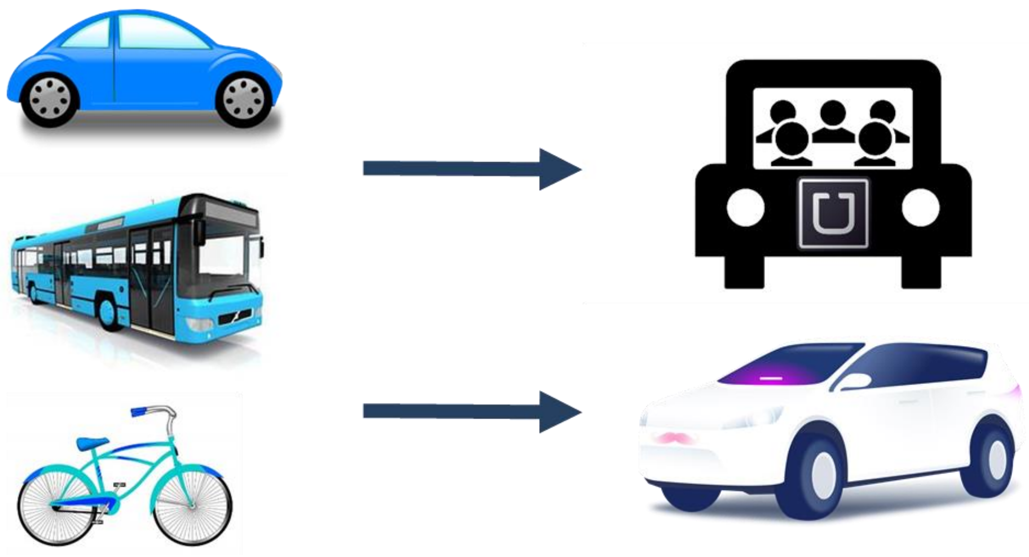
- *Most affluent* individuals, predominantly *dependent millennials* or *older Gen Xers,* who live with their *families*.
- Technology adoption rate, household income, and frequency of non-car business long-distance trips affect the adoption.

Adoption Rate: 5%

- *least affluent* and *less educated* individuals, who live in *rural* neighborhoods and *do not work nor study*.
- Adoption rate is affected by the characteristics of the *built environment*, including *transit accessibility* and *land-use mix*.

For more details:
Alemi, F., G. Circella, S. L. Handy and P. L. Mokhtarian (2018) “Exploring the Latent Constructs behind the Use of Ridehailing in California”, Journal of Choice Modelling, 29, 47-62.

How does the use of ridehailing affect the use of other modes?



…what replaces what?

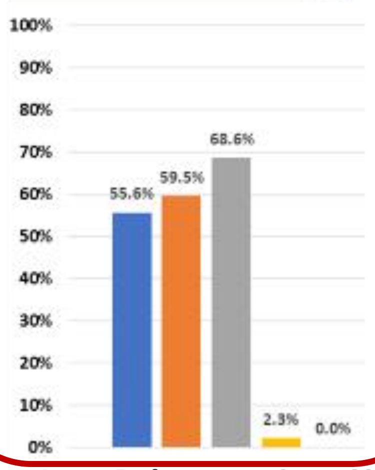
Impacts of Uber/Lyft on Use of Other Travel Modes

Latent-class analysis to investigate the impacts of ridehailing on other travel modes:

Urban Travelers

- Urban dwellers
- Walkable neighborhoods with good transit access
- Cost and time sensitive
- Least affluent
- Younger/independent Millennials
- Frequent commuters
- Multimodal travelers
- Most frequent users of Uber/Lyft

Class 1 (size=53%)



Car Users

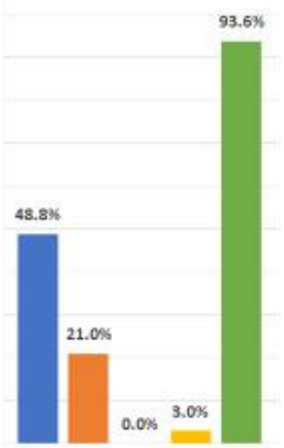
- Suburban Dwellers
- Car-oriented neighborhoods with poor transit access
- High number of vehicles per household drivers
- Frequent commuters
- Monomodal with high VMT
- Pro-suburban
- Materialistic/must own car
- Frequent air travelers
- Medium Uber/Lyft frequency

Class 2 (size=37%)

Transit and TNC

- Suburban Dwellers
- Low transit and walk accessibility
- Not cost and time sensitive
- Older Gen Xers
- Want to come back to urban area
- Non-frequent commuters
- Multimodal when possible
- Like biking
- Pro-environment
- Low frequency users

Class 3 (size=10%)

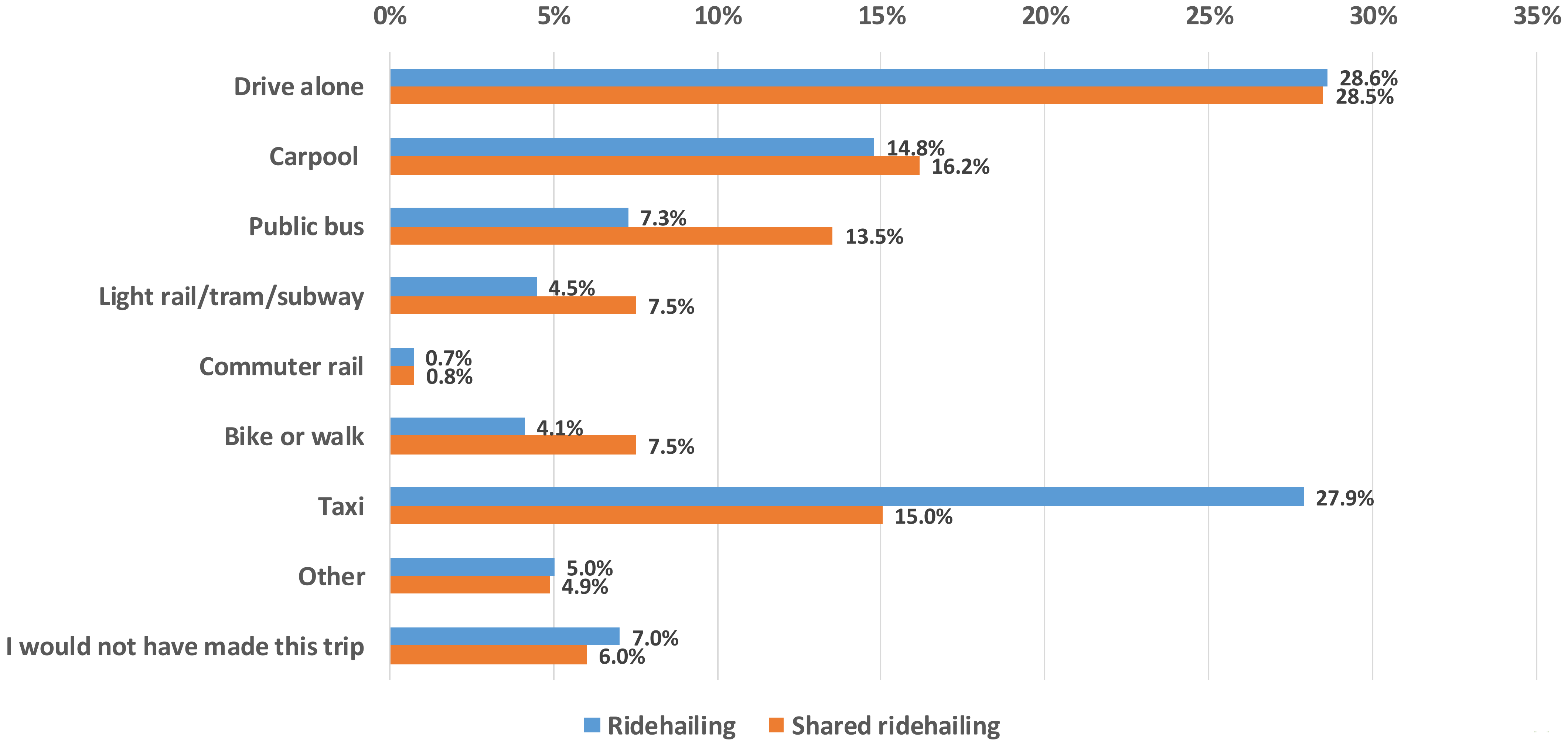


Less Drive | Less Walk/Bike | Less Transit | More Walk/Bike | More Transit

For more details:
Circella, G. and F. Alemi (2018) "Transport Policy in the Era of Shared Mobility and Other Disruptive Transportation Technologies", in Advances in Transport Policy and Planning, Volume 1, edited by Yoram Shiftan and Maria Kamargianni, Chapter 5, 119-144, Elsevier.

“Not all on-demand mobility services are created equal”…

Impact of ridehailing on use of other modes - *“What Would You Have Done if Ridehailing Was Not Available?”*



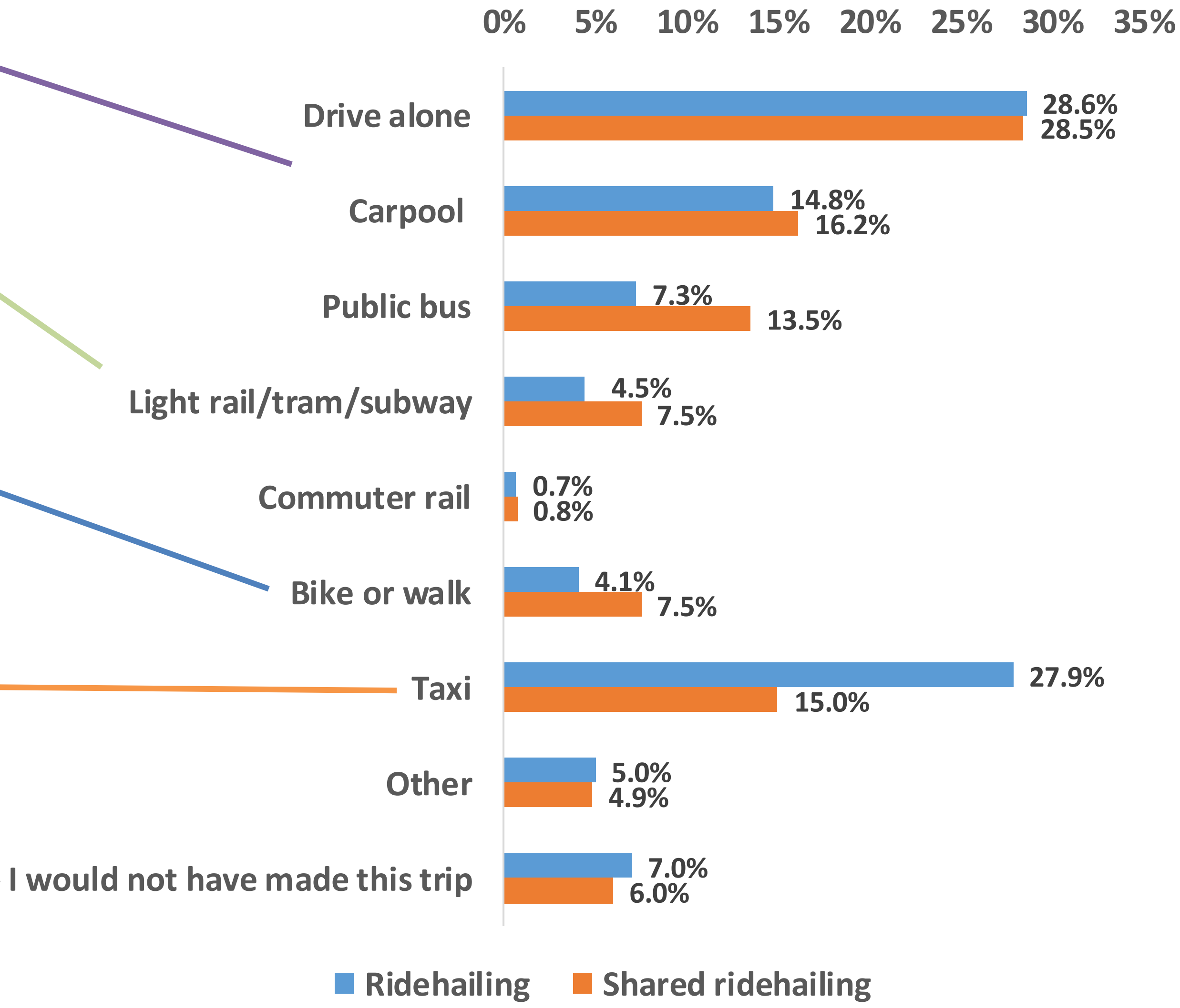
For more details:

Circella, G., G. Matson, F. Alemi and S. L. Handy (2019) “Panel Study of Emerging Transportation Technologies and Trends in California: Phase 2 Data Collection”, Project Report, National Center for Sustainable Transportation. University of California, Davis, January 2019; available at https://escholarship.org/uc/item/35x894mg

“Not all on-demand mobility services are created equal”…

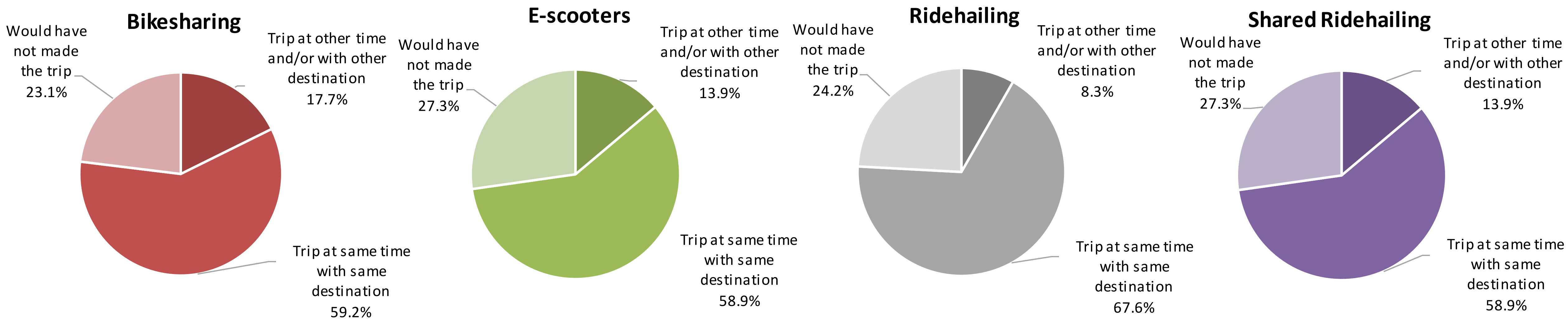
Who does that?	And for what type of trips?
• Higher and medium income • Higher-vehicle-owning HHs • Households with kid(s)	• Longer trips • Trips without company • Shopping and social trips
• Lower-income individuals • Students and workers • Multimodal (users of public transit and active modes)	• Trips during the daytime
• Lower-income individuals • Zero-vehicle households • Workers	• Trips during the daytime • Very short trips
• Higher-income individuals • Older generations	• Trips to/from Airports • Trips with others
• Lower-income individuals • Unemployed • Zero-vehicle households	• Trips without company • Shopping and social trips • Medium distance

Impact of ridehailing on use of other modes - *“What Would You Have Done if Ridehailing Was Not Available?”*



How are shared mobility options changing travel behaviors?

