



Dockless Scooter Travel: A Land Use Model with Implications for California

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Project Objective

Since their emergence in 2017, the use of commercial dockless scooters has grown rapidly. Yet, little research has been done to explain when, where, who, and for what reasons dockless scooters are used as a travel mode choice. The objective of our research is to bridge this gap by developing a land use model of dockless scooter use that can be used to both explain and predict locations with high propensity for dockless scooter trip-making. Increasing our understanding of this can help inform transportation policy, planning, and regulatory decisions with respect to dockless scooters – for example, if and where to make supportive infrastructure investments; whether and how to regulate the spatial distribution of dockless scooters; and what, if any, trip purposes and modes pose the greatest benefit and potential for being shifted to scooters.

Problem Statement

Knowledge about where, when, and how dockless scooters are used is limited. At the same time, policy and planning officials must grapple with managing and planning around the clearly visible increase in dockless scooter use over the past several years. Thus, increasing our understanding about dockless scooter travel is important for informing transportation policy and planning decisions.

However, publicly available data on dockless scooter use is limited. A nascent literature has begun to examine dockless scooter use using publicly available data, often limited to a small number of cities, or scraping data (e.g. Bai and Jiao, 2020; McKenzie, 2019; Merlin et al., 2021; Younes et al., 2020). Those studies have related scooter trips to land use and demographic characteristics, at times using data that are unique to specific cities (such as landmarks or tourist centers) or difficult to reproduce in many cities. We build on that literature but focus on a land use model of scooter use that can be reproduced for most any U.S. metropolitan, and we examine how the model predicts scooter use in locations in California without publicly available scooter data.

Research Methodology

In our research, we use publicly available scooter data from the cities of Louisville, KY and Minneapolis, MN to develop a land use model that can explain dockless scooter trip generation at the block group-level using land use variables that are easily attainable for any metropolitan area of the United States. We then verify our model by testing it against aggregate trip data available for the City of Austin, TX, and then make predictions for areas with high potential for dockless mobility in urban areas of California.

Dockless scooter trip data from the cities of Louisville, KY and Minneapolis, MN are aggregated to the block group-day – that is, the number of trips generated in a given block group on a given day – and regressed onto various land use variables of the block group, including population and employment

density, the density of various establishment types, and the distance between the centroid of the block group and the centroid of the census tract with the highest employment density (see **Table 1**). Due to our dependent variable (trips per block group-day) having many “0” observations, we also apply a Tobit model left-censored at “0.”

After fitting this model for the cities of Louisville, KY and Minneapolis, MN, we validate it by using it to predict dockless scooter trip generation in Austin, TX and contrasting our findings with the trips

per census tract-day available from Austin, TX public data. We then use the model to identify areas with high dockless scooter trip potential in urban regions of the State of California.

Table 1. Variables and Sources for Model Development

Variable	Description	Data Source
<i>tripcount</i>	The number of trips per day per block group	City of Louisville, KY City of Minneapolis, MN
<i>jobdensity</i>	The density of employment (jobs per km ²)	U.S. Census Bureau, LODES WAC, 2017
<i>popdensity</i>	The density of residential population (residents per km ²)	U.S. Census Bureau, 2010 Decennial Census
<i>density_food</i>	The density of establishments coded as “café,” “fast food,” “food court,” or “restaurant” (in establishments per km ²)	OpenStreetMap
<i>density_barclub</i>	The density of establishments coded as “bar,” “nightclub,” or “pub” (in establishments per km ²)	
<i>density_school</i>	The density of establishments coded as “school” (in establishments per km ²)	
<i>density_university</i>	The density of establishments coded as “university” (in establishments per km ²)	
<i>density_place_of_worship</i>	The density of establishments coded as “place of worship” (in establishments per km ²)	
<i>downtowndistance</i>	The distance from the centroid of the census tract with the highest employment density (in meters)	Authors’ calculation

Results

Our baseline findings show that employment density and the density of bars and nightclubs have the strongest influence on dockless scooter trip volume, that dockless trip generation decreases with distance from downtown, and that, when other land uses are controlled for, population density has negligible influence on dockless scooter use. More nuanced findings can be found in our report.

