APPENDIX
SIMULATION METHODOLOGY

To understand the impact that autonomous vehicles and ride sharing can have on traffic congestion and travel times, we simulated the real-world traffic conditions in a 0.45-square-kilometer portion of Boston's historic downtown, one of the city's busiest districts. We built an accurate representation of the area, including the road network, traffic signals, sidewalks, bus stops, and travel destinations.

We used US Census Bureau and Massachusetts Department of Transportation data to model travel patterns in and around the city, including current modes of transportation, time of day, and trip origins and destinations. We modeled 180,000 road-based one-way trips into and out of the study area in a typical 24-hour weekday period. This figure represents the number of trips taken by people commuting into and out of the study area during the morning and evening commutes, leisure trips to and from the suburbs in the course of the day, and trips within the study area by people who live and work in the city. The data translated into 89,000 private vehicles traveling 80,000 kilometers and spending an average of 4.5 minutes traveling on roads within the study area. (During congested peak travel times, average travel time in the study area rose to as much as 9 minutes.)

We input the data into the GAMA traffic simulation platform, a spatially explicit agent-based modeling tool. Agent-based models are detailed representations of real-world environments that treat the individual components—such as cars, roads, and passengers—as entities that interact dynamically with each other. In our agent-based model, for example, cars drove down roads, people rode in cars, and cars avoided each other. Our simulations also took into account the normal following distances between vehicles, as well as differences in vehicles' passenger capacity. We assumed faster acceleration and braking responses for electric AVs.