Carving Up the Curb:
Evaluating Curb Management Strategies for Ride-Hailing and Ride-Sharing Activity through Simulation

AUTHORS:
Matteo Saracco
Rebecca Kiriazes
Kari E. Watkins, P.E., Ph.D.
Michael P. Hunter, Ph.D.

Research Question

How do varying levels of Pick-Up/Drop-Off (PUDO) activity impact the curb and adjacent traffic flow? Can these effects be investigated through microscopic simulation?

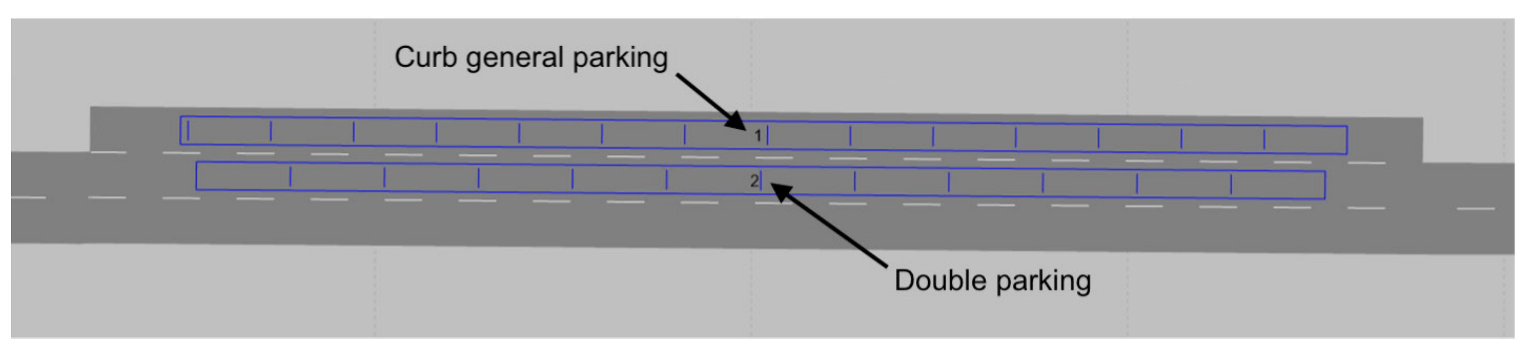
Methodology

Table 1: Scenarios considered in study

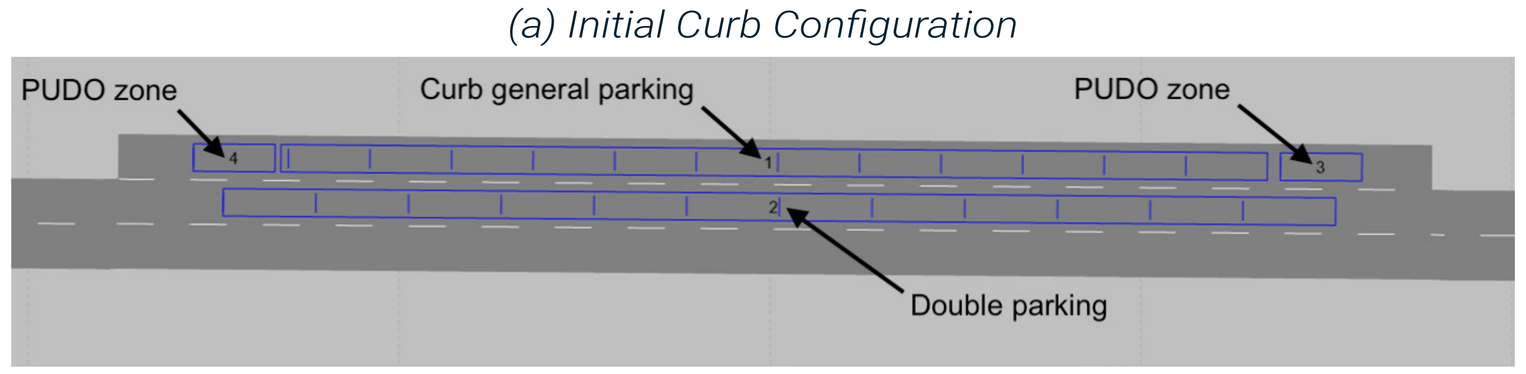
Flow level	Flow (veh/h)	Parking Rate (%)	PUDO Share (%)	Scenario no.
Base (observed)	1000 veh/h	3.2%	10%	1
Low Flow	1000 veh/h	5%	10%	2
			30%	3
			60%	4
			90%	5
Mid Flow	1500 veh/h	5%	10%	6
			30%	7
			60%	8
			90%	9
High Flow	2000 veh/h	5%	10%	10
			30%	11
			60%	12
			90%	13

