### Title

Dashboard Cameras Combined with AI Provide an Affordable Method for Identifying Curb Usage




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# Dashboard Cameras Combined with AI Provide an Affordable Method for Identifying Curb Usage

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## Issue

The increasing reliance on transportation network companies (TNCs) and delivery services has transformed the use of curb space. The curb space is also an important interface for bikeways, bus lanes, street vendors, and paratransit stops for passengers with disabilities. These various demands are contributing to a lack of parking, resulting in illegal and double-parking and excessive cruising for spaces and causing traffic disturbance, congestion, and hazardous situations.

How cities manage this public asset to support safety and the local economy relies on first understanding the usage patterns over time and space. Various curb management models, such as dynamic parking pricing , and parking reservations , have been developed to improve curb usage, but implementing an adequate control policy requires extensive parking analysis to identify area-specific curb characteristics, spatiotemporal demand distributions, common reasons for congestion, and other parameters. Currently, no systematic process for identifying these patterns exists, but emerging machine learning technologies combined with low-tech dashboard cameras mounted on vehicles that routinely travel the area provide a potential, affordable, and scalable method to monitor usage.

To demonstrate how video data can be used to recognize usage patterns, we collected over a thousand hours of dashboard camera footage from a shuttle traveling along Bancroft Way in Berkeley, California. We trained a machine learning model to recognize different types of delivery vehicles in the data images, such as Amazon, FedEx, and UPS, and then used the model to visualize curbside usage trends (See Figure 1). The findings include identifying hot spots, analyzing arrival patterns by delivery vehicle type, detecting bus lane blockage, and assessing the impact of parking on traffic flow.

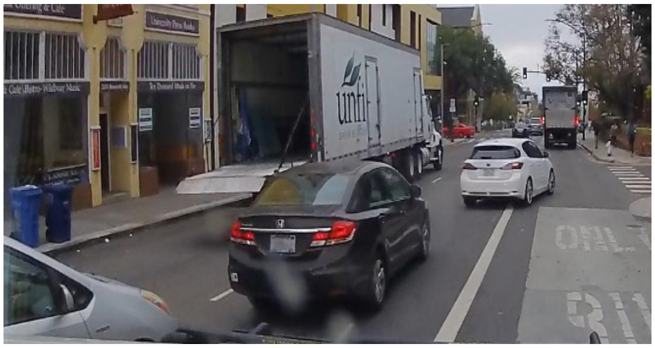


Figure 1. A dashboard camera image shows the left and right lanes blocked by delivery trucks, creating a bottleneck.

## Key Research Findings

**Dashboard cameras installed on public transit buses provide the information necessary for curb management.** Transit buses traverse the same streets in the same directions with some variable frequency during the day. The collected video footage provides the basis for building a comprehensive traffic dataset to identify parking trends, busy areas, and curb usage patterns. Compared to static cameras, this method is flexible, inexpensive, and scalable. In addition, for privacy concerns, captured license plate numbers can be encrypted.

**Using neural networks automates object and vehicle classification to establish curb usage patterns.** Manually analyzing video camera footage is time consuming. Machine learning and computer vision techniques can distinguish object classes, such as a bus, truck, car, cyclist, or pedestrian, as well as identify delivery trucks and TNC vehicles by company, to understand hourly and daily usage patterns.

**Hot spots can be identified and prioritized.** When parking management resources are limited, communities can use the data to focus on hot spots—busy streets with a large number of delivery vehicles and a high demand for curb usage—such as by implementing reservation and dynamic pricing systems for curb space or significant fines for the violations.

**The approach mutually benefits transit agencies and cities.** Using dashboard cameras in transit buses to collect curb usage data reduces cost. In turn, the data collected provides cities with the data needed to help facilitate efficient bus transit operation on busy streets, such as creating dedicated bus lanes, establishing methods to prevent double-parking and blocking bus stops, and implementing transit signal priority to minimize bus travel time.

## More Information

This policy brief is drawn from the report "Pattern Recognition for Curb Usage" prepared by Murat Arcak and Alexander A. Kurzhanskiy with the University of California, Berkeley. The report can be found here: www.ucits.org/research-project/2022-23. For more information about findings presented in this brief, please contact Murat Arcak at arcak@berkeley.edu.

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