Estimating the Potential Demand for Shared Mobility in First/Last Mile Transit Using MTC Travel Demand Model

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Introduction

Problem:

Conventional fixed-route, fixed-schedule bus and rail services are highly efficient in dense traffic corridors, but not in suburban areas, where long-term, cost-effective solutions to bridging the first and last mile gap have eluded planners for decades. Current transportation systems in suburban areas present barriers toward sustainable mobility:

- Public transit: limited transit stations, unreliable services, accessibility
- Park-and-ride: expensive and inefficient over time
- Private vehicles: externalities (e.g., traffic congestion, emissions)

Research:

Evaluate the potential of using shared mobility services to improve first and last mile transit access programs

- Using the San Francisco Bay Area activity based travel demand model (MTC-ABM) and the dynamic assignment model (MATSim)
- Focus on AM peak work trips originated from suburban areas (first mile) which can possibly shift from SOV to BART transit line
- Estimate travel demand, energy and emission impacts of this first and last mile transit access

Contributions:

Consider research-based assumptions about travel demand and supply, improving from previous research (Fagnant and Kockelman, 2014; Spieser et al., 2014; Zhang et al., 2015)

Use of continuous approximation models to improve computation efficiency over discrete models

Methods and Data

1. Analyze the mode and destination choice models of the MTC-ABM to identify important factors affecting mode choice decisions
2. Update drive to BART's utility function
3. Implement case scenario and identify the potential market share 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 (In progress)
5. Simulate the scenarios and evaluate the results using MATSIM (In progress)

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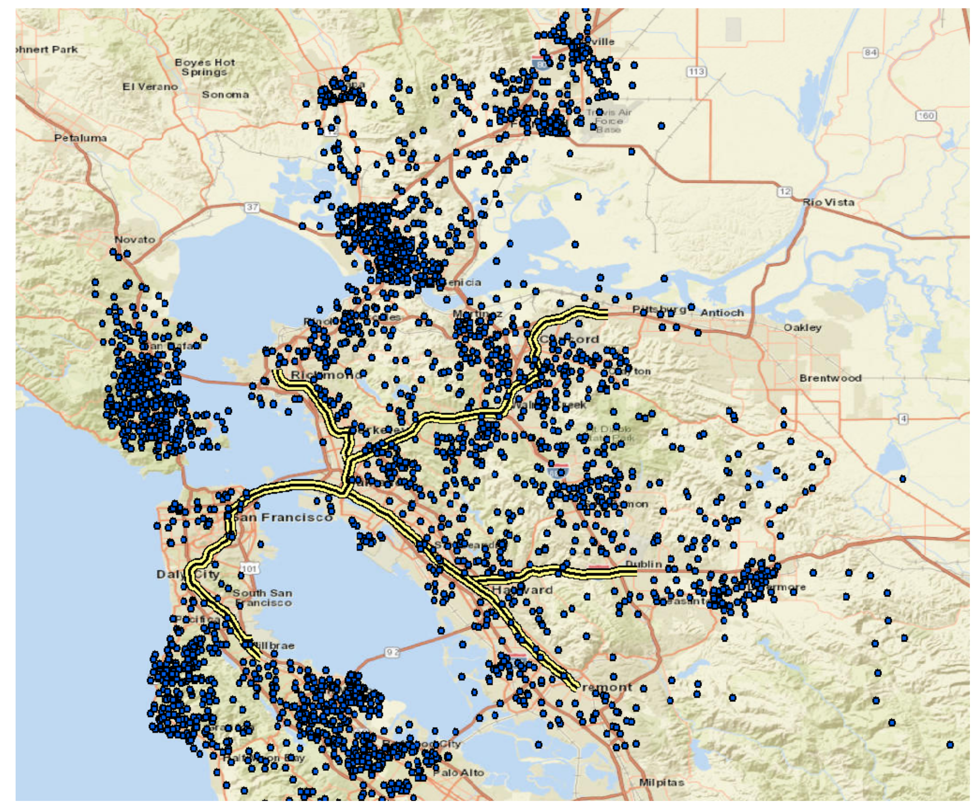
Modeling Process and Results