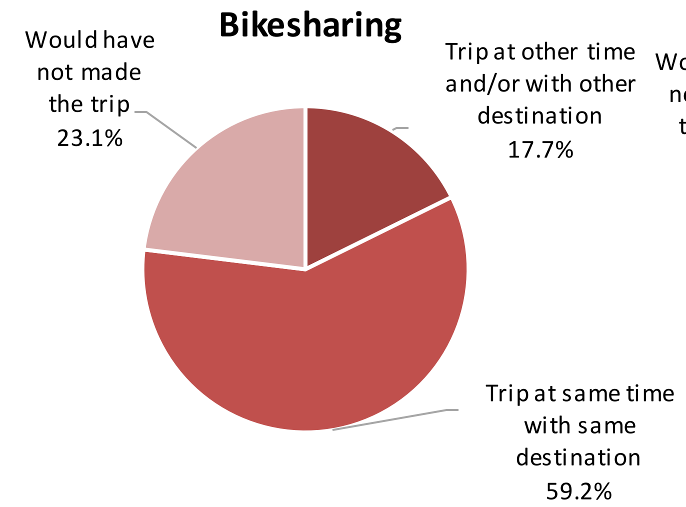
What would have happened if these emerging transportation services had not been available for the last trip?

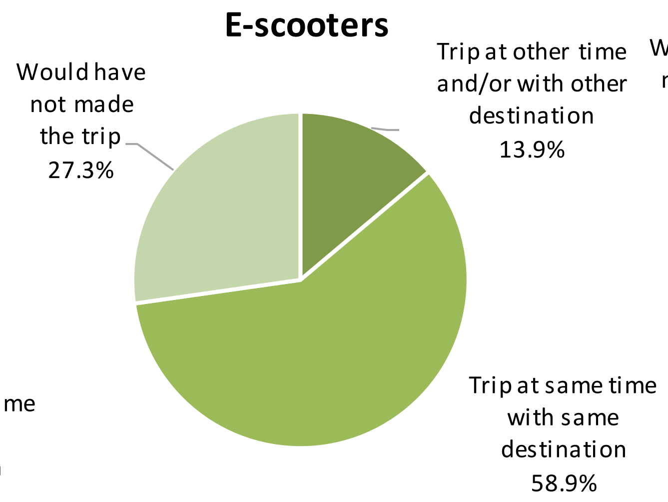


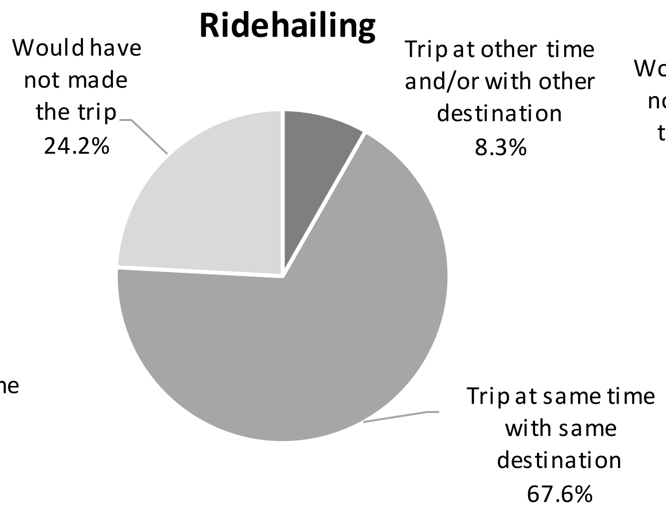
UC DAVIS INSTITUTE OF TRANSPORTATION STUDIES

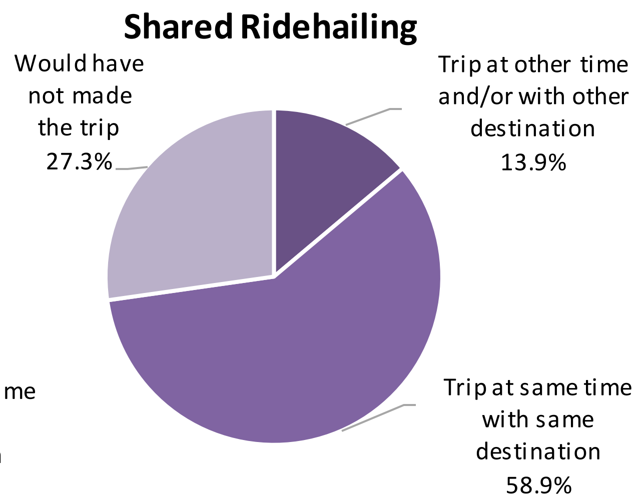
3 REVOLUTIONS SHARED · AUTOMATED · ELECTRIC

What would have happened if these emerging transportation services had not been available for the last trip?

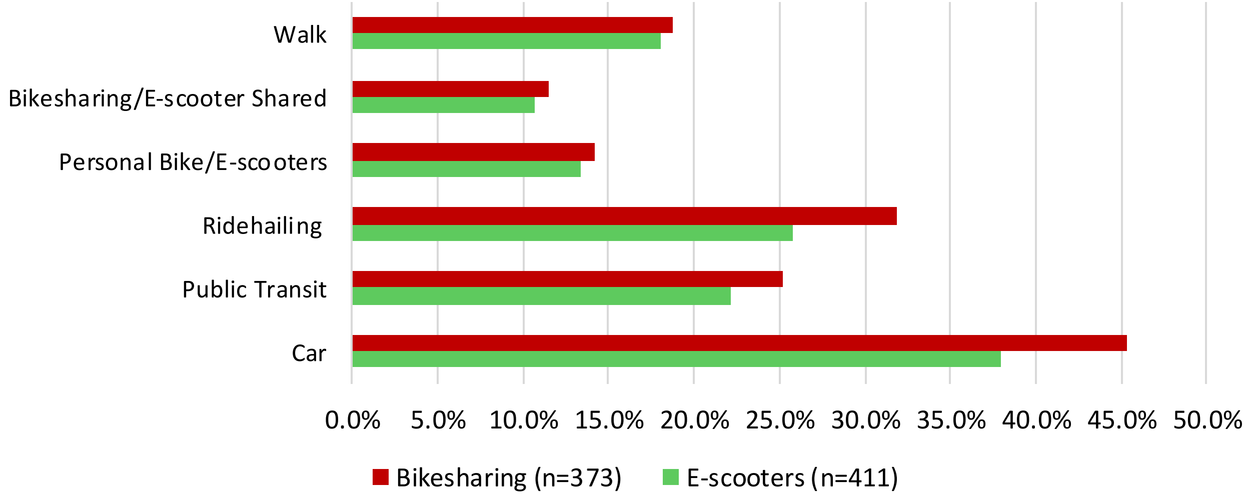


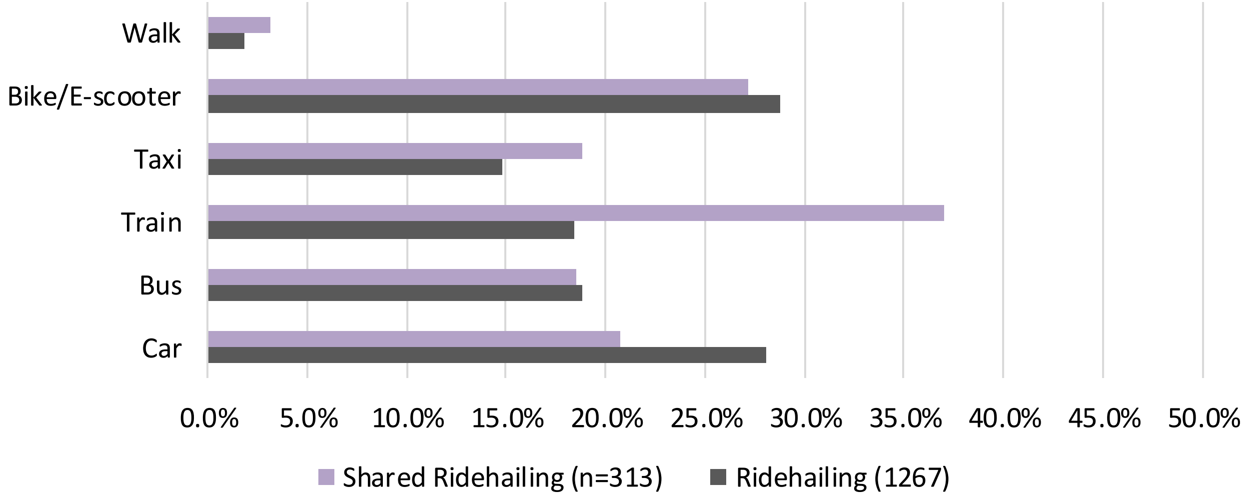






How would you have made your trip if [this shared mobility service] were not available?





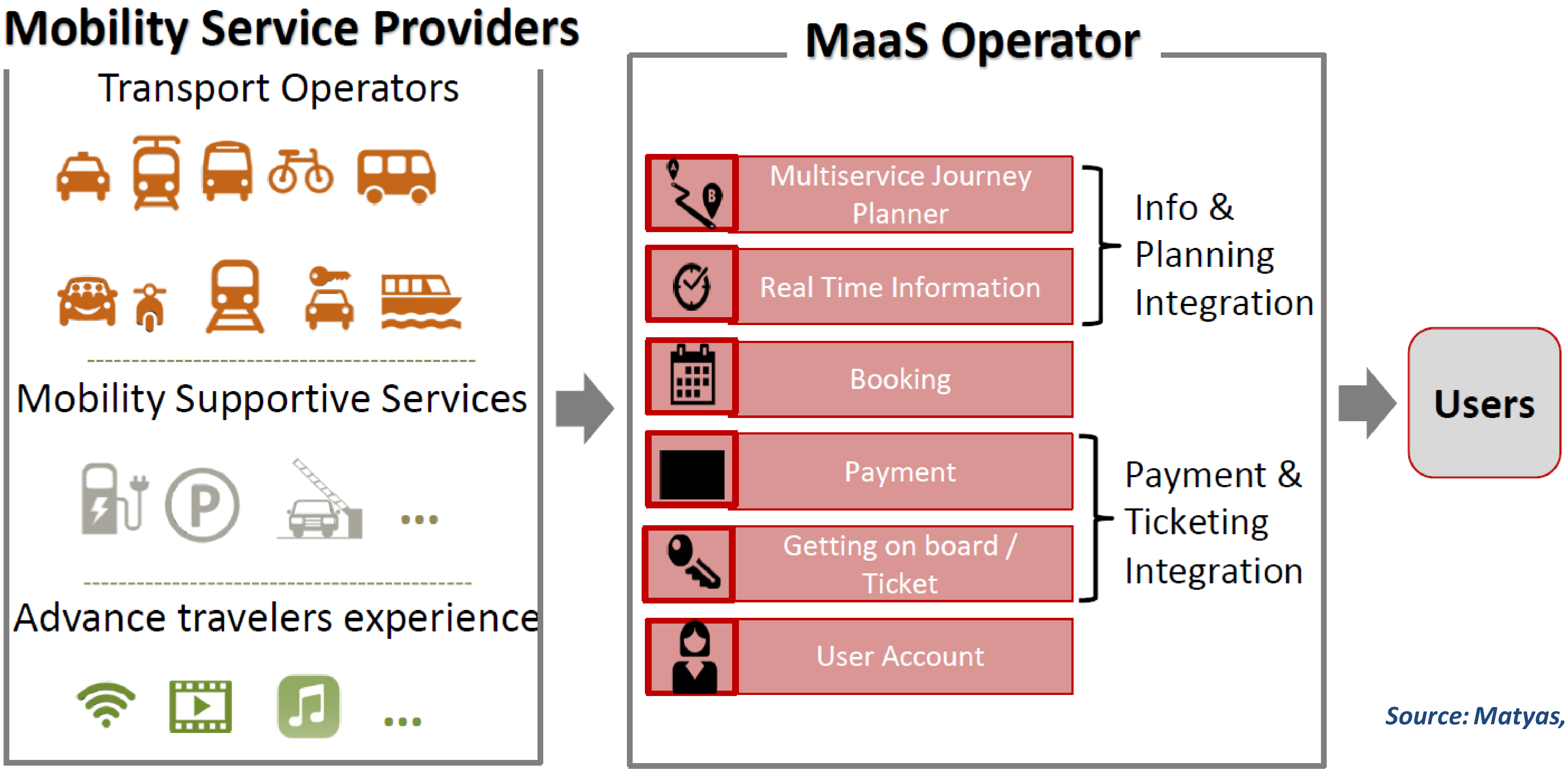
UC DAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Car Ownership vs. Shared Mobility?