The 13 scenarios described above were applied to three different curb configurations modeled in VISSIM:

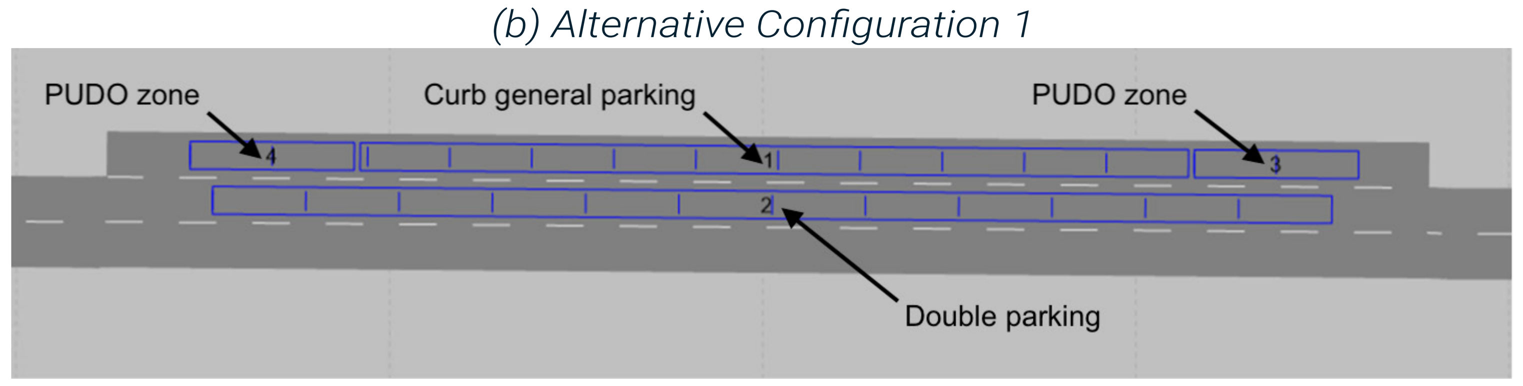
1. Initial curb configuration (a), with 14 curb spaces and 12 double-parking spaces;
2. Alternative 1 (b), with 12 curb spaces, 2 PUDO spaces, and 12 double-parking spaces;
3. Alternative 2 (c), with 10 curb spaces, 4 PUDO spaces, and 12 double-parking spaces.



(a) Initial Curb Configuration



(b) Alternative Configuration 1



(c) Alternative Configuration 2

All traffic flow was divided into three vehicle classes: General Passenger Vehicles (GPVs), with a dwell time of between 30 seconds and 8 hours; PUDO vehicles, with a dwell time generally less than 3 minutes; and Through vehicles. After 10 simulation runs with different random seeds, average values of **vehicle delay**, **occupancy rate**, and **share of parking requests declined** for each scenario and curb alternative were recorded and used as performance metrics.

Results

Data Analysis

Video footage from Atlanta, GA, was used for initial model calibration. In particular, 31 hours of video feed (collected over 3 days, both weekday and weekend) was analyzed to determine:

- Dwell time of vehicles at the curb and double-parking, distinguishing between PUDO and general parking vehicles (GPVs)
- PUDO share of total parking events (found to be 10% for scenario 1)
- Traffic flow at the observed location (found to be circa 1000 veh/h)
- Parking rate of vehicles (found to be 3.2% in scenario 1, increased to 5% for all other scenarios)
- Double-parking likelihood (average value of 40% was used)

Table 2: Percent Change in Average Vehicle Delay across all Scenarios and Configurations

