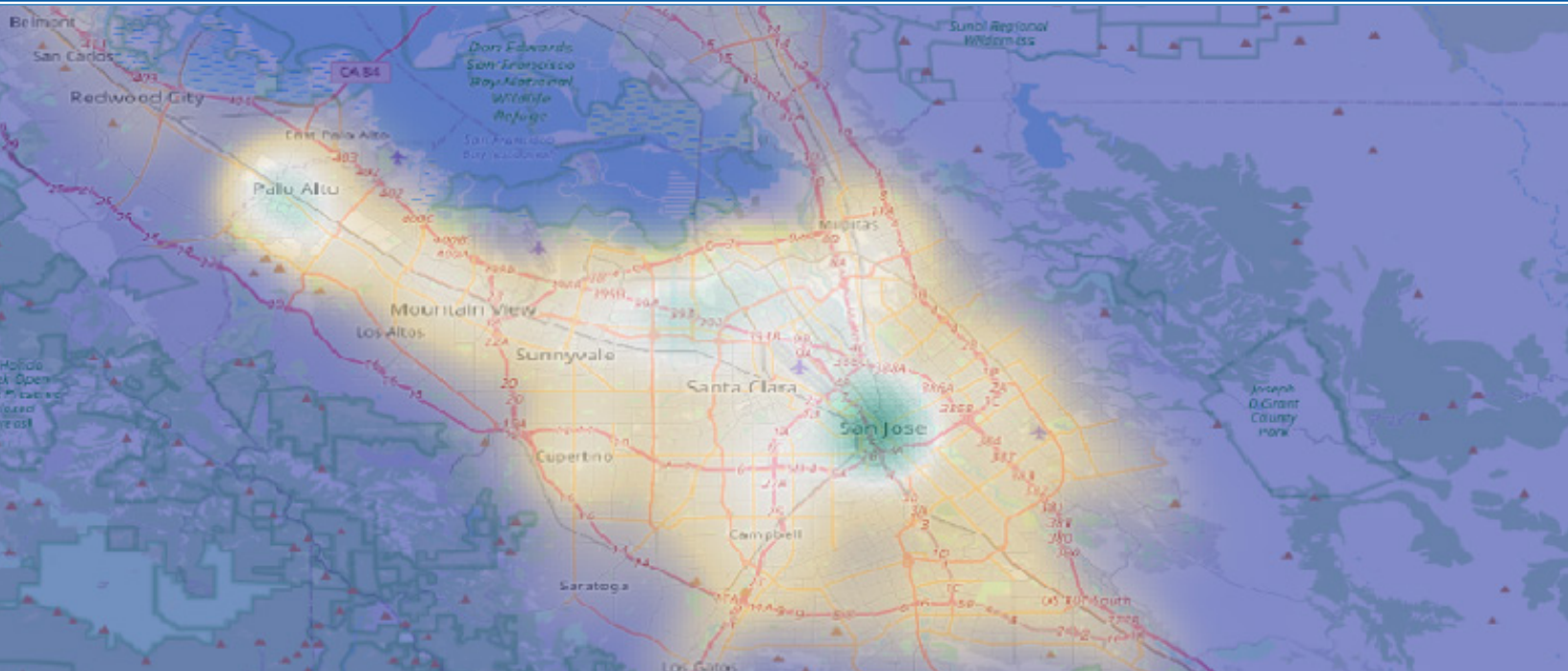


# Using BEAM Software to Simulate the Introduction of On-Demand, Automated, and Electric Shuttles for Last Mile Connectivity in Santa Clara County

Project 1822  
January 2021

Gary Hsueh, David Czerwinski, Cristian Poliziani, Terris Becker, Alexandre Hughes, Peter Chen, and Melissa Benn



On-demand automated shuttles have not yet been widely studied in the literature, and pilot programs have just begun in a few places. This study aims to evaluate the impacts of a hypothetical wide-scale deployment of first and last mile, on-demand, flexible-route automated shuttles in Santa Clara County by applying the beta software BEAM developed at Lawrence Berkeley National Laboratory, an agent-based mesoscopic travel model calibrated for the San Francisco Bay Area region.