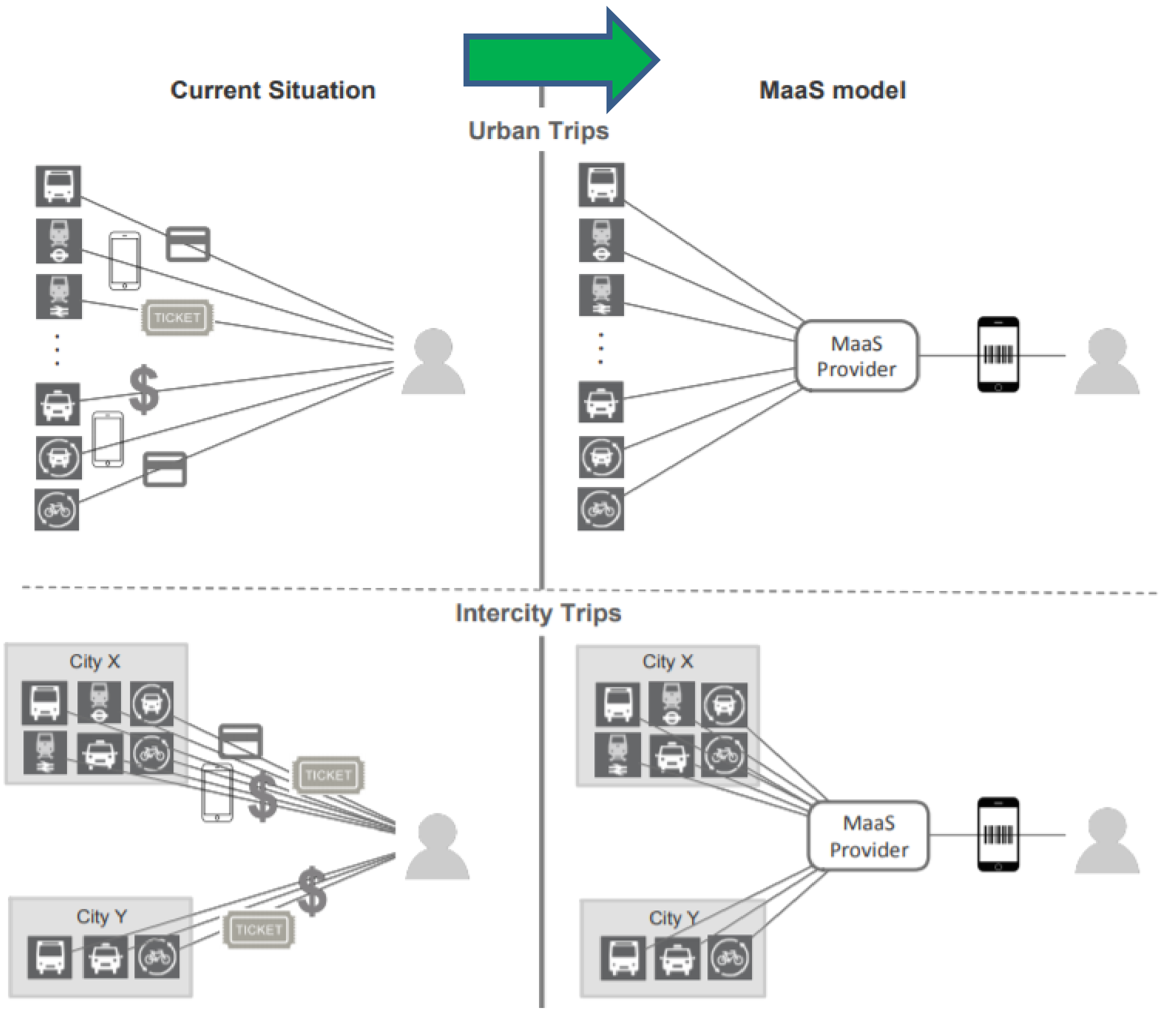
- *Under what conditions would individuals prefer to access a vehicle as needed rather than owning one?*
- *How will MaaS (Mobility as a Service) change future mobility?*
- *To date, only a minority seems interested in not owning a vehicle and access a suite of mobility services when needed…*

How Will Mobility as a Service (MaaS) Change Mobility?



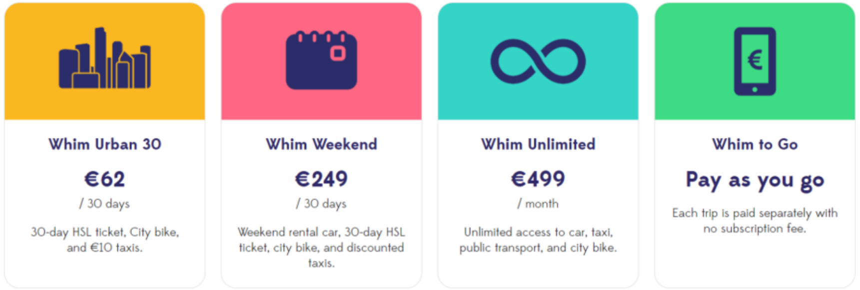
Source: Matyas, 2018

Mobility as a Service

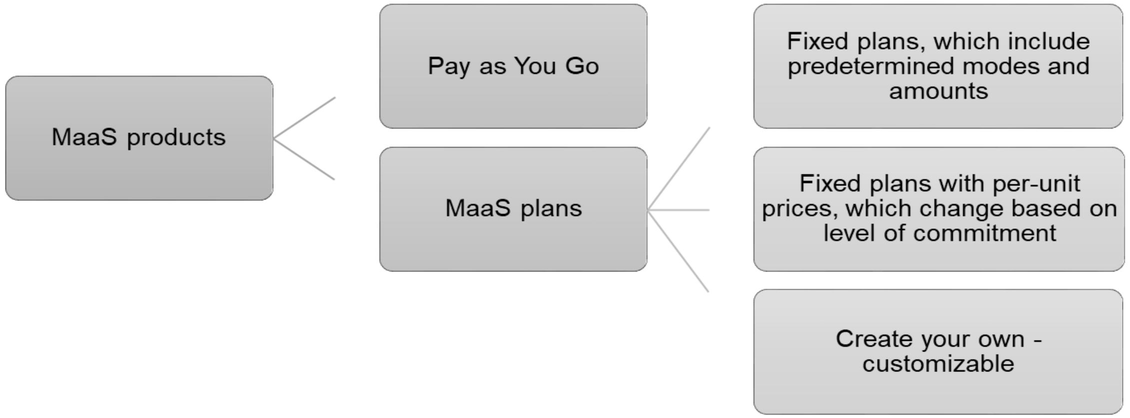


Source: Kamargiani et al., 2017

- Option to access bundle of transportation services:
  - Includes certain use of various travel modes (public vs. private; motorized vs. non-motorized)
  - Can be personalized for each users (i.e. Netflix of transportation)
  - A great tool for travel demand management and behavioral nudge



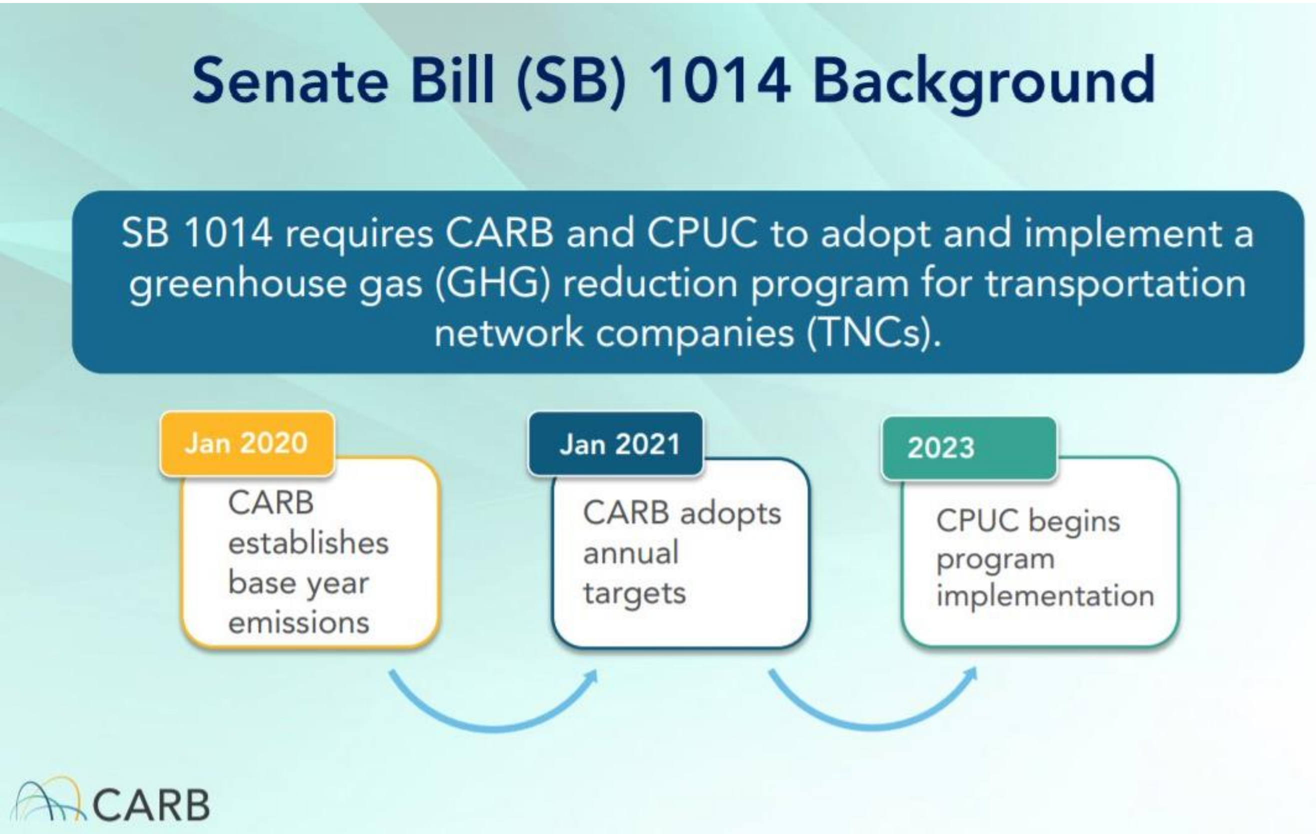
- Interest in adopting the MaaS model vs. changing private vehicle ownership



Next Steps…

- Longitudinal analysis of ***changes in vehicle ownership*** associated with adoption of shared mobility
- ***Mobility as a Service (MaaS)*** likely to affect future car ownership
  - *Under what conditions individuals prefer to access a vehicle when needed rather than owning one?*
  - *To date, only a minority (mainly in urban areas) seems interested in not owning a vehicle and accessing a suite of mobility services when needed*
- New study examining willingness to join ***MaaS***
- New study focusing on ***airport*** access (with US DOE/NREL)

Support to Clean Miles Standards Policy Making



Identify and quantify **barriers and opportunities** for TNC drivers and Riders to:

1. Increase pooling and occupancy in TNC vehicles;
2. Electrify the vehicles used to provide Lyft and Uber ridehailing services;
3. Decrease deadheading;
4. Connect to public transit; and
5. Connect to/promote active transportation.

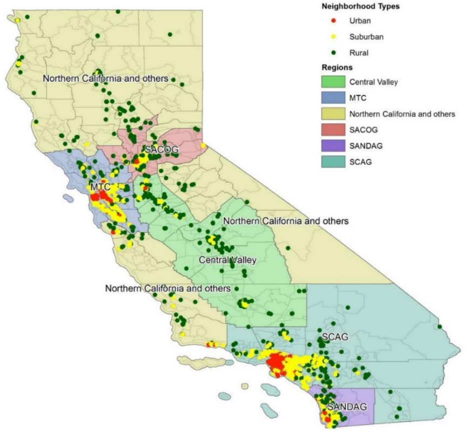
UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Support to CMS Policy Making - Data Sources

(UCD) 2018 California mobility panel survey

~3,700 respondents from California



(UCD) 2019 "8 US cities" 3R survey

~3,300 respondents from Boston, Kansas City, Los Angeles, Sacramento, Salt Lake City, San Francisco, Seattle, Washington DC

(SANDAG + Other MPOs) 2019 CA Transportation Study

57,000 person-days of transportation data with an app-enabled seven-day travel diary