	Percent Change in Average Vehicle Delay												
Scenario	Base	Low Flow				Mid Flow				High Flow			
PUDO %	10%	10%	30%	60%	90%	10%	30%	60%	90%	10%	30%	60%	90%
Initial to Alt 1	-47%	-22%	-61% (**)	-67% (**)	-38%	-57%	-75% (**)	-48% (*)	-10%	-74% (*)	-75% (***)	-29% (-)	-10%
Initial to Alt 2	-50%	-36%	-68% (**)	-83% (***)	-76% (***)	-68% (-)	-87% (**)	-88% (***)	-64% (***)	-83% (*)	-92% (***)	-79% (***)	-51% (*)
Alt 1 to Alt 2	-6%	-18%	-19%	-48% (-)	-62% (*)	-27% (**)	-47% (*)	-78% (**)	-60% (**)	-35% (*)	-69% (**)	-71% (***)	-45% (-)

Welch Two Sample t-test, 95% Conf. Level: (-) = p-value < 0.1; (*) = p-value < 0.05; (**) = p-value < 0.01; (***) = p-value <0.001

Figure 1: Average Vehicle Delay (s) for All Configurations and Scenarios

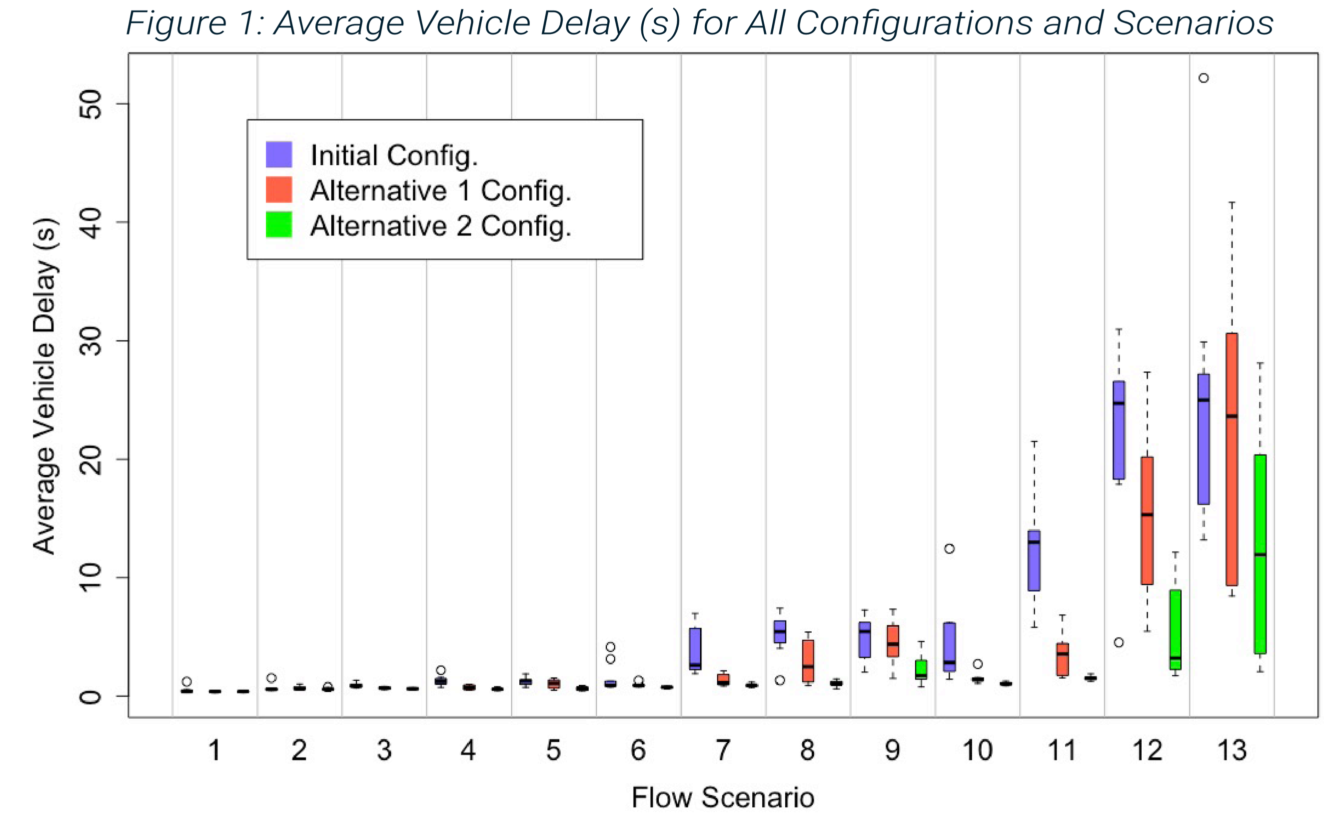


Figure 2: Percentage of Parking Requests Declined for All Configurations and Scenarios