When tested in Austin, TX, we find that our Minneapolis model predicts high dockless scooter census tracts well; 61% of census tracts that rank in the 75th percentile of of dockless scooter trip generation in Austin are correctly identified by the Minneapolis model. This suggests that the Minneapolis model has promise in identifying locations of high potential scooter use in cities outside of Minneapolis. We then used the Minneapolis model to predict dockless scooter trips in census tracts in California urban areas (**Figures 1-4**). The census tracts with the highest predicted scooter use in **Figures 1-4** are shown in the darkest red. The predicted high scooter use tracts broadly conform to our expectations, although suburban or campus-style commercial environments appear to predicted scooter use levels that might be larger than what would be realized. We suggest that this is driven by these areas’ high employment density, despite their low land use density and diversity. Overall, we conclude that land use models can

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be useful as an initial screening tool to identify locations of potentially high dockless scooter use, followed by a more detailed assessment based on local knowledge.

Figure 1: Predicted Daily Scooter Trips for Los Angeles, Minneapolis Model

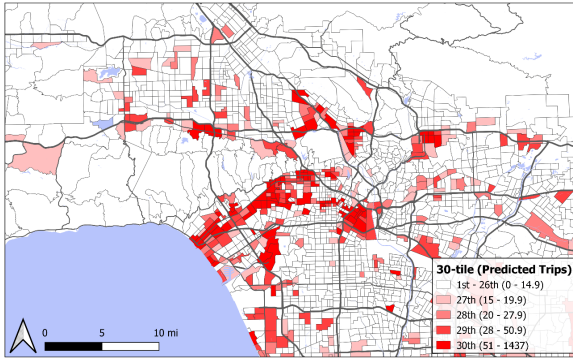


Figure 2: Predicted Daily Scooter Trips for San Diego, Minneapolis Model

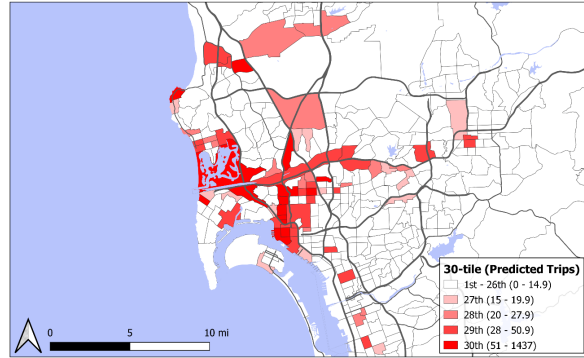


Figure 3: Predicted Daily Scooter Trips for San Francisco and Oakland, Minneapolis Model

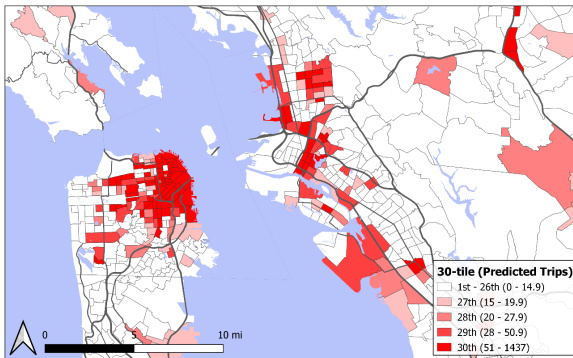
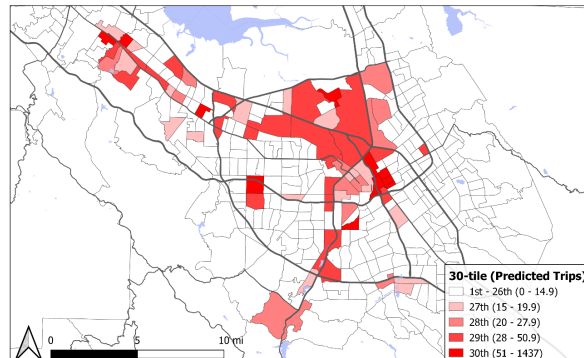


Figure 4: Predicted Daily Scooter Trips for San Jose, Minneapolis Model



References

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