GPS tracking data of 70 TNC drivers in SANDAG region

- requesting data

(SACOG) 2018 SACOG Regional Household Travel Survey

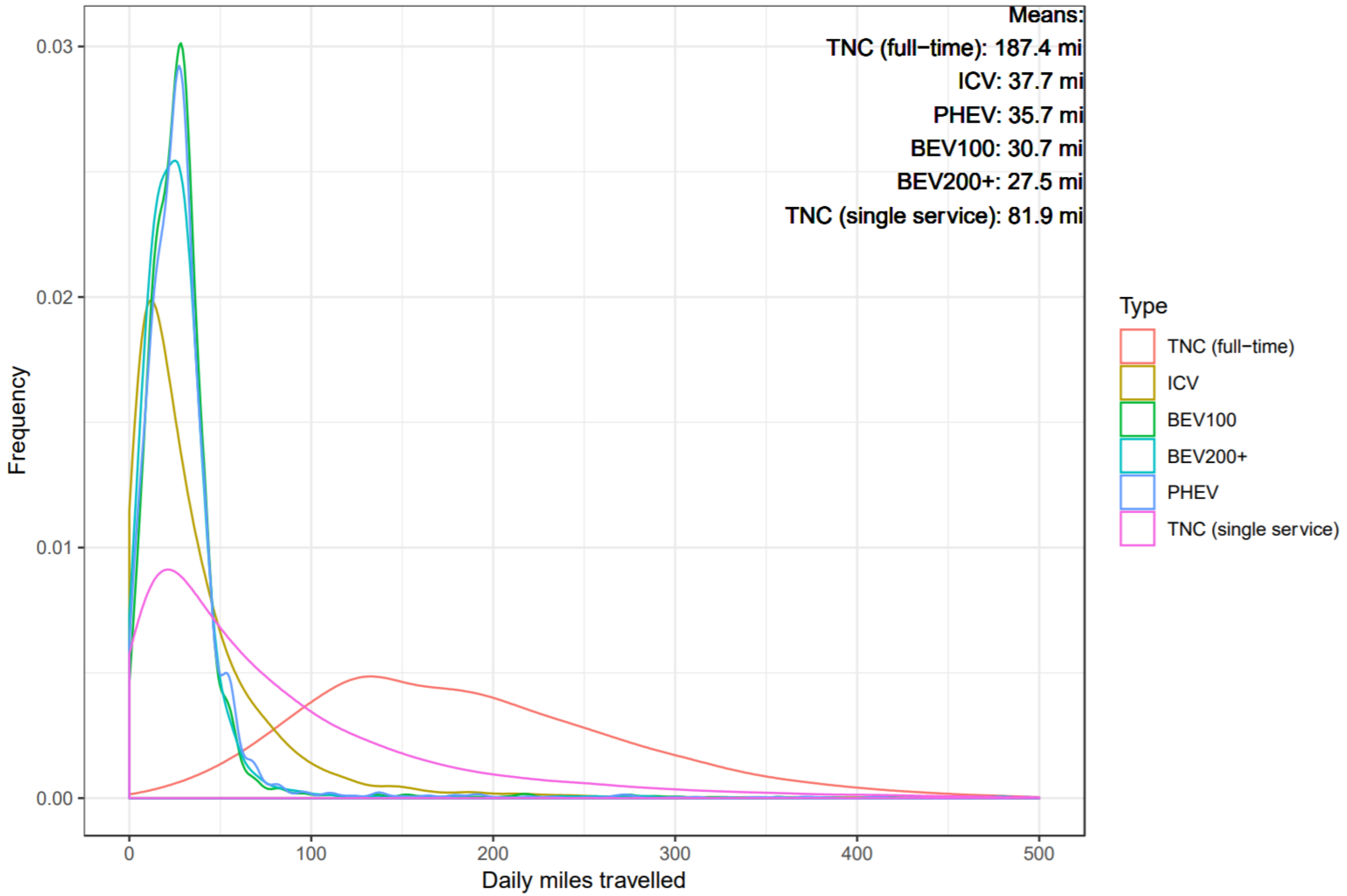
- requesting data

(UCD) Resources from other TNC studies

- joint analysis

Electrification of Ridehailing

- Driving patterns of TNC drivers in most cases compatible with performance of EVs
- Costs favor use of PHEVs, but competitiveness of EVs growing
- Impacts on charging infrastructure
- New project focusing on electrification of TNC fleets in California
- Support to policy making



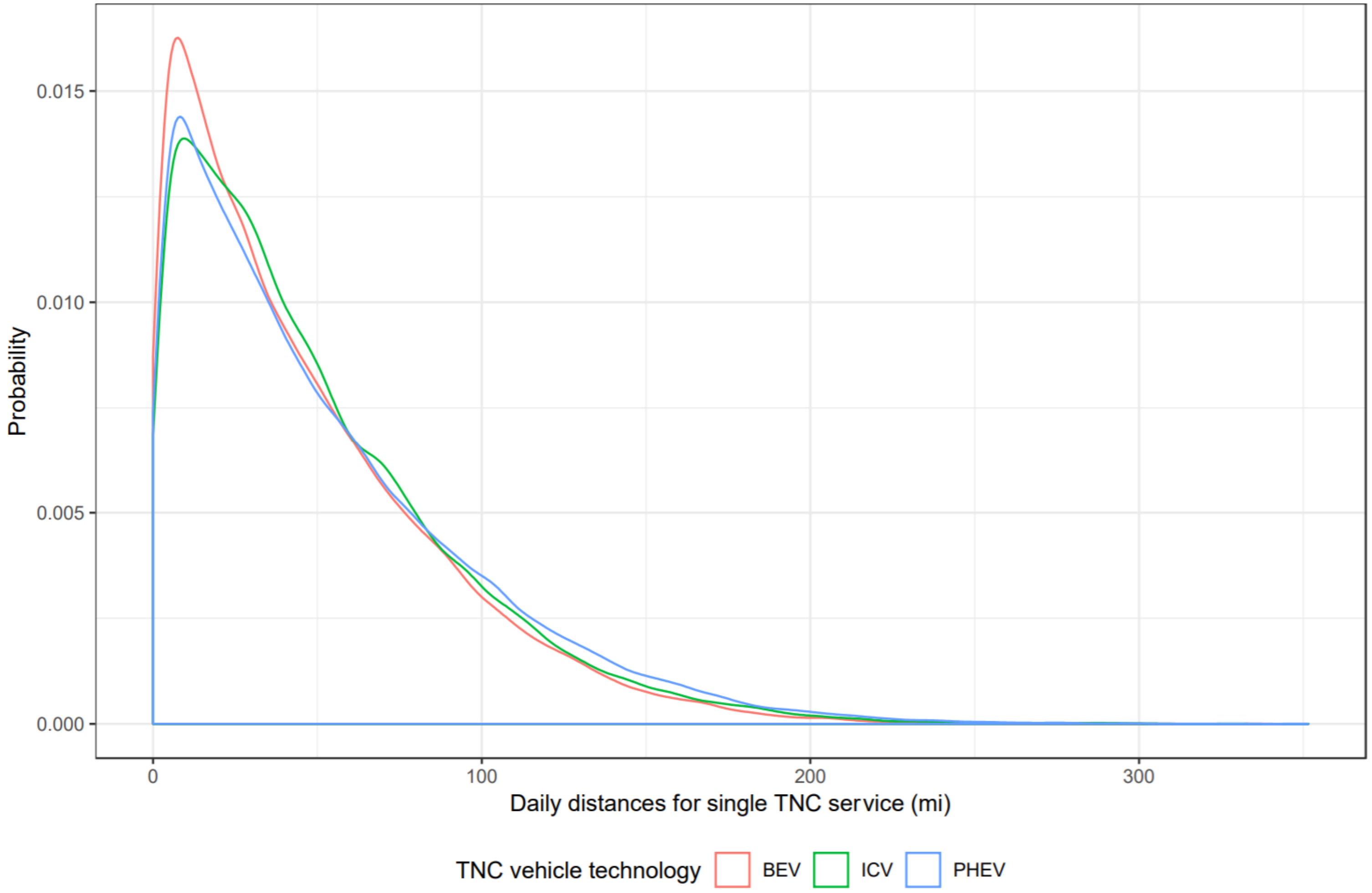
Source: Jenn (2019)

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Electrification of Ridehailing

- Driving patterns of TNC drivers in most cases compatible with performance of EVs
- Costs favor use of PHEVs, but competitiveness of EVs growing
- Impacts on charging infrastructure
- New project focusing on electrification of TNC fleets in California
- Support to policy making



Source: Jenn (2019)

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Vehicle Automation

Vehicle Automation

SAE Level	SAE Name	Description
0	No Automation	The human driver controls all aspects of driving always. The vehicle may have warning systems.
1	Driver Assistance	The vehicle may be able to control steering or acceleration/deceleration using information from the external environment. The human driver performs all driving tasks.
2	Partial Automation	The vehicle may be able to control both steering and acceleration/deceleration using information from the external environment. The human driver performs all driving tasks.
3	Conditional Automation	The vehicle can control all driving tasks (steering, acceleration/deceleration) and monitors the environment. A human driver may need to respond to a request to take over the vehicle and acts as the back-up system.
4	High Automation	The vehicle can control all driving tasks (steering, acceleration/deceleration) and monitors the environment. The vehicle may request a human to intervene though intervention is not necessary.
5	Full Automation	The vehicle can control all driving tasks (steering, acceleration/deceleration) and monitors the environment. The human could choose the manage the vehicle if they desire.

Source: Adapted form SAE (2016)

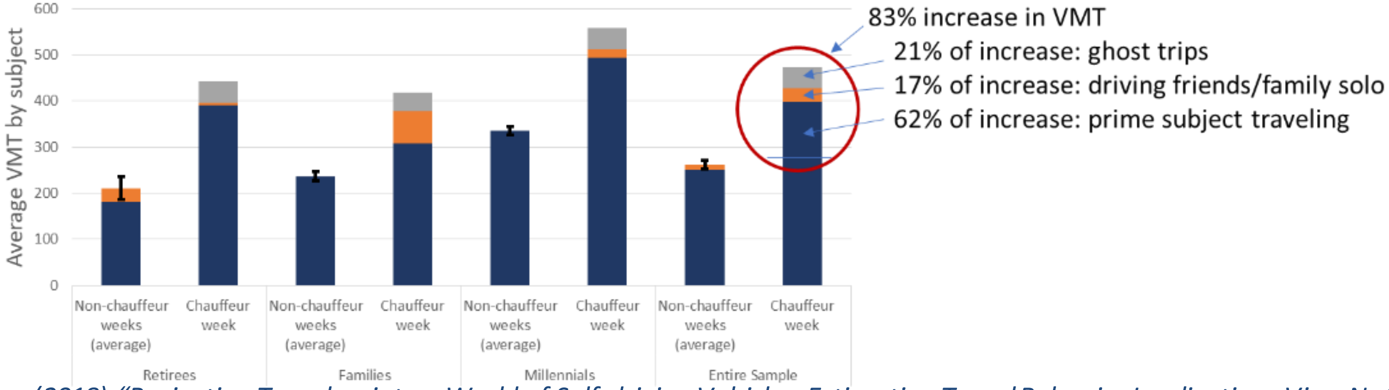
How will fully autonomous vehicles impact travel and activity behavior?

- FUTURE OF INTEREST:
  a fully autonomous vehicle

- SIMULATION OF FUTURE:
  a personal driver

Don't have to drive the car
Full multitasking
No parking worries
Can send on errands

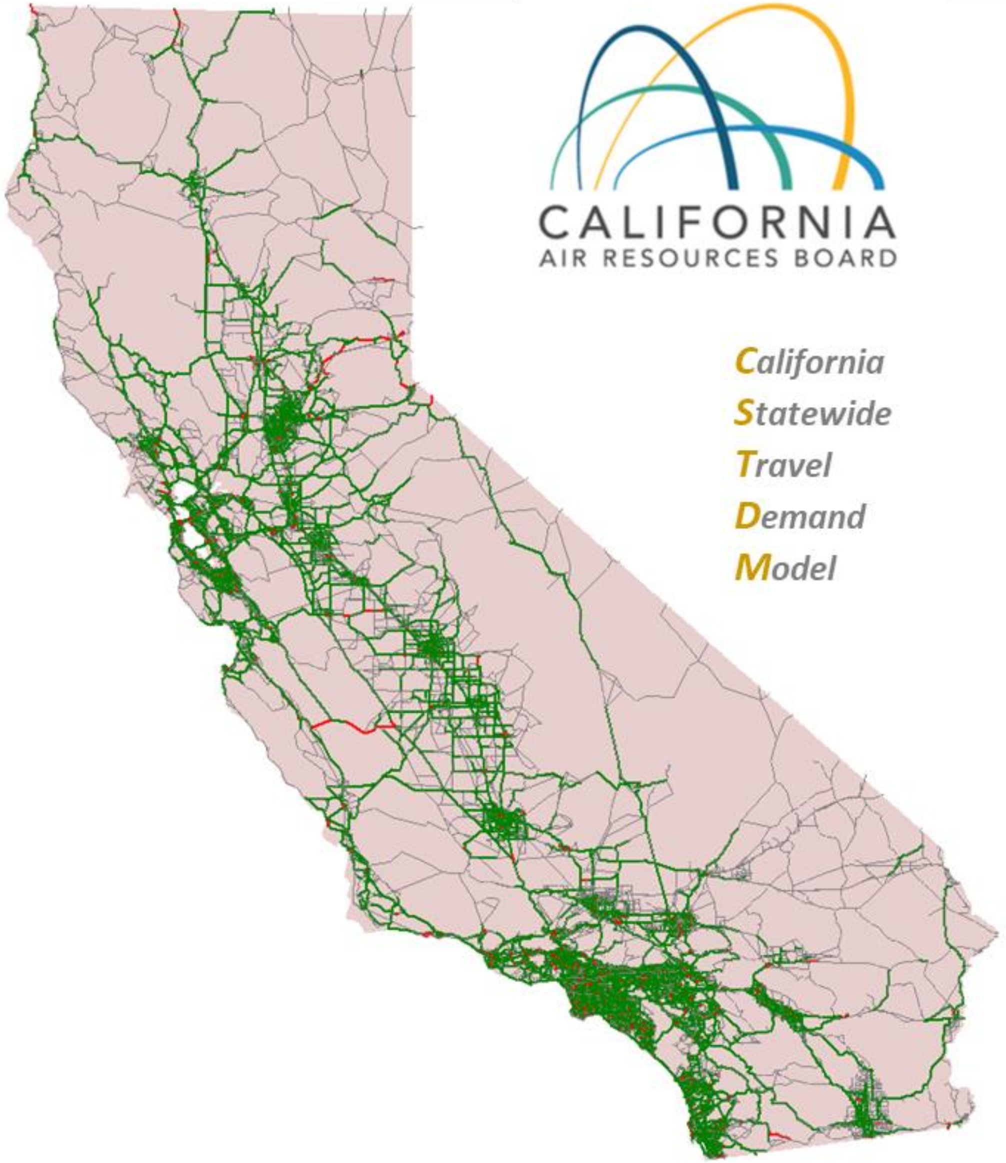
Results from pilot study



For more details:
Harb, M., Y. Xiao, G. Circella, P. L. Mokhtarian and J. Walker (2018) "Projecting Travelers into a World of Self-driving Vehicles: Estimating Travel Behavior Implications Via a Naturalistic Experiment", Transportation, 45 (6), 1671–1685.