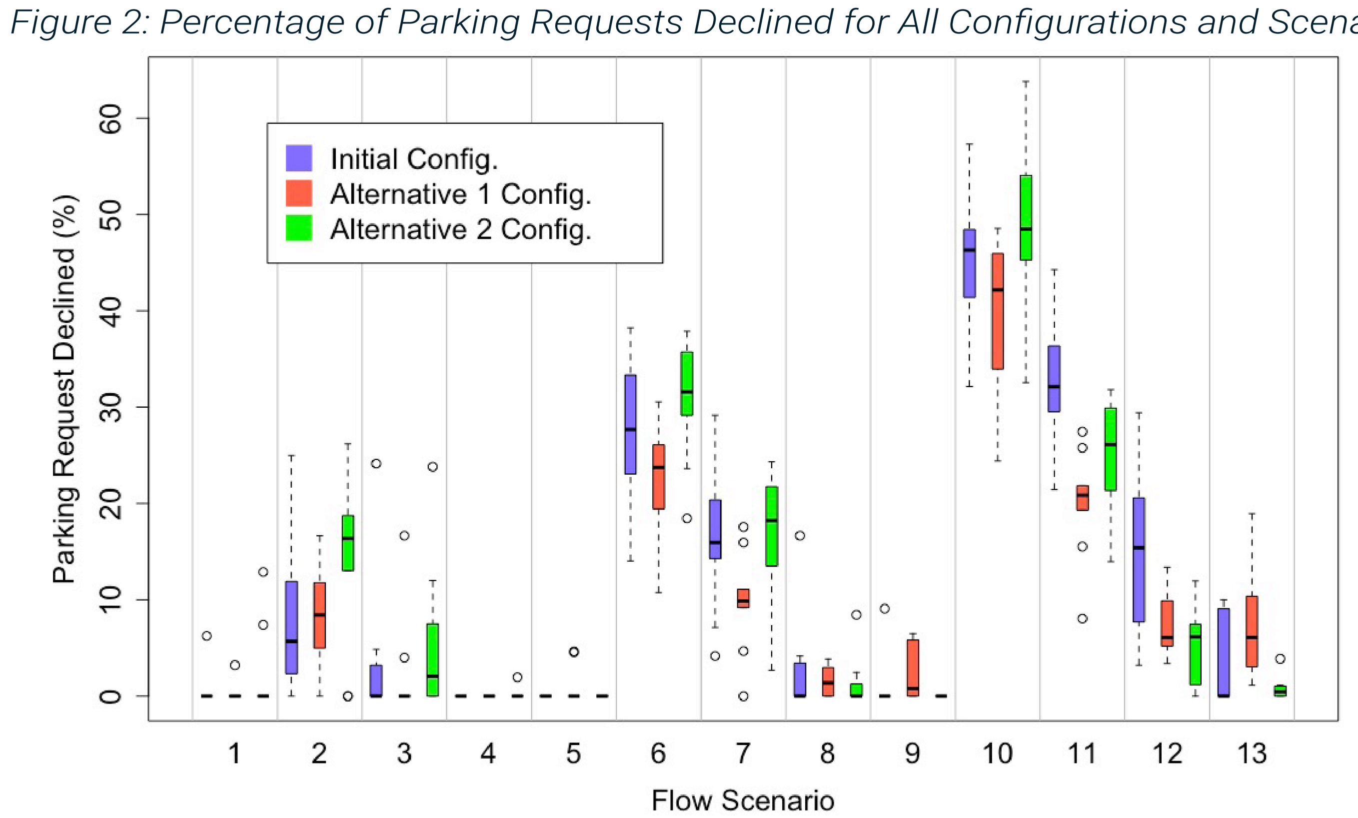


Figure 3: Occupancy Rate (%) for All Configurations and Scenarios - Curb

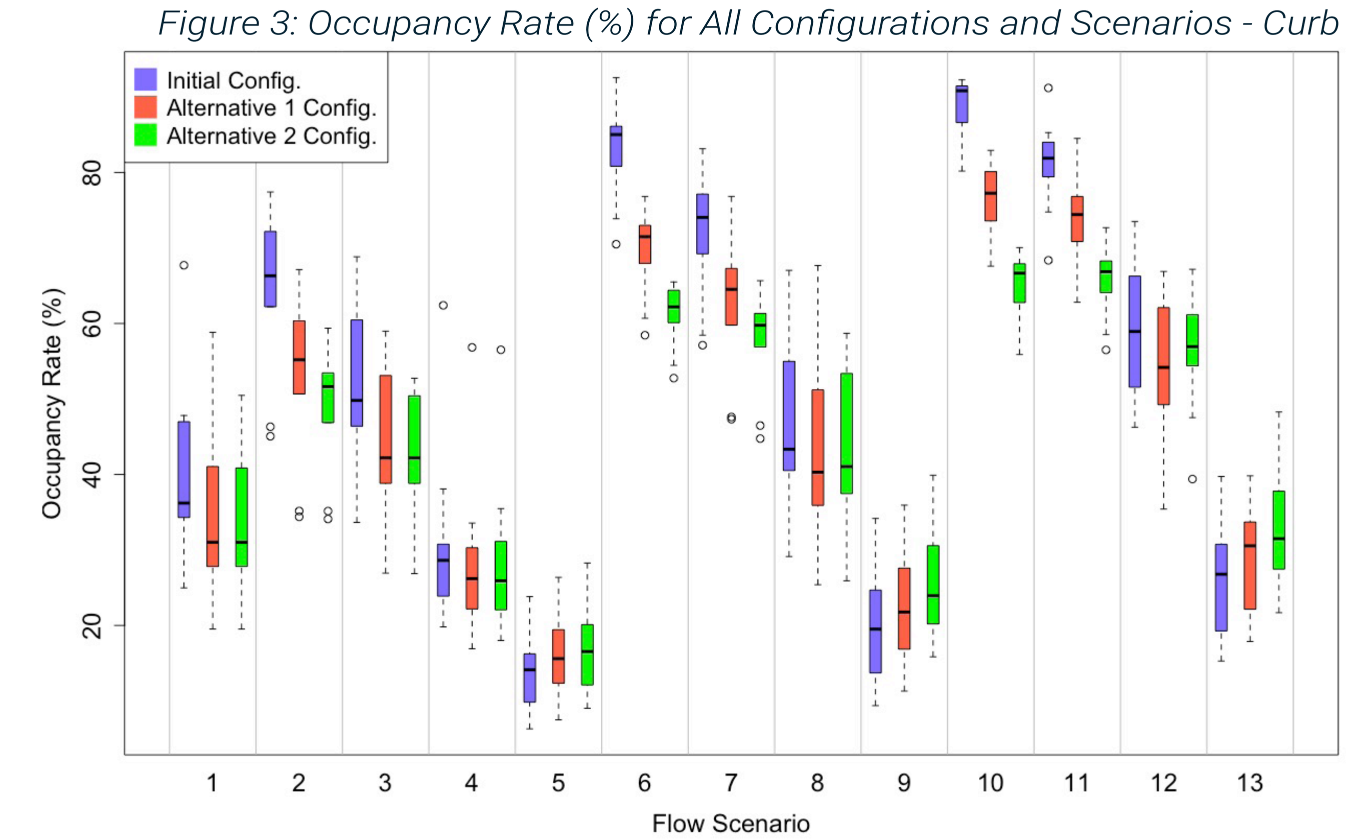
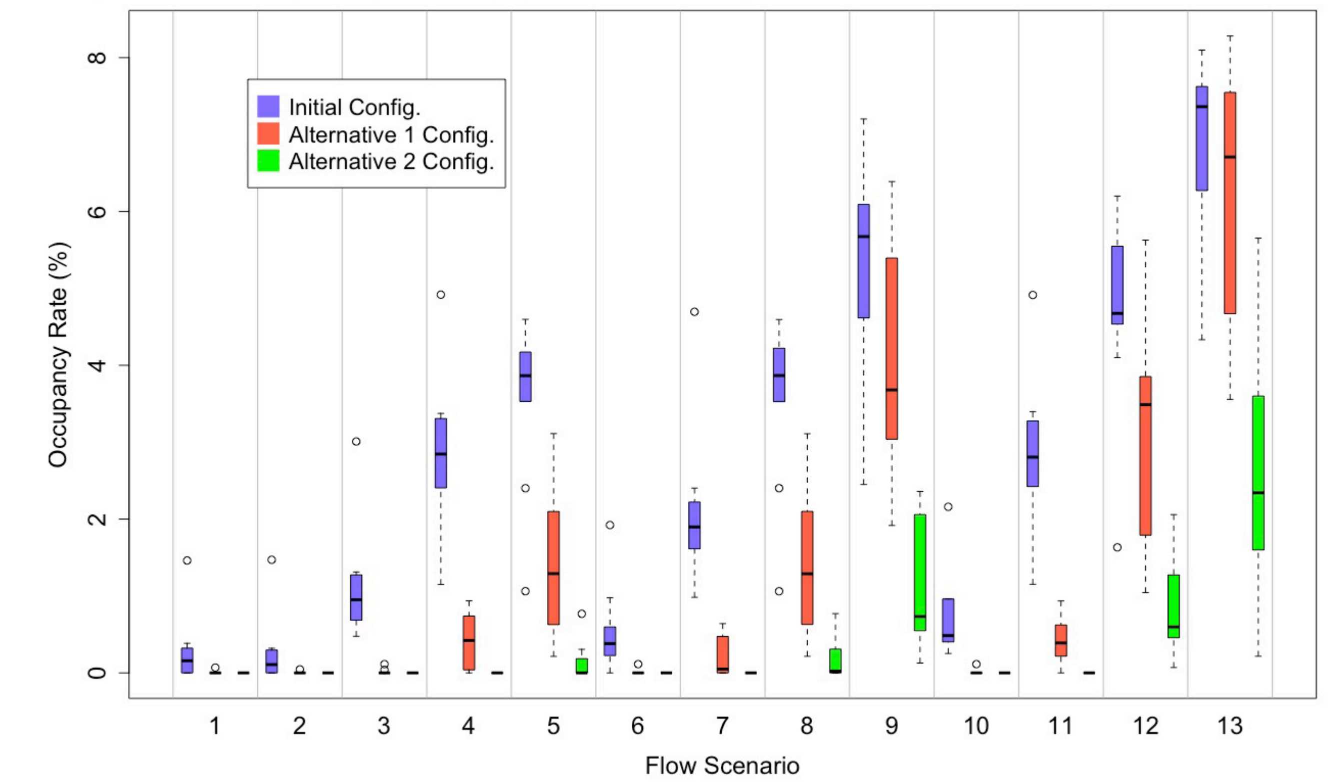


Figure 4: Occupancy Rate (%) for All Configurations and Scenarios - Double Parking



Findings and Conclusions

- Analysis of simulation results indicates potential benefits from introducing curb management strategies.
- Should future transportation trends lead to an increase in the share of PUDO activity at the curb, strategies which involve the separation of curb uses appear to be effective in reducing delay for vehicles and optimizing curb utilization.
- Throughout the simulations, a progressive shift away from traditional, long-term parking towards PUDO activity led to an observed higher curb productivity and lower occupancy, although higher rates of double parking were recorded.
- The use of dedicated PUDO zones helps to reduce the likelihood of double parking and associated delays.

Acknowledgments

This research was funded by the Southeastern Transportation Research, Innovation, Development and Education (STRIDE) Center. The authors thank Midtown Blue for supplying video footage.