MORE OR LESS CURB? TESTING STRATEGIES TO MITIGATE THE IMPACT OF RIDE-SOURCING ON TRAFFIC[1]

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1 Introduction

Increased ridesourcing (the use of services like Uber and Lyft) leads to increased passenger pick-up and drop-off activity. Anecdotal evidence suggest this may slow traffic or cause delay as vehicles increase curb use for parking, conduct pick-up and drop-off activity directly in the travel lane, or slow to find and connect with passengers. One of the challenges for city officials is how to respond to this change in an effort to keep travel lanes operating smoothly and efficiently.

This research evaluates a street test of two strategies in the South Lake Union area of Seattle, WA: 1) an increase in curb space allocated to passenger pick-up and drop-off by changing curb allocation from paid parking to Passenger Load Zone (PLZ) during 7-10am and 2-7pm during weekdays along with installing relevant signs; and 2) a geofencing approach, implemented in Uber and Lyft apps, which restricts pick-up and drop-off activity to particular zones.

The study area is dominated by a number of buildings occupied by Amazon, and based on anecdotal evidence one-third of workers commute using ride-sourcing services. The area is also known for being busy in terms of vehicular traffic, pedestrian activity, and passenger pick-up/drop-offs.

2 Data

The study was conducted on three blockfaces of Boren Avenue North, which is a two-way street. The study block-faces shown in Figure 1 are two segments of Boren Avenue North: between John and Thomas Streets (west side) and between Thomas and Harrison Streets (both sides). Three periods of data collection were conducted as described in Table 1. Data collected over these three weeks include the following categories:

a) Roadway traffic volume and travel speeds (via tube counters) - 24 hours, every day of the week for all three weeks
b) Number and location of pick-up and drop-off events (on-street or at curb), the vehicle dwell time, number of vehicle-vehicle or vehicle-other conflicts (through analysis of video recordings) - 8-10 am and 2-6pm, every day of the week for all three weeks
c) Passenger satisfaction ranking (through intercept surveys) - 8 morning (8:30-10:30 am) and 9 evening (5-7 pm) periods during Weeks 1 and 3

These data were used to measure various effects such as changes on the travel lane speed, parking dwell time, curb usage, safety and passenger satisfaction, across the three project phases.

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Figure 1. Study Area in South Lake Union area of Seattle, WA

Table 1. Three Phases of Data Collection

Phase	Phase Name	Description	Dates
I	No Change	No changes were made.	3rd to 7th December 2018
II	Signage	Signs were installed to change PS-VEN to PLZ-VEN at AM and PM times.	17th to 21st December 2018
III	Signage+Geofence	Curb change signs stayed, and TNCs Geofenced up.	7th to 11th January 2019

3 Results

Does adding PLZs and geofencing change TNC pickup and dropoff behaviours?

We analyzed two parking behaviours: *(i)* the choice of parking location by drivers picking-up/dropping-off a passenger, which would be one of on a travel lane on street, at a PLZ (authorized curb), and somewhere else at the curb (un-authorized curb), and *(ii)* the length of time vehicles stopped to pick-up/drop-off passengers.

The results showed that compliance in parking location choice for pick-ups was similar to that for drop-offs, and in both cases the number of un-authorized stops at the curb significantly dropped in Weeks 2 and 3 compared to Week 1; however, it should be noted that in Weeks 2 and 3 the available PLZ spaces are about 20 times more than in Week 1. The number of on-street stops also significantly decreased in Phases 2 and 3 compared to Phase 1.
Having compared the cumulative empirical distribution of dwell time across the three project phases, we observed a statistically significant decrease in dwell times for both pick-up and drop-off events between Phase III and Phases I and II, but not between Phases I and II.

Does adding PLZs and geofencing impact traffic speed?

An analysis of the change in average traffic speed before and after the increased PLZs and before and after the implementation of geofencing is performed. A lognormal linear regression of traffic speed was estimated based on traffic volume, number of drop-off and pick-up events, and a few interaction terms using dummy variables indicating whether curb re-allocation and/or geofencing was implemented. Weather conditions and time of the day were also controlled for in the model.
While the effect of number of drop-off events on average traffic speed is negative, a positive change was observed during Phase III; namely, the increased PLZs and the implementation of geofencing seemed to mitigate the negative effect of passenger drop-off on average traffic speed. Numerically speaking, while in Phase I, adding 10 passenger drop-offs per half an hour would decrease average traffic speed by 11.3%, adding the same number of passenger drop-offs in Phase III decreases average traffic speed only by 6.8%. No statistically significant changes were observed for the effect of the number of pick-up events on average speed before and after Phase III, as well for effects of the number of both drop-off and pick-up events before and after Phase II. In other words, the marginal increase in the curb allocated to PLZ did not bring about any significant change in the negative effect of pick-up and drop-off events on average traffic speed.

Does adding PLZs and geofencing impact road safety?

An increase in the total number of conflicts was observed across the three project phases. However, such an increase might be due to increased traffic volume and demand for passenger pick-up/drop-off. Passenger pick-up and drop-off events were modeled as a series of Bernoulli trials, in which each event outcome can be a “conflict” or “no conflict”. A binomial regression was then derived for the probability of an event resulting in a conflict as a function of several explanatory variables, including total traffic volume, number of pick-up events, number of drop-offs and a set of indicator variables for signage and geofencing. However, no statistically significant effect was observed on the probability of a pick-up/drop-off event being a conflict as a result of of increased PLZs and geofencing implementation.

Does adding PLZs and geofencing impact passenger experience?

Travelers were asked to rate their pick-up/drop-off experience from among *Excellent*, *Very Good*, *Good*, *Okay*, *Poor*, and *Awful*. The results showed that overall travelers’ satisfaction with pick-up and drop-off increased after adding new PLZs and implementing geofencing. In Phase III, 79% of passengers rated their pick-up experience between *Excellent* to *Good*; whereas the corresponding number for Phase I is 72%. This difference is even larger for drop-offs, with all passengers rating their drop-off experience in Phase III at least *Good*, and 97% rating it either *Excellent* or *Very Good*; whereas the corresponding numbers for Phase I are 89% and 63%, respectively.

4 Conclusions

In urban areas where traveller behavior is changing rapidly, cities may be required to allocate or manage transport in new ways. Through a primary data collection effort of field-tested operational strategies, this project investigates the in-situ impact of a change in curb allocation and geofencing on pick-up and drop-off activity and roadway performance. While field tests present some experimental and data analysis challenges, these approaches must be used to complement more theoretical analyses, which can overlook or mischaracterize relationships. The results of this research suggest that curb allocation and geofencing can mitigate the impact of ride-sourcing activity on roadway performance, at the same time that they improve traveller experiences and curb use compliance.