Emission Impacts of Connected and Automated Vehicle Deployment

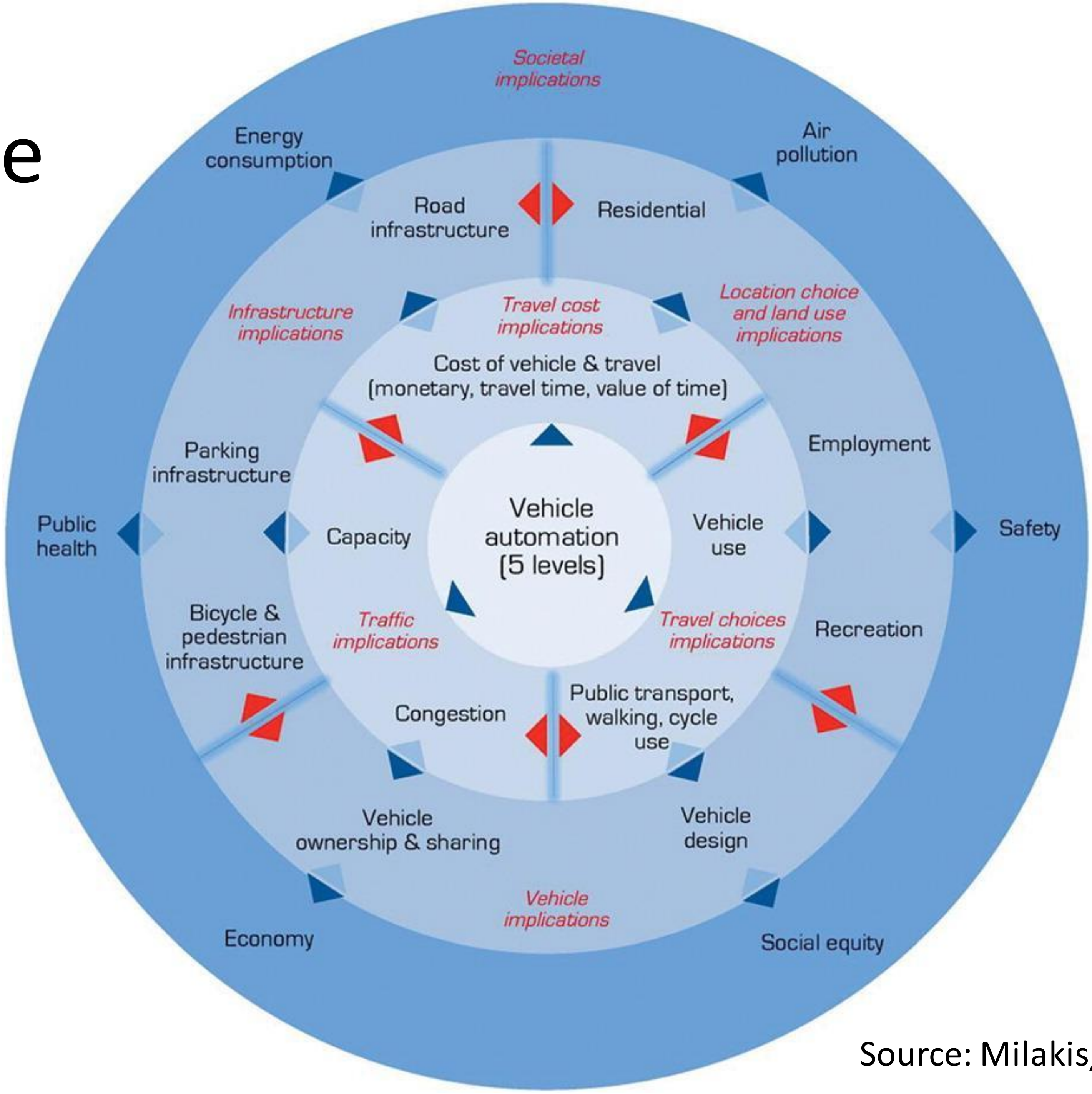
- Evaluate future scenarios of C/AV deployment
- Investigate ranges of potential VMT, GHG, and criteria pollutant emission impacts
- Project builds on knowledge from leading research in the field



CALIFORNIA
AIR RESOURCES BOARD

California
Statewide
Travel
Demand
Model

What can be modeled?



Source: Milakis, van Arem, van Wee 2017

Behavioral Factors to be Considered

Category	Factor	Response to CAV deployment	Impact
Travel Demand	Trip Making Rates	• Remain unchanged. • Increase.	• Total number of trips.
	Vehicle ownership	• Remains unchanged. • Decreases. • Increases.	• Modal split • Trip making rates
	Residential Choice	• Remain unchanged. • Increased sprawl.	• Location of home-based-trip origins.
	Activity Location Choice	• Remains Unchanged. • Less sensitive to travel time.	• Location of trip destinations.
	Modal Split	• Remains unchanged. • Increased use of ridesourcing (Part II)	• Trips by mode. • Number of vehicles on the road.
Traffic Assignment	Route selection paradigms for CAVs	• Remains unchanged. • User optimal w/ real-time and/or historical information. • System optimal or other.	• Path choice & resulting travel times. • Modal split (indirectly).

Source: Kuhr et al. (2017)

Technical Factors to be Considered

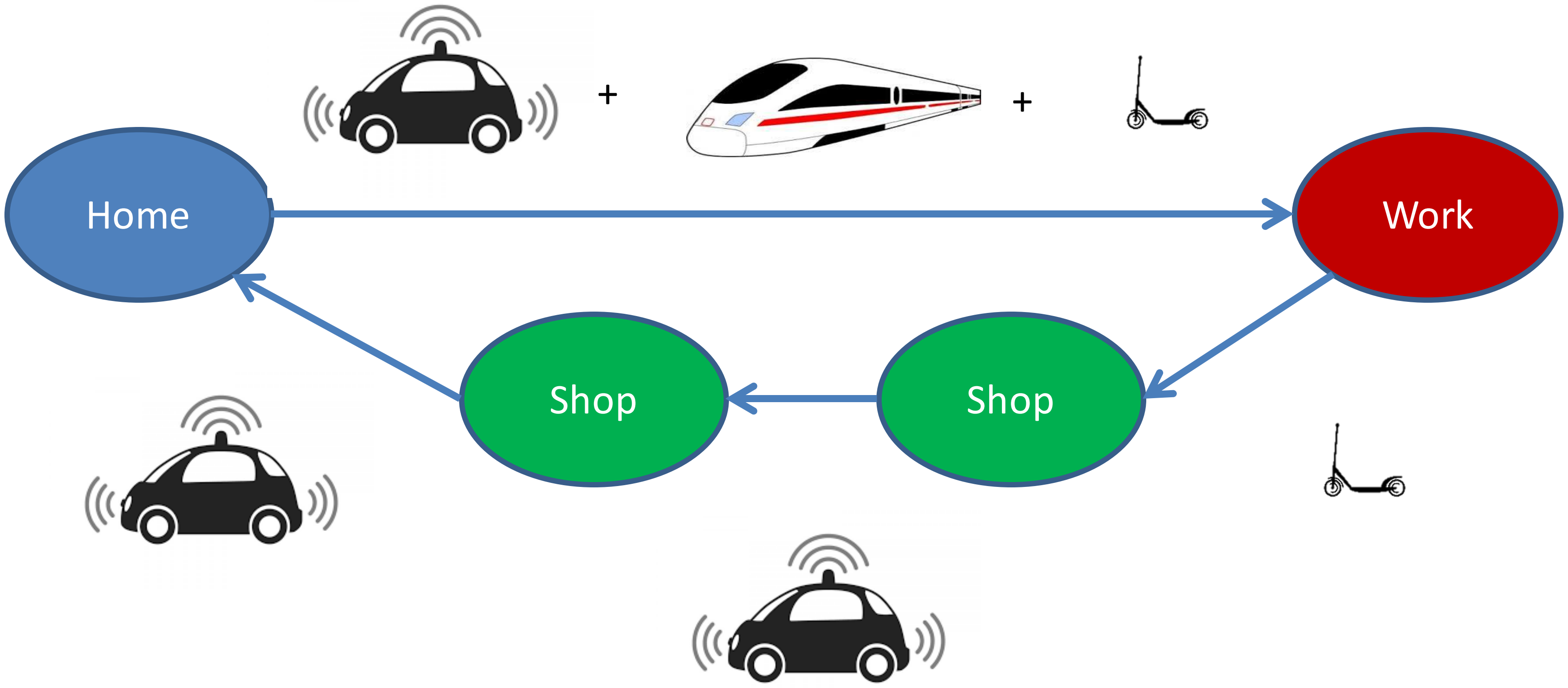
Category	Factor	Possible Assumptions	Impact
System Performance	Vehicle fleet characteristics	• Remains unchanged. • Decrease in vehicle size • Increase in vehicle size	• Arterial and freeway performance. • Residential location choice (Indirect).
System Performance	Automation	• Optimistic adoption rate for personal vehicles (Part II). • Pessimistic adoption rate for personal vehicles (Part II). • Automation of transit fleet. • Automation of freight fleet.	• Headways. • Traffic control strategies. • Safety. • Indirect: Arterial and highway performance. • Indirect: Modal Split
System Performance	Communications	• Technology adoption. timeline dictated by DSRC deployment. • Technology adoption timeline accelerated through cellular technologies. • V2V. • V2V+V2I. • V2X+Backhaul (enabling centralized data collection and traffic management).	

Source: Kuhr et al. (2017)

Uncertainties in AV Impacts

- Land use
- Travel demand
- Trip length
- Auto ownership
- Mode choice
- Parking
- Auto occupancy
- In-vehicle travel time
- Zero-occupancy vehicle

How to Model Mode Choice?



Long-distance Travel

vs.

Potential Changes in Long-Distance Travel

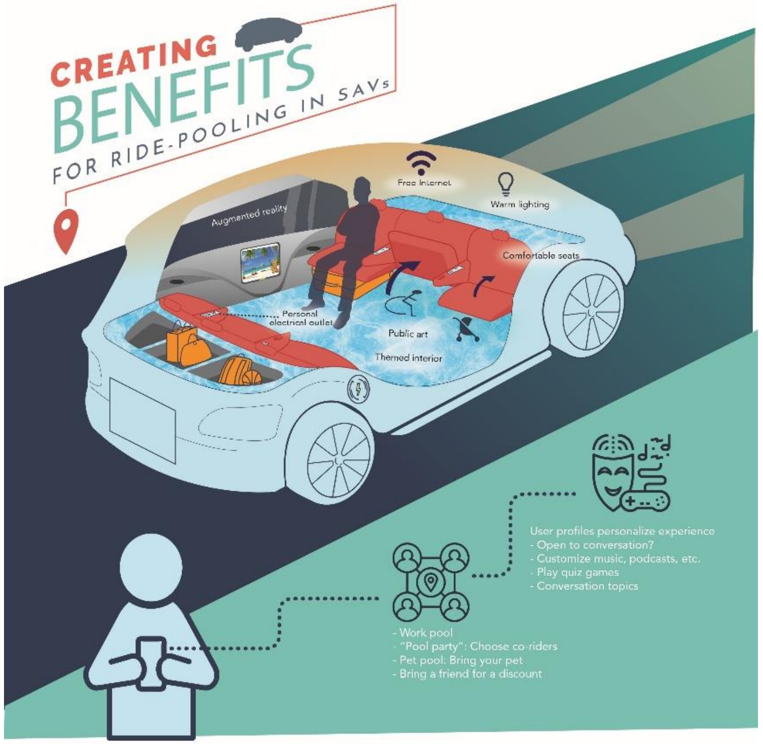
- Smaller airports might be affected by AV, and may even shut down
- AVs might cause congestion in airport area
- Group size need to be considered in travel demand models
- Dead-head trips might be worse due to the use of AV on long distances
- Intercity automated buses might be a way out
- Induced demand could cause more air trips
- Potential for scheduled AV service
- Roadway congestion is creating market for air travel
- AV can be considered as feeder service

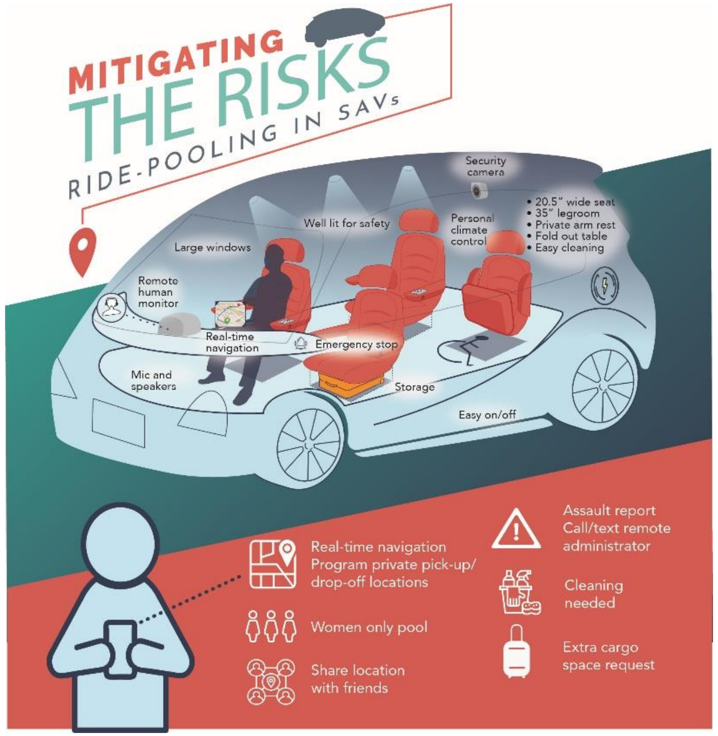
Strategies to Support VMT and GHG Containment Goals:

