Something about Microtransit Simulation

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Abstract

This paper has to do with simulating microtransit and determining whether it makes sense to deploy microtransit in other areas in the Wasatch Front.

Keywords: Microtransit Passive Data Location Choice

1. Question

In November of 2019, the Utah Transit Authority (UTA) began a partnership with Via Transportation, a private mobility company (Robertson et al., 2020). Under this partnership, UTA has supplemented its fixed-route services with on-demand shuttles hailed through a mobile application. So-called "microtransit" offerings of this kind have the potential to efficiently extend UTA services into low-density areas and function as first- and last-mile services for the regular fixed-route rail and bus network. The current microtransit service is currently only operating in southern Salt Lake County (Utah Transit Authority, 2021c). UTA is interested in examining if there are other areas where similar services can be effectively deployed.

In September 2020, UTA released a report detailing a possible expansion of microtransit services to other areas in Utah following the UTA on Demand pilot program (Robertson et al., 2020). 19 zones were identified between Brigham City and Santaquin as areas that could potentially benefit from microtransit services. Ridership was estimated based on number of residents and number of workers employed within each zone, as well as a mode share score that VIA developed based on their internal demand model.

We seek however to provide UTA and the Utah Department of Transportation (UDOT) with a microsimulation model they can use as a template to examine future similar projects. We want to know how the results of such a model would compare to those of UTA's September 2020 report. Though UTA's own report made no definitive recommendations regarding expansion of microtransit services, it may be useful in calibrating our simulation. We also seek to use our results (possibly in conjunction with those of UTA's report) to make recommendations to UTA and UDOT regarding expansion of microtransit services.

2. Methods

We used BEAM (Behavior, Energy, Autonomy, and Mobility) as our model to run and calibrate our simulations. BEAM is being developed by Lawrence Berkeley National Laboratory and the UC Berkeley Institute for Transportation Studies, and is an extension to the MATSim (Multi-Agent Transportation Simulation) model (The BEAM Team, 2017). We created a fork of the main BEAM repository for this and other projects. One aspect of the code we developed is the ability to add geofencing, in which ridehail vehicles are constrained to a specific polygon. The version of the code we used is available at https://github.com/tscore-utc/beam/commit/b28bc396fd50db6099e9aecc54c24642feb4f74d.

As UTA already has a ridehail pilot program underway, we reached out to find the fleet size and shifts for the ridehail vehicles. Shaina Quinn, a researcher at UTA's Office of Innovative Mobility Solutions, informed

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us that typically 12 ridehail vehicles provide service at a time. We found the shifts on UTA's website for the service (Utah Transit Authority, 2021b). Since we didn't have information on fleet size or shifts for any scenario except the existing pilot program, we used the same values for each additional study area as well.

We first created a base scenario to model the existing pilot program. There were three other areas we wished to analyze for potential ridehail expansion: near the SLC Int'l airport, Sandy, and West Jordan. The area near the airport is planned to get ridehail service beginning December 13, 2021 (Utah Transit Authority, 2021a), so we included that area in all scenarios except the base.

We compared the different scenarios on several metrics, including weekday ridership, utilization (passengers/hour/vehicle), wait time, and travel time. We also compared the base scenario to the results of UTA's September 2020 report (Robertson et al., 2020). The results of that report used many qualitative metrics, but some quantitative metrics of interest were average ridership, wait time, and utilization. These results of the report are presented in Table 1 below.

Table 1: UTA On Demand Report Findings

Month	Avg wkday ridership	Utilization	Avg wait time
DEC	224.00	1.33	9.00
JAN	334.00	2.00	11.00
FEB	392.00	2.31	12.00
MAR	316.00	1.88	11.00
APR	275.00	1.52	10.00
MAY	105.00	0.67	8.00
JUN	162.00	1.10	9.00
JUL	155.00	1.10	9.00
AUG	193.00	1.50	12.00
SEP	214.00	1.60	12.00
OCT	200.00	1.70	13.00
NOV	169.00	1.70	13.00
Average	**228.25**	**1.53**	**10.75**
Average Jan–Mar	**347.33**	**2.06**	**11.33**

3. Findings

We calculated several metrics from the output of our base ("South SL County only") scenario and compared them with data from UTA's report on their pilot program (UTA Innovative Mobility Solutions, 2021a, UTA Innovative Mobility Solutions (2021b), UTA Innovative Mobility Solutions (2021c), UTA Innovative Mobility Solutions (2021d)). Much of the data in that report, however, is not necessarily representative, due to the COVID-19 pandemic and its onset in late March 2020. We also figured the data for December was not particularly valuable: since the service was new, people who would otherwise have used it may not have been accustomed to or even known about it. We therefore decided to use the average of the data from January through March. The comparison is given in Table 2.

Table 2: Comparison of Actual Pilot Program Data with Simulated Base Scenario

Scenario	Total Ridership	Average Wait Time (minutes)	Utilization[a]
South SL County only	1006.00	5.82	4.14
UTA Report Average Jan–Mar	347.33	11.33	2.06

[a] Utilization is calculated as passengers per hour per vehicle

It is clear from this comparison that more calibration is required in order to better match the real-world data from the pilot program. There are several ways to adjust parameters and code in BEAM to achieve this calibration, and work is planned to continue on doing exactly that (though that is outside the scope of this report). However, it is encouraging to see that the simulated values are within an order of magnitude of the real-world values.

Additionally, we calculated these and other metrics for our other scenarios, and compared them. These metrics are given in Table 3.

Table 3: Comparison of Simulated Scenarios

Scenario	Total Ridership	Ride Hail Trips	Percent of RH Trips	Average Wait Time (minutes)	Utilization[a]
South SL County only	1006	930	1.16	5.82	4.14
South SLC with Airport	1395	1328	1.66	5.37	2.87
South SLC/Airport/Sandy	2796	2473	3.08	5.77	3.84
South SLC/Airport/West Jordan	2620	2353	2.93	5.53	3.59

[a] Utilization is calculated as passengers per hour per vehicle

These results seem to indicate that adding a ridehail zone near the airport would not have much of an effect, but adding a zone in either Sandy or West Jordan would. It's possible that the airport zone was too small to be of much use, and there is already public transit to the airport, so adding a ridehail service wouldn't provide much additional benefit. However, the other scenarios present a substantial increase in ridership, as well as percentage of trips involving a ridehail vehicle. Utilization in these scenarios on the other hand doesn't seem to improve; it may be that the fleet size needs to be adjusted to better match the demand.

Overall, these results seem to indicate that additional implementation of ridehail services would see good use, and should be seriously considered by UTA.

Acknowledgements

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