Estimating the Impacts of First and Last Mile Transit Access Programs Using Shared Mobility Services

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Introduction

Problem:

- Land use context and dominant culture in suburban areas contradict with the long-term cost-effective operation of public transit.
- Access to existing limited transit stations by walk or bike is difficult due to the distance from residential areas, exposure to weather and discomfort. Park-and-ride mode can be a temporary solution, however it is expensive and inefficient over time.
- Thus, commuters are left with no choice but private vehicles which cause several externalities such as traffic congestion and emission.

Research:

- Evaluate the potential of car sharing services (e.g. uber and lyft) to fill the first and last mile transit access gap using the San Francisco Bay Area activity based travel demand model (MTC-ABM) and the dynamic assignment model from the MATSim framework.
- The study focuses on the work trips originated from suburban areas in morning peak hours (first mile) and ends in the evening peak hours (last mile) which can possibly shift from SOV to BART transit line in San Francisco Bay Area.
- Estimate travel demand, energy and emission impacts of this first and last mile transit access.

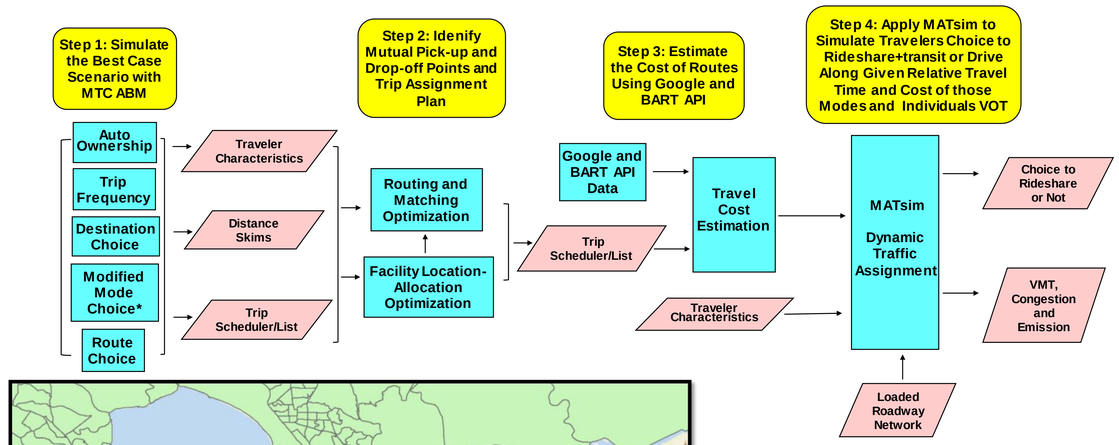
Contributions:

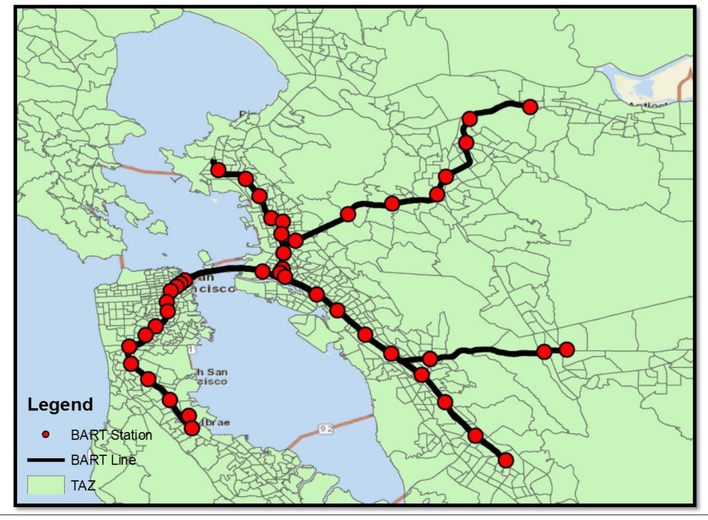
Unlike previous studies (Fagnant and Kockelman, 2014); Spieser et al., 2014; Zhang et al., 2015), this study employs realistic assumptions about travel demand and supply.

Methods and Data

1. Analyze the mode and destination choice models of the MTC-ABM to identify the important factors impacting mode choice decisions.
2. Modify the BART's utility function based on research findings.
3. Implement the model for best case scenario and identify the potential market for ridesharing first/last mile transit access.
4. Develop continuous approximation models to explicitly solve facility location and routing problems for pick-up and drop-off decisions.
5. Simulate the scenarios and evaluate the results using MATSIM

Modeling Process





*Modifying BART utility function to feature lowest cost walk access

Next Steps

- This is an ongoing research project and will be ending at the end of the year.
- We will use the models developed in this project to explore the potential benefits of providing the service with the advent of autonomous and connected vehicles.
- We want to expand the modeling and work to develop a micro-transit system.
- We will expand the models to urban freight pick-up and drop-off activities.

References

- Fagnant, Daniel and Kara Kockelman. "The travel and environmental implication of shared autonomous vehicles using agent based model scenarios." Transportation Research C 40 (2014): 1-13.
- Spieser, Kevin, et al. "Toward a systematic approach to the design and evaluation of automated mobility-on-demand systems: A case study in Singapore." Road Vehicle Automation. Springer International Publishing, 2014. 229-245.
- Zhang, Rick, et al. "Models, algorithms, and evaluation for autonomous mobility-on-demand systems." American Control Conference (ACC), 2015. IEEE, 2015.

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