1. Deploy driverless vehicles as shared use vehicles, rather than privately owned
2. Ensure widespread carpooling
3. Deploy driverless vehicles with zero tailpipe emissions
4. Take advantage of opportunities to introduce pricing
5. Increase line haul transit use rather than replacing it
6. Ensure driverless vehicles are not larger or more energy consumptive
7. Program vehicle behavior to improve livability, safety and comfort on surface streets

“Not all vehicles are created equal”:

AVs will differ from today’s vehicles…



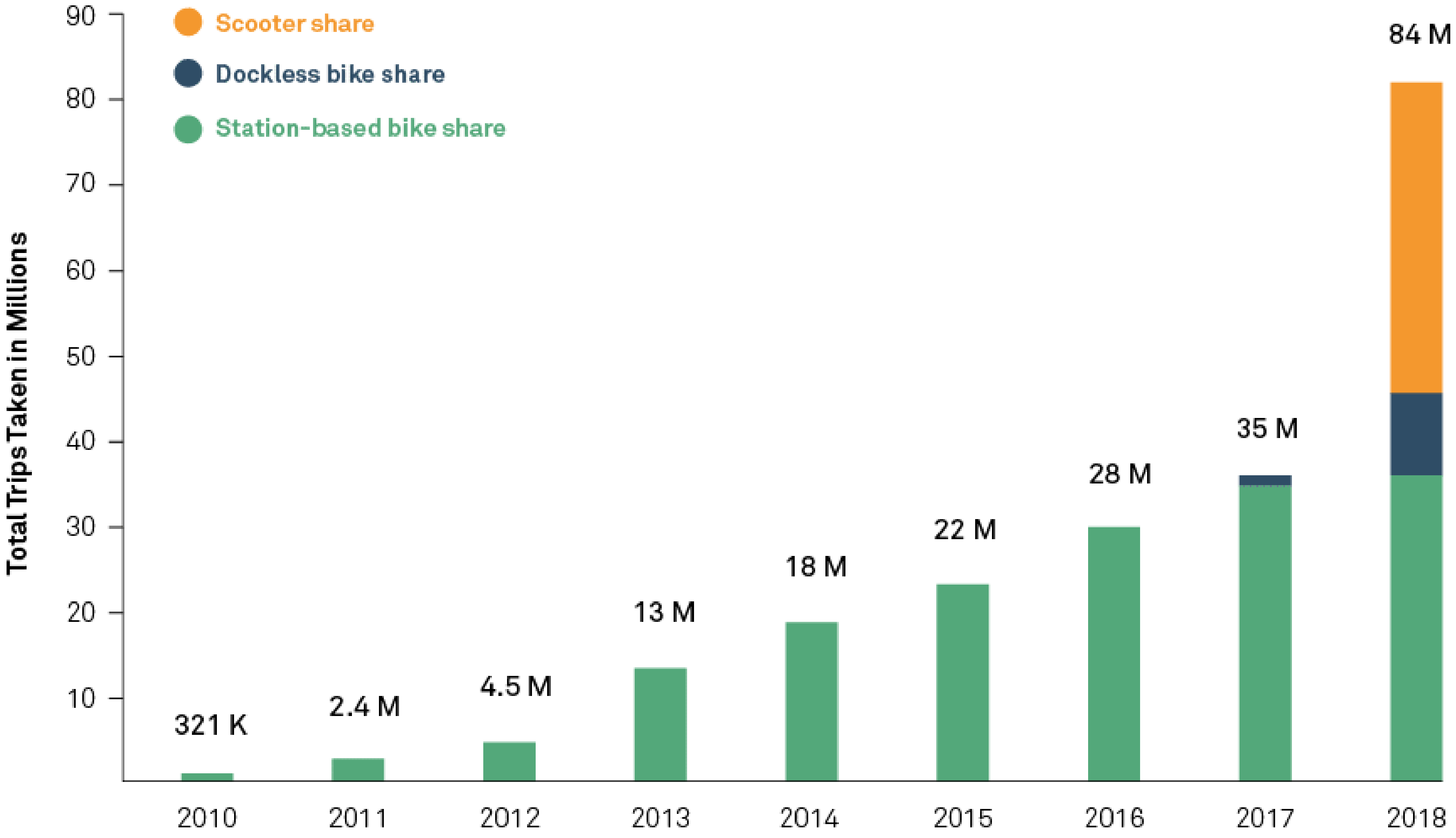


Source: Beth Ferguson and Angela Sanguinetti (2018)

…What factors can encourage travelers to share rides with strangers?

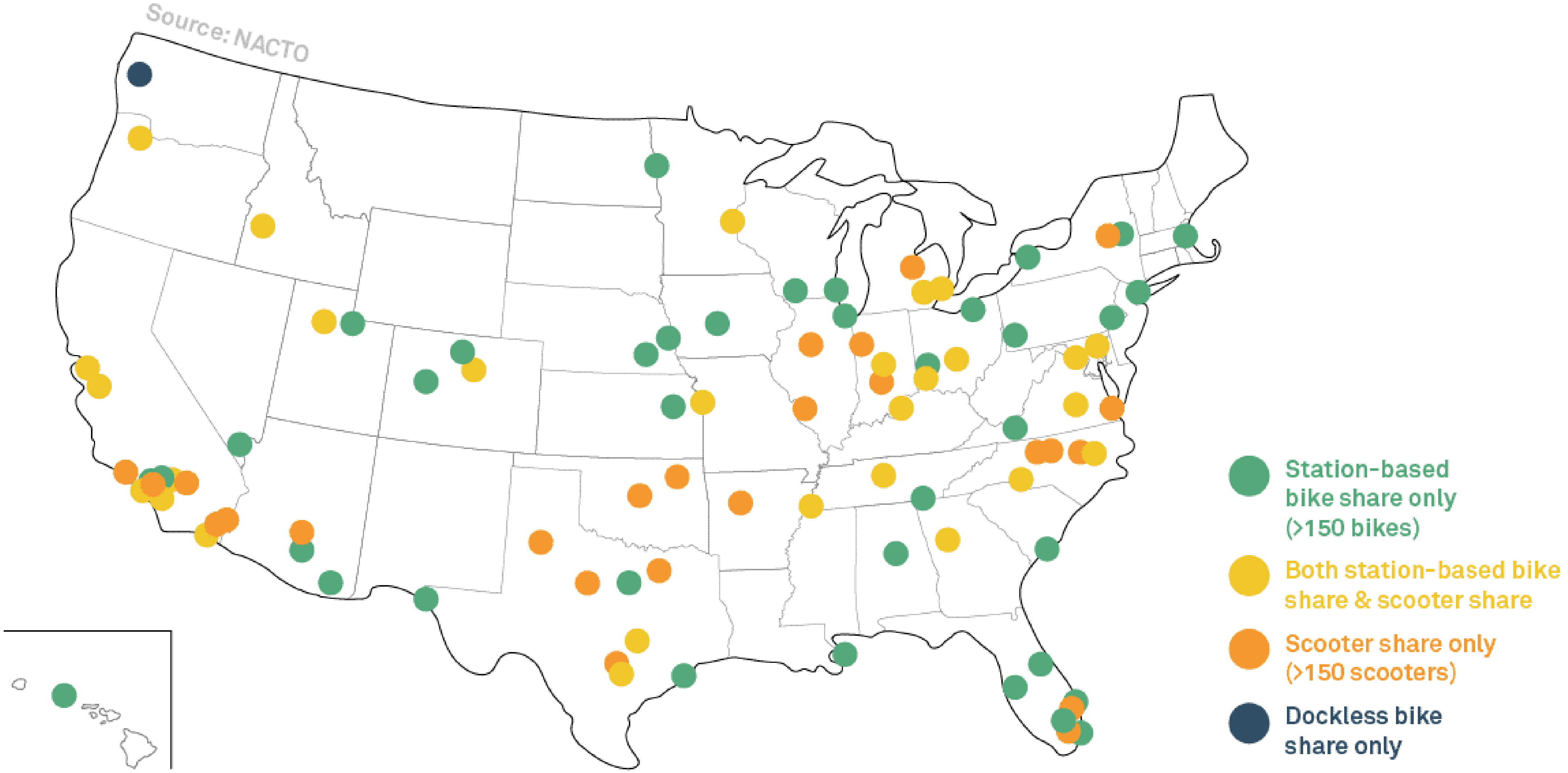
How are micromobility services changing travel behaviors?

From *Bike Share* to *Shared Micromobility*

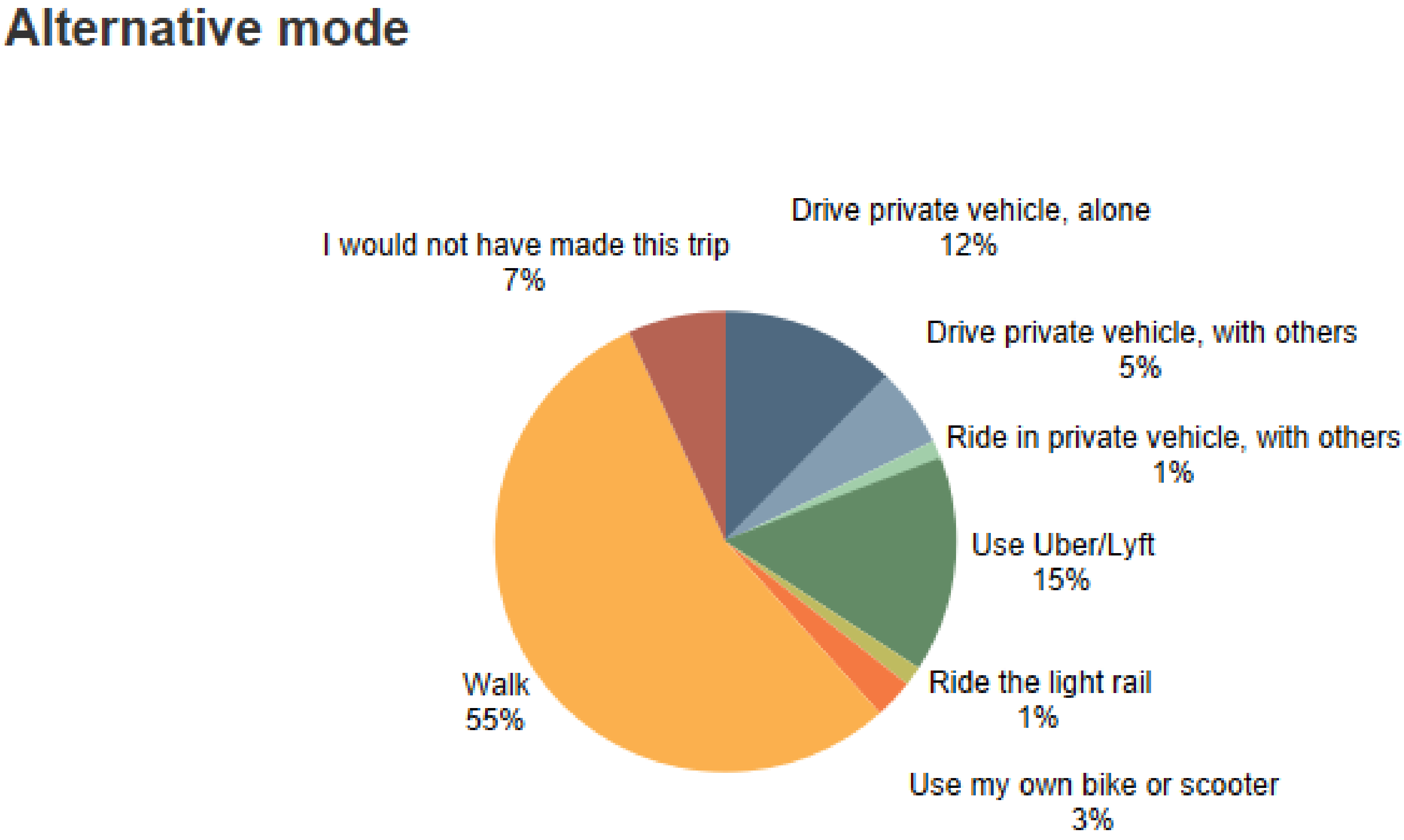


Source: NACTO

Shared Micromobility across the U.S. in 2018



E-scooter Trips – Impacts on Other Modes



Impacts of E-scooter Trips – by Trip Length

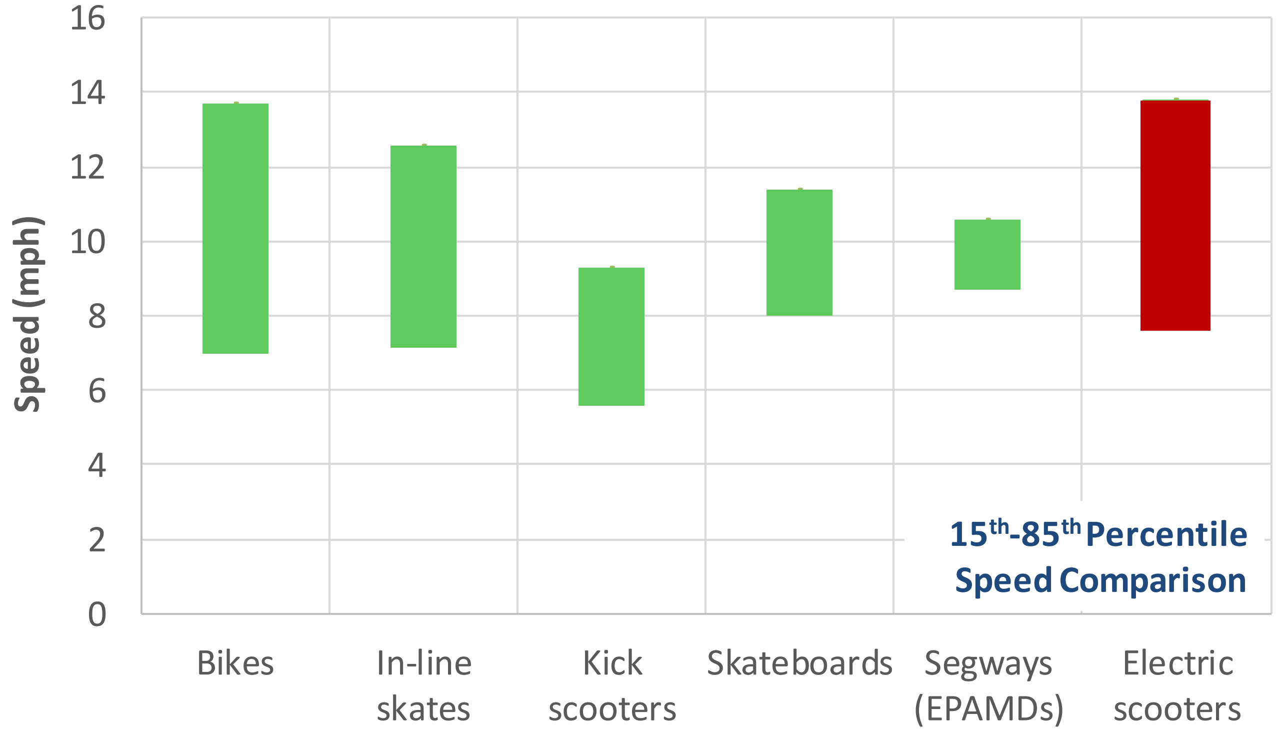
Trip length

Alternative mode	Less than a mile	1-2 miles	3-4 miles	5 miles or more
Drive private vehicle, alone		8	1	
Drive private vehicle, with others		3		1
Ride in private vehicle, with others		1		
Ride the light rail			1	
Use Uber/Lyft	3	7		1
Use my own bike or scooter	2			
Walk	13	27		
I would not have made this trip	2	3		

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

E-scooters largely similar in speed to bicycles…



Can share bike lane infrastructure!

