Institute of Transportation Studies | UNIVERSITY OF CALIFORNIA

California Resilient and Innovative Mobility Initiative

Understanding the Impact of TNC Operations: Insights from Data and Supportive Designs for Research

Elliot W. Martin, PhD

Senior Researcher; Email: elliot@berkeley.edu

Susan A. Shaheen, PhD

Professor, Civil and Environmental Engineering and

Co-Director, Transportation Sustainability Research Center

Email: sshaheen@berekeley.edu

June 18, 2025

tsrc UNIVERSITY OF CALIFORNIA Berkeley Transportation Sustainability RESEARCH CENTER

ITSBerkeley Institute of Transportation Studies

Impacts from TNCs

- TNCs play a prominent role in our transportation system providing mobility to urban, suburban, and rural areas.

- Because of their large role in the state and nation, the measurement of their impacts is similarly important.

- TNCs have impacts on
  - Vehicle Miles Traveled (VMT)
  - Air and Greenhouse Gas (GHG) Emissions
  - User mobility and accessibility
  - Driver income and livelihood
  - Congestion
  - Travel safety
  - Labor markets
  - Other key sectors of the state economy and society

Measuring Impacts from TNCs

- Measuring the impacts of TNCs requires multiple types of data that are used together, including, but not limited to:

- **Survey Data:** Describing the travel behavior and auto ownership of TNC users and drivers.

- **Trip Activity Data:** Cataloging the trips that users make using TNC services.

- **TNC Fleet Mix Data:** Delineating the vehicles that are delivering the TNC services.

TNC Impacts in California and D.C.

As an example, results from research can show us whether and where TNCs are contributing to net GHG emissions.

GHG Change Due to Behavioral Change	Behavioral Change per Passenger per Year	Operator GHG Emissions per Passenger per Year	Difference (t per Passenger per Year)	Change in GHG	Statistically Significant?	p-Value (1-Tailed)
Los Angeles	−0.303	0.374	0.071	Increase	Yes (1% level)	0.001
San Francisco	−0.287	0.338	0.051	Increase	Yes (5% level)	0.027
Washington, D.C.	−0.199	0.179	−0.020	Decrease	Yes (5% level)	0.018

Source: Martin et al., 2024

TNC Electrification

As another example, research can show us the financial pathways and operating conditions through which TNC drivers can acquire electric vehicles.

	Miles/week			EV Dominant Pathways		
Month	100	300	500	700	900	1100
3	Lease	Lease	Lease	Rent	Rent	Rent
6	Lease	Lease	Lease	Lease	Lease	Rent
9	Lease	Lease	Lease	Lease	Lease	Finance
12	Lease	Lease	Lease	Lease	Finance	Finance
24	Lease	Lease	Lease	Finance	Finance	Finance
36	Lease	Lease	Finance	Finance	Finance	Finance
48	Lease	Lease	Finance	Finance	Finance	Finance
60	Lease	Lease	Finance	Finance	Finance	Finance
72	Lease	Lease	Finance	Finance	Finance	Finance
84	Finance	Finance	Finance	Finance	Finance	Finance

	Miles/week			ICE Dominant Pathways		
Month	100	300	500	700	900	1100
3	Lease	Lease	Lease	Rent	Rent	Rent
6	Lease	Lease	Lease	Lease	Rent	Finance
9	Lease	Lease	Lease	Lease	Finance	Finance
12	Lease	Lease	Lease	Finance	Finance	Finance
24	Lease	Lease	Finance	Finance	Finance	Finance
36	Lease	Lease	Finance	Finance	Finance	Finance
48	Lease	Lease	Finance	Finance	Finance	Finance
60	Lease	Finance	Finance	Finance	Finance	Finance
72	Finance	Finance	Finance	Finance	Finance	Finance
84	Finance	Finance	Finance	Finance	Finance	Finance

Source: Ju et al., 2025

Issues with TNC Data

- Useful data was provided by operators for the GHG study. But it was aggregated and averaged over the population.
- More detailed questions require trip activity data of greater precision.
- Concerns with **PII and trade secrets** have prevented data with this resolution from being more readily accessible.

Simplified Example Data Structure

- De-identified Passenger ID
- De-identified Vehicle ID
- Trip request time
- Trip start time
- Trip end time
- Origin (Latitude, Longitude)
- Destination(Latitude, Longitude)
- Trip Cost

TNC Data that are Publicly Available Today

- California Public Utilities Commission (CPUC) has published Trip Activity Data of TNCs for the year 2021.
- Much of the general structure of the data are consistent with what we would need for social and energy/environmental analysis.
- But these data are heavily redacted. In some cases, the data posted is just 40 gigabytes of the word "REDACTED."

TNCID	Submissio	RideID	Waybill1	Waybill2	Waybill3	Waybill4	Waybill5	Waybill6	Waybill7	DriverID	VIN	VehicleMa	VehicleMo	VehicleYe	AppOnOrF	AppOnOrF
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted
PSG00381	4/11/2022	Not provic	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted	Redacted

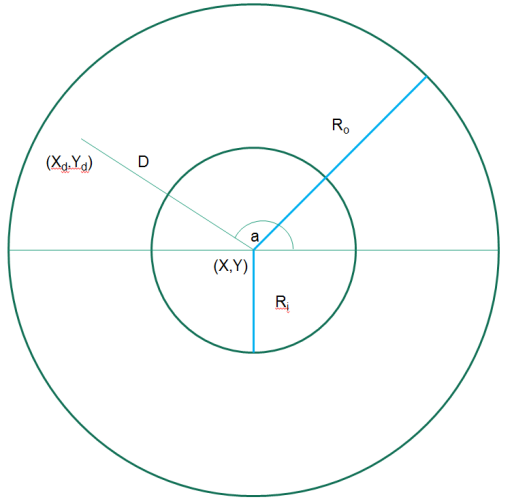
Concerns with posting data to the public

1) **Compromising Personally Identifiable Information (PII)**
   - Precise data on time and location of travel could potentially identify a user, even if a name is not included in the data.

2) **Exposing usable market data (e.g., trade secrets) to competitors**
   - The same data that are useful for researchers to answer important policy questions would also be useful to competitors to understand operations and develop competing strategies.

3) **Exposing data to markets that could permit an estimate of revenue or cost data**
   - Precise trip activity data can provide information on costs and revenue that operators may not wish to reveal to the public or competitors.

Addressing Data Concerns with PII



- Concerns with PII come from the ability to **match outside information**, such as **home address** and perhaps **known travel times**, with information in the data to **plausibly identify the person** who made a given trip.

- This issue can be addressed by inserting some **randomness and imprecision** that moves the origin and destination by some distance in a random way that can alter the actual address but still preserve the general travel patterns expressed in the data.

- The same approach can be taken with time of travel. Such modifications, if not excessively large, will generally preserve the value of the data to public policy research.

Addressing Data Concerns with Exposure of Competitive Information

- De-identified trip data, even without exposing PII, will **show competitors where the operator is earning revenue** and approximately how much.
- This issue is **harder to address with data design** without compromising its value for policy research.
- Rather than posting data on the internet, agencies could consider more carefully curating data access for those who have a verifiable need and policy purpose for analysis.
- Markers can even be put in datasets that indicate who received them.

Concluding Remarks

- TNCs are central players in our transportation system.
- The research community needs access to data about TNC operations to continuously measure its impacts as well as address questions that directly inform policy questions and related metrics.
- There are ways to **design data and data access** to allow the research community to address these questions while significantly mitigating the risks associated with PII and exposure of competitive information.

www.tsrc.berkeley.edu