## Study Methods

The study was accomplished by applying BEAM (The Modeling Framework for Behavior, Energy, Autonomy, and Mobility). BEAM was used to simulate the proposed shuttles using a combination of ride hail algorithms and a new geofencing function developed to support this study. A literature review evaluated the automated shuttle concept and identified a range of parameters. Next, the simulation parameters, including radius of the catchment areas, cost associated with the automated shuttles, time

of simulation, initial position of the shuttles inside the catchment areas, size of vehicles, and maximum speed, were calibrated through a detailed sensitivity analysis and geospatial processing. Finally, the BEAM outputs were analyzed with GIS and the software R.

## Findings

The BEAM model is capable of simulating the proposed automated shuttle service and could be applied to other counties in the Bay Area to test automated shuttles as well as other scenarios. The report provides lessons learned from using this software and suggestions for future users. The model results are encouraging. The service is estimated to be used by many people within the defined service zones throughout the County for first and last mile connections to high-quality transit and for point-to-point trips within zones. In particular, the model shows that this service would also be used during the night hours—mainly between midnight and 2am—when people do not have many options for travel, increasing

the accessibility of travel during night hours. The trips with automated shuttles are distributed across the county, with a higher use in the downtown San José area. The automated shuttles are anticipated to increase the use of public transport overall and to reduce gas-powered vehicle trips.

On-demand automated shuttles used as first and last mile connections to high-quality transit can increase transit ridership overall.

### Policy/Practice Recommendations

The results of this study support the wide-scale adoption of on-demand, flexible-route shuttles to address the first/last mile problem and improve accessibility to high-quality public transit throughout Santa Clara County. Communities, particularly those lacking many fixed-route transit services, can look to on-demand shuttles as an alternative approach. Regional and county transportation agencies can use these high-level conclusions as a basis to support more robust scenario testing and planning with their official models. The BEAM model is intriguing. Given the beta status of the software and user interface limitations, it is not yet recommended for practitioners to use “off the shelf,” but owing to its Bay Area calibration, can be applied to other Bay Area counties for high-level planning of similar scenarios.

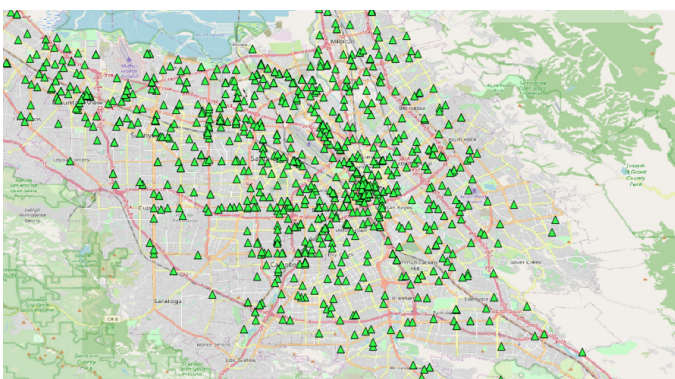


Figure 1. Spatial distribution of departure of automated shuttle trips in Santa Clara County when using a 10% population sample.

### About the Authors

**Gary Hsueh**, AICP is the Director of Mobility Programs at CHS Consulting Group; **David Czerwinski**, PhD, is Professor in the College of Business at San José State University; **Cristian Poliziani** is a PhD student in Transportation Engineering at the University of Bologna, Italy; **Terris Becker** holds an MS in Statistics from San José State University; **Alexandre Hughes** graduated from San José State University with a Master’s Degree in Urban and Regional Planning; **Peter Chen**, PhD, is a Senior Transportation Planner at Santa Clara Valley Transportation Authority, and **Melissa Benn** is a Program Associate at Prospect Silicon Valley.

### To Learn More

For more details about the study, download the full report at [transweb.sjsu.edu/research/1822](https://transweb.sjsu.edu/research/1822)



MTI is a University Transportation Center sponsored by the U.S. Department of Transportation’s Office of the Assistant Secretary for Research and Technology and by Caltrans. The Institute is located within San José State University’s Lucas Graduate School of Business.