Source: Pernia, Lu, and Birriel (2000); FHWA (2004); Fang and Handy (2017); Fang (2018)

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

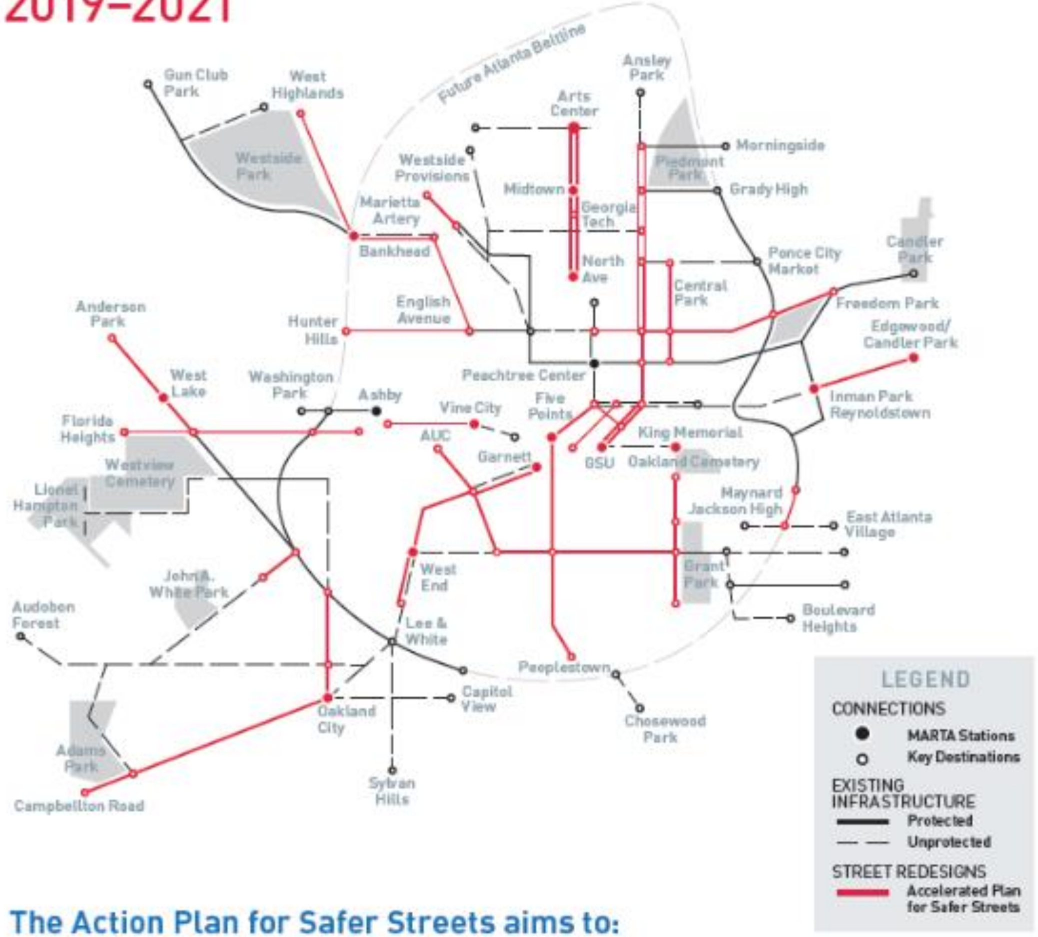
Lime

ATL NOVEMBER NEWSLETTER

ATLiens - 20 Miles of Bike Lanes are Coming!

Thanks in part to the massive adoption of micromobility (like Lime's escooters), Mayor Keisha Lance Bottoms announced a plan to rapidly build and implement over 20 miles of additional bike lanes in the City of Atlanta over the next 2 years! Consider sending the administration a thank you email by clicking here or tweeting @keishabottoms.

TARGET NETWORK FOR SAFER MULTI-MODAL STREETS 2019–2021



The Action Plan for Safer Streets aims to:

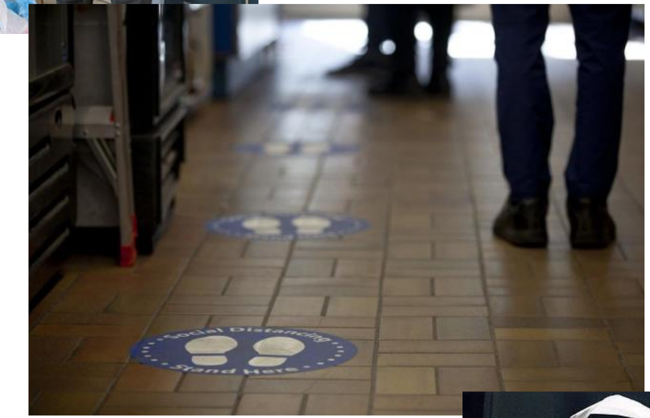
- Connect SW Atlanta to Westside Trail and MARTA
- Provide north-south connections between Midtown, Downtown, and West End
- Bridge the gap between Grant Park and West End
- Expand access to MARTA stations, city parks, and schools by providing first/last mile connections
- Reduce risk as 100% of routes are on the city's high-injury network or near schools

TARGET CORRIDORS

Anderson	Georgia	Pryor St
Bill Kennedy Way	Jesse Hill	Ralph David Abernathy
Brady Ave	Juniper	Ralph McGill
Campbellton	Lee	Spring
Cascade Ave	McDaniel	West Peachtree
Central Park Place	MLK Jr Dr	Whitehall
Cherokee	Oakland Dr	
DeKalb	Piedmont	

Big disruption caused by the COVID-19 pandemic with…

…need for social distancing



…impacts on employment and travel

…adoption of ICT-based remote working and e-shopping

+ BIG CHANGES IN TRANSPORTATION SUPPLY AND BUSINESS MODELS

UCDAVIS
INSTITUTE of TRANSPORTATION STUDIES

3 REVOLUTIONS
SHARED·AUTOMATED·ELECTRIC

Impacts of COVID-19 Pandemic on Mobility

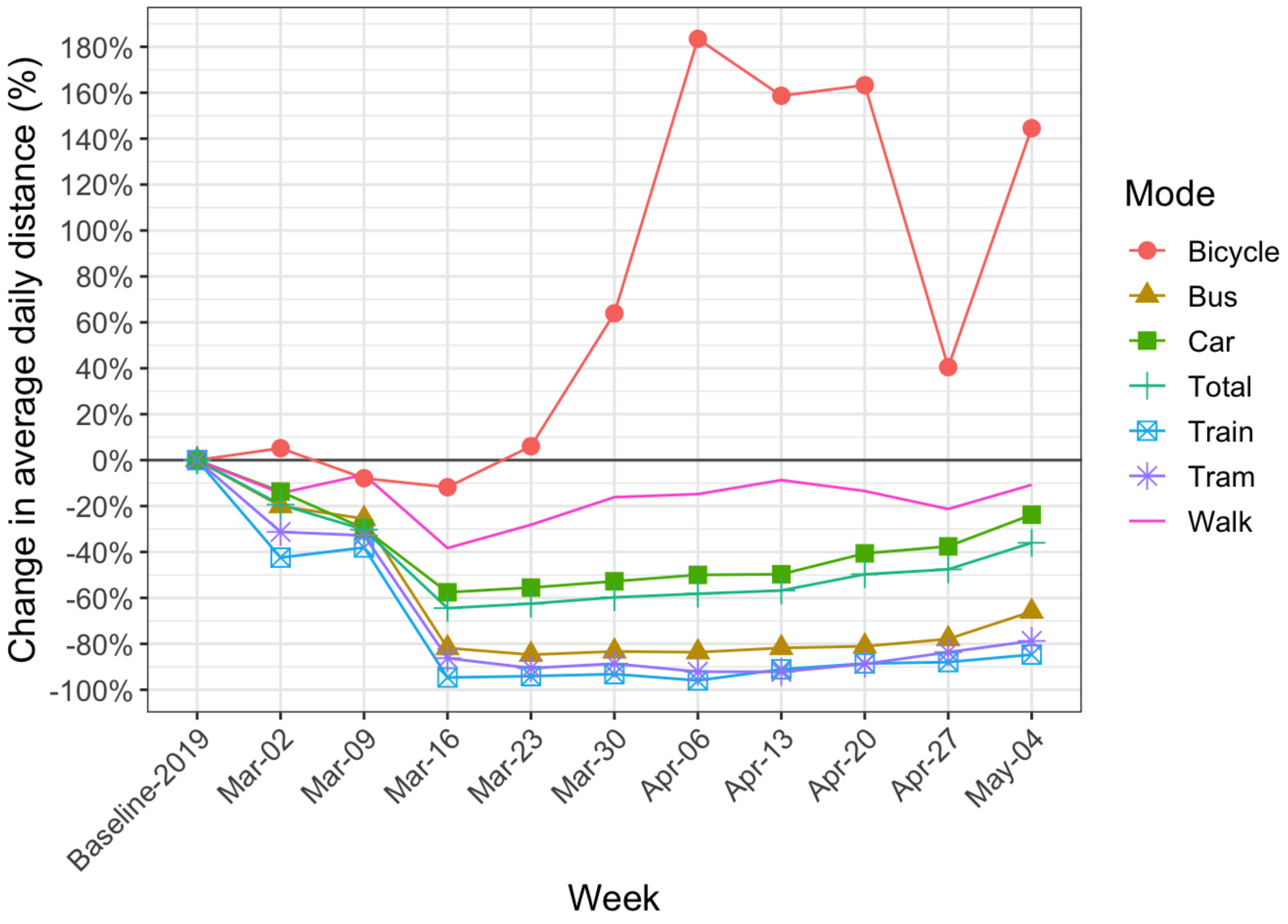
UCDAVIS
COVID-19
MOBILITY STUDY

postcovid19mobility.ucdavis.edu

Investigate the temporary and longer-term impacts of the pandemic on:

1. The use of technology
2. Lifestyles and household organization
3. Employment and activities
4. (E)-shopping patterns
5. Travel choices and vehicle ownership
6. Use of new mobility services
7. Expectations for future travel

COVID-19 Pandemic has already heavily affected transportation



Source: MOBIS-COVID19 Study (IVT, ETH Zurich and WWZ, University of Basel), https://ivtmobis.ethz.ch/mobis/covid19/

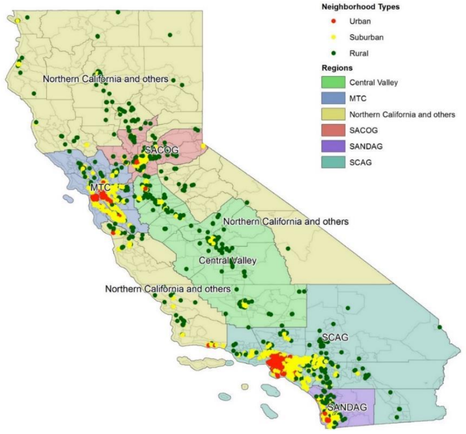
Countries affected by the pandemic have experienced:

- Steep decline in air travel
- Reduction in all ground transportation during lockdown
- Steep decline in use of public transit
- Sharp reductions in use of shared mobility
- Uber/Lyft suspended pooled rides to prevent COVID-19 transmission
- Temporary (at least) reductions in VMT and GHG emissions
- Adoption of teleworking promoted whenever possible
- Economic recession causing devastating impacts on employment
- Mid-term reductions in gas tax revenues and funding for transportation
- Evidence after reopening points to increased car travel
- Likely changes in transportation supply and business models

ITS Davis blog on impacts of pandemic on transportation: https://its.ucdavis.edu/blog-post/what-the-present-pandemic-means-for-the-future-of-transportation/

UC Davis Study of COVID-19 Pandemic Impacts on Mobility

<u>2018 California mobility panel survey:</u>
~3,400 respondents from California



<u>2019 "8 US cities" 3R survey:</u>
~3,300 respondents from Boston, Kansas City, Los Angeles, Sacramento, Salt Lake City, San Francisco, Seattle, Washington DC