Identifying important factors impacting mode choice decision and modifying the BART's utility function

Increase accessibility → relaxing age restriction and auto ownership

Increasing popularity → decreasing drive time to show implicit effect of comfort or incentives



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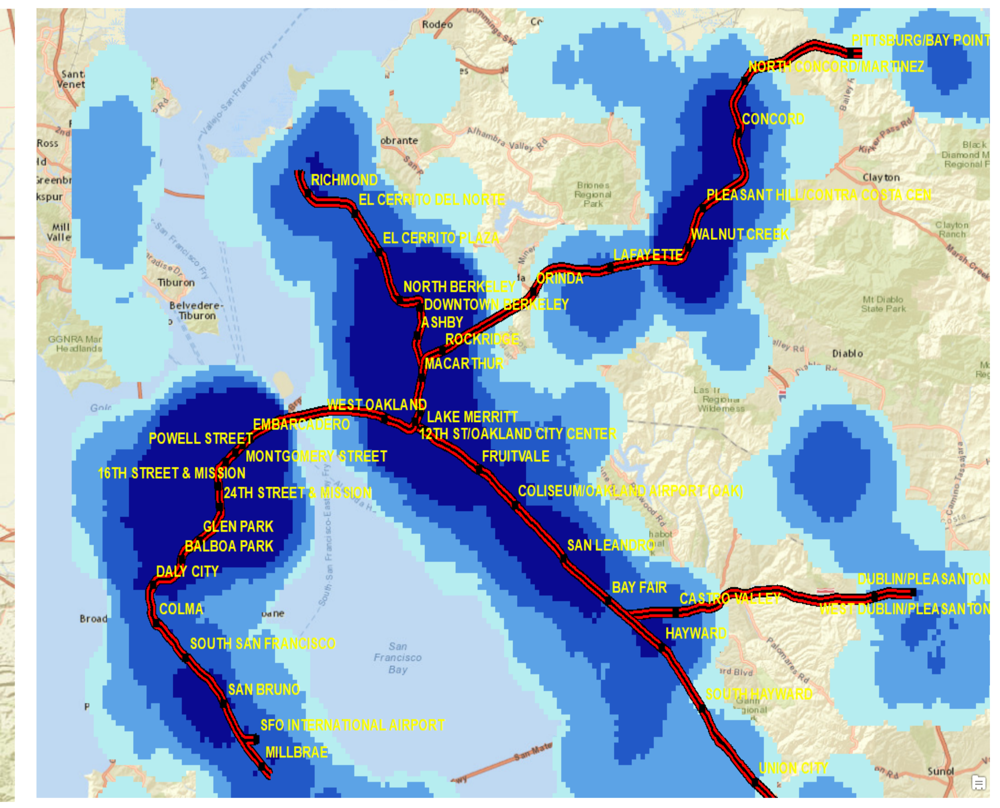

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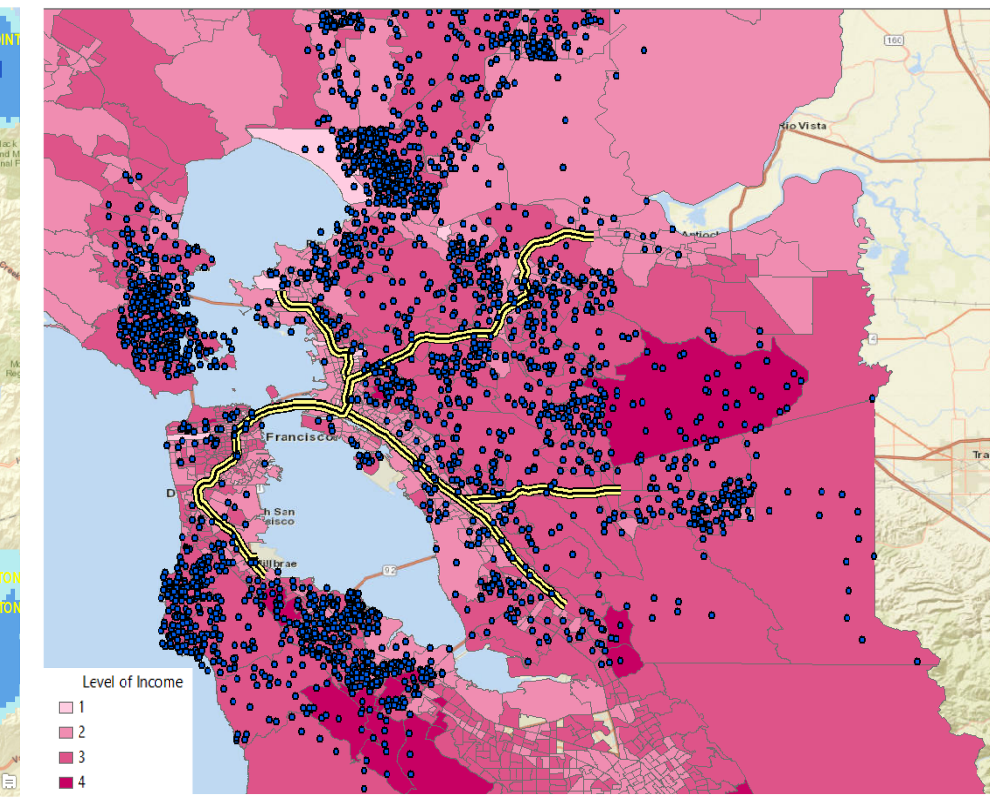

c

Individuals shift from SOV to the modified mode with BART line for AM work trip
a) origins b) destination density and BART stations c) origin and level of income

Comparison of resulted trips and network statistics of travel model between base case and the modified case

	DA trips	SR trips	WT trips	Other DT trips	drv_BART trips	VMT Total	VMT_DA	VHT Total	VHT_DA
Time period									
EA Base	238,654	43,543	10,722	2,512	8,206	8,154,436	5,586,320	167,609.7	117,794.1
New	237,822	43,276	10,477	2,289	11,084	8,193,250	5,626,755	168,337.1	118,538.9
change %	-0.35	-0.61	-2.29	-8.88	35.07	0.48	0.72	0.43	0.63
AM Base	1,697,326	335,051	175,328	31,516	67,455	38,882,379	29,959,653	1,030,093	796,783.5
New	1,682,549	330,020	171,484	26,826	90,640	38,708,678	29,797,524	1,023,819	791,552.7
change %	-0.87	-1.50	-2.19	-14.88	34.37	-0.45	-0.54	-0.61	-0.66
MD Base	580,695	105,079	47,836	4,990	11,876	60,449,638	23,141,447	1,875,220	709,176.9
New	576,387	103,648	47,078	4,437	15,763	60,474,025	23,146,499	1,879,464	710,168.5
change %	-0.74	-1.36	-1.58	-11.082	32.73	0.040	0.02	0.23	0.14
PM Base	1,543,295	293,036	149,233	22,555	47,160	48,415,777	30,437,141	1,385,726	895,515.6
New	1,529,689	288,880	146,111	19,420	62,802	48,348,530	30,358,994	1,382,791	892,757.1
change %	-0.88	-1.42	-2.092	-13.90	33.17	-0.14	-0.26	-0.21	-0.31
EV Base	784,132	149,252	63,788	11,373	30,417	31,262,634	18,407,333	704,303.4	437,076.7
New	778,415	147,066	62,395	9,624	41,141	31,227,944	18,378,133	703,455.8	436,241
change %	-0.73	-1.46	-2.18	-15.39	35.26	-0.11	-0.16	-0.12	-0.19

References

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