- Combination of *quantitative* (online surveys) + *qualitative* (in-depth phone interviews) research
- *Resampling* of respondents from 2018-2019 surveys
- Unique *longitudinal study* to investigate the impacts of the pandemic
- Recruitment of *additional participants* in same 8 regions from 2019 + new regions in this data collection:
  - *Atlanta, Denver, Detroit, Tampa, New York, San Diego (USA)*
  - *Canada: Toronto and Vancouver (Canada)*
- Additional data collection with convenience sample with respondents recruited through various channels
- Investigation of *temporary* vs. the *longer-term* impacts of the pandemic

UCDAVIS
INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS
SHARED·AUTOMATED·ELECTRIC

UCDAVIS COVID-19 MOBILITY STUDY

Previous 2018-2019 data

Information on many topics, e.g.
- Household organization
- Telecommuting patterns
- E-shopping behaviors
- Travel patterns
- Vehicle ownership
- Emerging delivery services
- Personal attitudes and preferences
- Shared mobility adoption
- Propensity towards AVs

2020 COVID-19 Data

Data collection on:
- Impacts of the COVID-19 on Lifestyles
- Employment and Activities
- Household Organization and Child Care
- E-shopping Behaviors
- Emerging delivery services
- Current Travel Patterns
- Vehicle Ownership
- Shared mobility adoption
- Personal attitudes and preferences

Post-COVID-19 Data

To be collected in Fall 2020 and/or Spring 2021

Interest in evolution of changes over time

Integration with passively-collected (i.e. cell phone) data

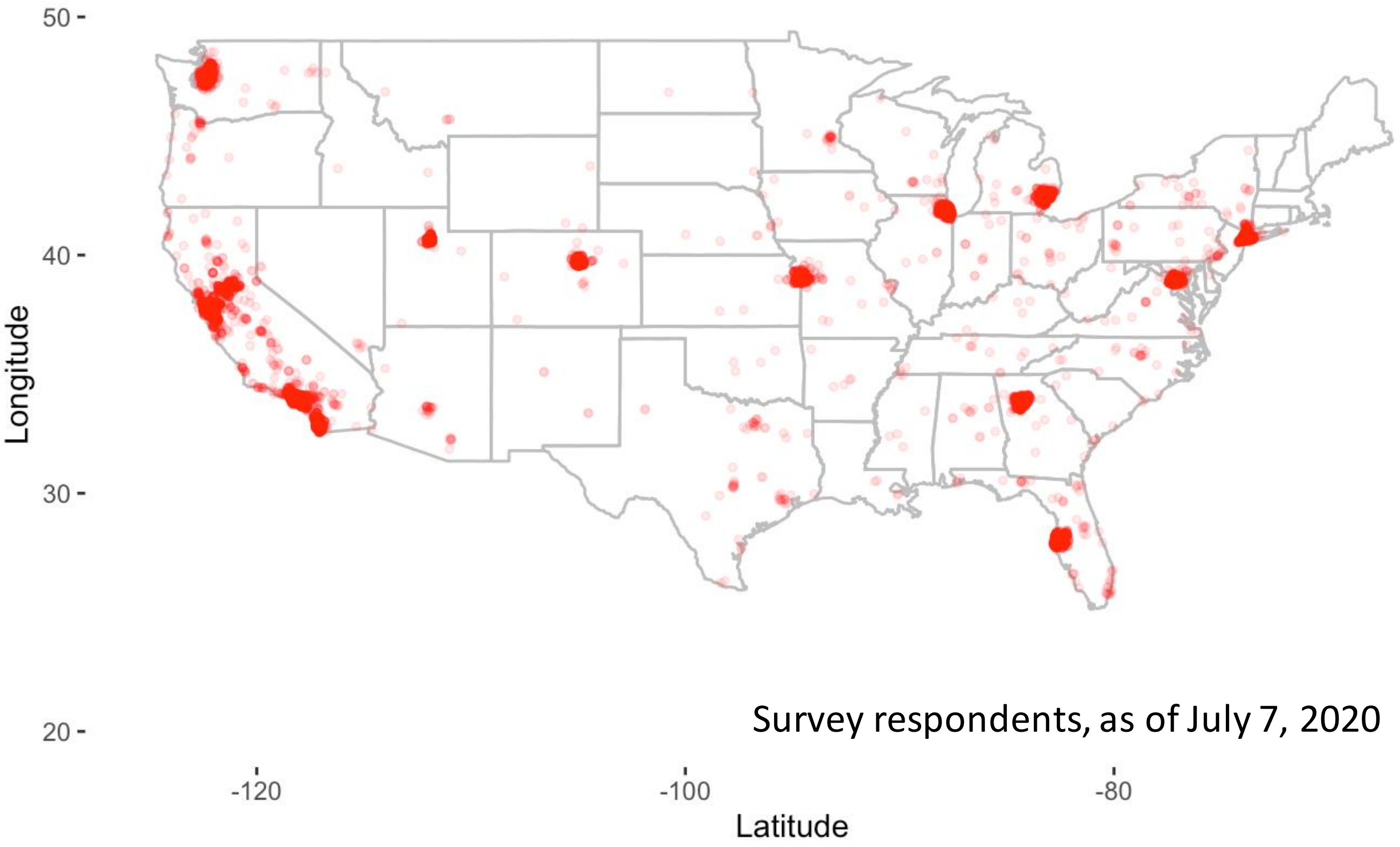
Cooperation with other researchers in the US and Europe for comparative analyses

Task 2: COVID-19 Data Collection and Analysis

2020 COVID-19 Data

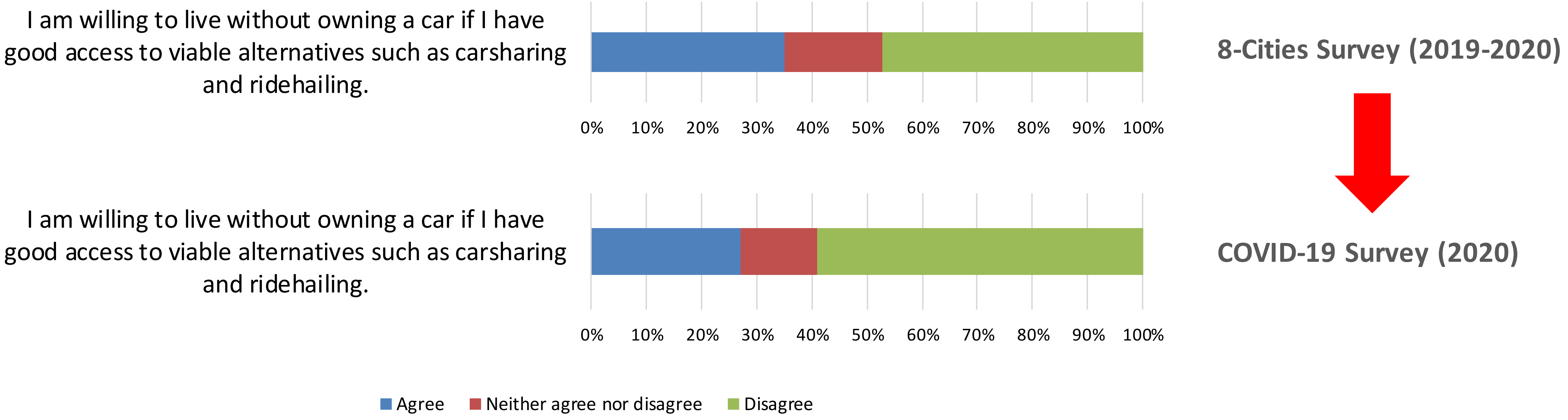
Data collection on:

- Impacts of the COVID-19 on Lifestyles
- Employment and Activities
- Household Organization and Child Care
- E-shopping Behaviors
- Emerging delivery services
- Current Travel Patterns
- Vehicle Ownership
- Shared mobility adoption
- Personal attitudes and preferences

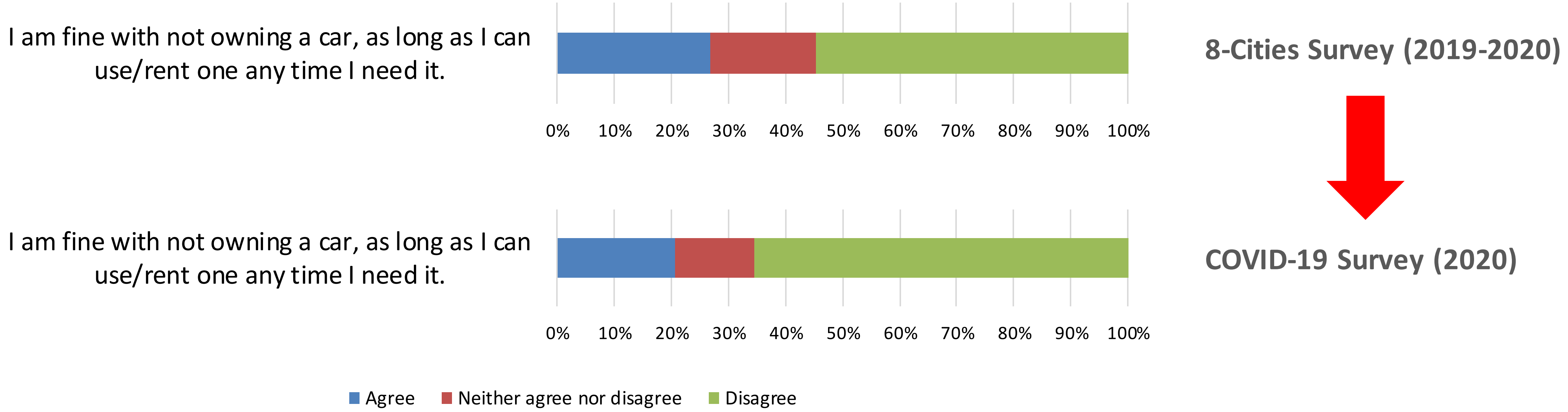


Survey respondents, as of July 7, 2020

Changes in Attitudes Towards Vehicle Ownership



Changes in Attitudes Towards Vehicle Ownership (2)



- A relatively small percentage of respondents also reported an intention to increase their number of vehicles in the household during the next six months.
- No conclusions can be drawn (yet) on the degree to which such attitudes might turn into actual behaviors.

New website to share information on UC Davis COVID-19 Mobility Study:

postcovid19mobility.ucdavis.edu

postcovid19mobility.ucdavis.edu

Post Covid-19 Mobility

THE STUDY | THE TEAM | 3RFM PROGRAM | ITS DAVIS | IN THE NEWS

About the Study

Our research team at UC Davis is leading a large data collection effort that includes a combination of *quantitative* (online surveys checking how behaviors and attitudes have changed and how people are adjusting to the COVID-19 outbreak) and *qualitative* (in-depth phone interviews to discuss more details on household organization, work activities, use of e-shopping and delivery services, changes in habits, preferences about land use, future plans to adjust travel choices and vehicle ownership, etc.) approaches.

As part of the project, we are resampling thousands of respondents from our previous-2018 California mobility survey (**~3,400 respondents from California**) and 2019 "8 cities" travel survey (**~3,300 respondents from Los Angeles, San Francisco, Sacramento, Boston, Seattle, Salt Lake City, Kansas City and Washington DC**). This is giving us a unique opportunity to build a longitudinal study to investigate the impacts of the pandemic. Our research team is also coordinating with other colleagues in the US and Europe, and plans to develop comparative

Policy Implications

- Need to focus on human beings and not cars
- Future of mobility will depend on how the market is regulated and ***priced***, e.g. by time of day, location, to reduce congestion, promote sharing, improve equity, promote alternative fuels
- TNC drivers' activity already compatible with EV range and performance (but need to remove barriers!)
- Need for behavioral nudge to support shift towards increased sustainability
- Land use will be a key factor to promote more sustainable choices
- Potential of MaaS to modify relationships with private vehicle ownership
- Micromobility provides critical mass for *bicycling* infrastructure

HOME › RESEARCH PROGRAM › POLICY INITIATIVE › EVENTS NEWS

Research Program

https://3rev.ucdavis.edu/research-program

Home > *Research Program*

Behavioral Studies, Surveys and Experiments

California Panel Study of Emerging Transportation Trends

This research will expand the current statewide panel study to investigate emerging trends in travel behavior, vehicle ownership, adoption of shared mobility and propensities towards the use of AVs.

Travel Demand Modeling and Simulation Projects

Modeling Emissions Impacts of Automated Vehicle (AV) Deployment in California under Various Ownership Models

This project evaluates potential future scenarios of

Environmental, Economic, Equity Impacts and Policy Analysis

3 Revolutions and Smart Cities: Exploring Future Potentials and Impacts on the Energy System

This research explores the impacts of the changes in the mobility ecosystem and travel demand provided by future potentials of a smarter city and

Acknowledgements

- Yongsung Lee
- Dillon Fitch
- Grant Matson
- Keita Makino
- Jai Malik
- Pat Mokhtarian
- Susan Handy
- Lew Fulton
- Dan Sperling
- Junia Compostella
- Xiatian Wu
- Sean McElroy
- Kailai Wang
- Tho Le

Research Supported by:

Caltrans
National Center for Sustainable Transportation
ITS UC Davis
SB1
California Air Resources Board

Other Research Partners:

California Strategic Growth Council
Capitol Corridor
SACOG
NREL National Renewable Energy Laboratory
World Resources Institute
NUMO New Urban Mobility alliance

3 Revolutions Future Mobility Program Sponsors:

BMW
Daimler
Bay Area Air Quality Management District
Volvo
Lyft
EPA United States Environmental Protection Agency
PG&E Pacific Gas and Electric Company
Ford
Caltrans
Uber
Honda
Nissan
Faurecia
ClimateWorks Foundation

Any questions? Please contact:

Dr. Giovanni Circella

Director, 3 Revolutions Future Mobility Program

Institute of Transportation Studies, University of California, Davis

Email: gcircella@ucdavis.edu | Twitter: @CircellaG

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC