Is Innisfil the Future of Rural Public Transit? Should it be?

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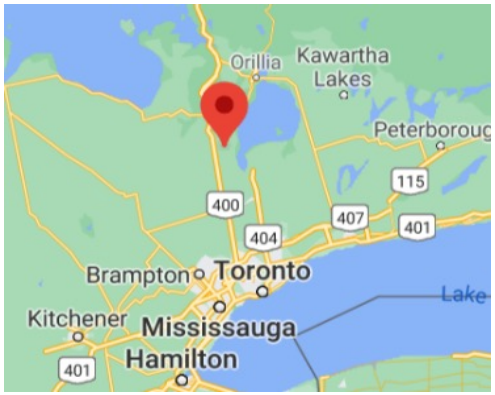

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Study Motivation

Sweet, Matthias; Raktim Mitra, Anne Benaroya. 2021. Innisfil Transit System Performance: May 2017 to February 2020. Ryerson University, School of Urban & Regional Planning. Published Jan 12, 2021. 67pp.

- Innisfil Transit represents an innovative approach to rural transit through a public-private partnership between the town and the ride-hailing service provider Uber
  - 24-hour, subsidized, pooled, on-demand trips for a flat or subsidized fare (based on destination) through Uber platform
  - Vehicles are owned and operated by Uber gig workers

- Initial evaluation (Sweet, et al., 2021) found Innisfil Transit offered:
  - 4x the accessibility of the proposed bus alternative per unit cost or time
  - Comparable cost per passenger to bus services in similar communities
  - 3x the ridership as was estimated for the proposed bus service (in part due to expanded hours of operation)

- This work expands on the prior analysis to evaluate the service's ***sustainability***, ***scalability***, and pandemic ***resiliency***
  - Findings show that Innisfil Transit out-performs rural fixed route bus service in carbon emissions per passenger mile traveled and economic resiliency to supply/demand shocks (COVID-19) with potential expansion to communities comprising 18% of the US population

Analysis Overview

Innisfil Transit Operations (2017-2019)

	2017 (May 15-Dec)	2018 (Jan – Dec)	2019 (Jan – Dec)
Trips	26,688	85,943	102,487
Subsidy	$150K	$645K	$846K
Riders	3,493	5,749	9,500
Drivers	1,393	2,203	4,500
Match Rate	17%	31%	33%
Wait Time	9:10 mins	6-10 mins	4:36 mins
Completion Rate	71%	87%	84%

Innisfil Transit and Social Outcomes- Sweet, et al., 2020

The above operational statistics were used to assess the service in terms of…

- **Sustainability:** Assessment of energy use and emissions for vehicle and passenger miles traveled across 7 scenarios.
- **Scalability**: Estimation of the deployment potential in similarly-sized communities across the US.
- **Resiliency with respect to COVID**: The financial performance of Innisfil Transit is compared to other rural public transit systems to inform resiliency and adaptability within the context of the COVID-19 pandemic.

Scenario Definitions

Assumptions by Scenario	Baseline	Current	EV	EV Efficient Ops	1 Bus	2 Buses	2 EV Buses	Source
Annual Trips/Ridership	79,118	79,118	79,118	79,118	22,200	37,000	37,000	Sweet, et al., 2021
Average Occupancy	1.0	0.8	0.8	1.2	4.5	4.5	4.5	Sweet, et al., 2021
Fuel Economy [mi/gge]	22.0	26.0	100.0	100.0	5.0	5.0	13.3	*See Notes below
Emissions [lbs CO2/gge]	19.6	19.6	31	31	22.4	22.4	31	**See Notes below
Annual VMT	278,101	347,627	347,627	231,751	69,369	91,047	91,047	Sweet, et al., 2021

- 7 Scenarios compared across 5 assumed input characteristics
  - **Baseline**: Innisfil Transit is replaced by private vehicle use
  - **Current**: Operations for Innisfil Transit given by Sweet, et al. 2021
  - **EV**: 100% electrified vehicles used for Innisfil Transit
  - **EV Efficient Ops:** Higher efficiencies in pooling increase avg. occupancy
  - **1 Bus/2 Buses**: The two bus (diesel) plans from Sweet, et al. 2021
  - **2 EV Buses**: Electrified version of 2 Bus scenario
- Other assumptions derived from values found in literature

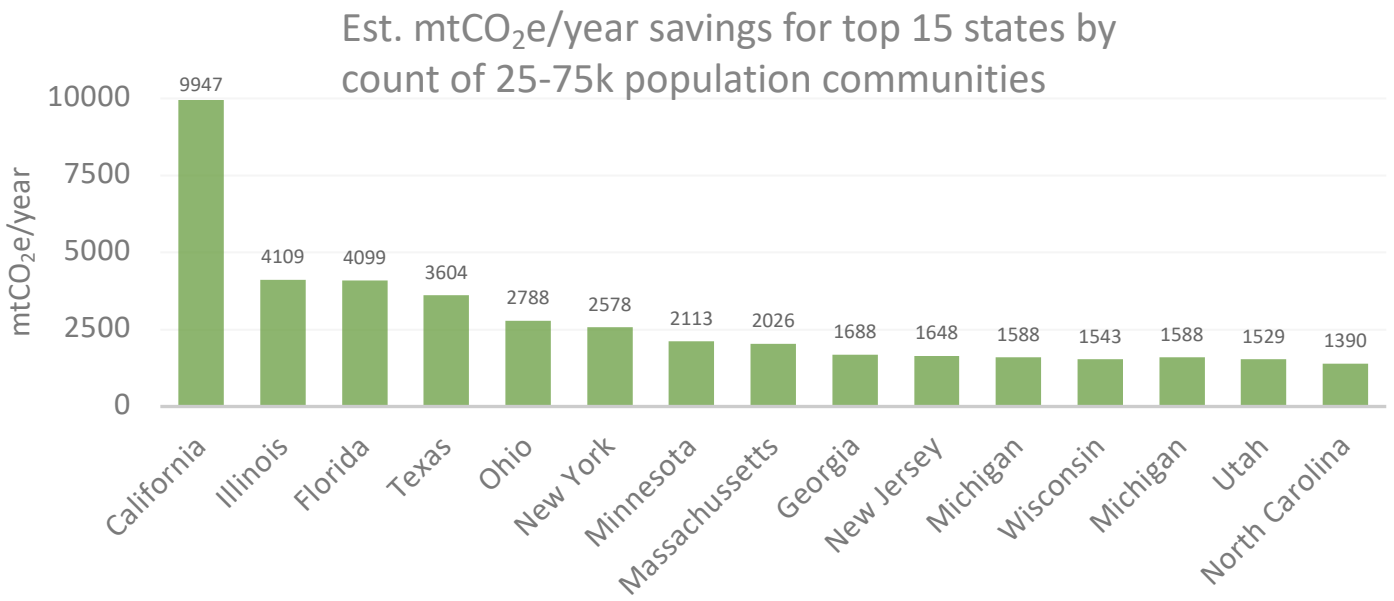
Sustainability Outputs

Outputs by Scenario	Baseline	Current	EV	EV Efficient Ops	1 Bus	2 Buses	2 EV Buses
Annual PMT [mi/year]	447,466	447,466	447,466	447,466	312,160	409,711	409,711
Annual Fuel [gge/year]	12,640	13,390	3,476	2,317	13,873	18,209	6,845
Annual CO2 Emissions [mt CO2/year]	112	119	48	32	140	184	96
Average CO2 per 100 PMT [mt CO2/100 mi]	0.025	0.027	0.011	0.007	0.045	0.045	0.023

- The bus options have the highest emissions per PMT unless electrified due to low avg occupancy (assumed) and low fuel economy

- Innisfil Transit users must opt in to pooling and occupancy numbers are based on normal Uber operations so above estimates are likely worst-case
  - Peak of 43% match rate for Innisfil Transit prior to the pandemic
  - 17% match rate in Chicago for normal Uber operations (Hou et al., 2020)
  - Differences in deadheading between typical Uber ops (as estimated in Henao, et al., 2019) and Innisfil Transit is unclear

Scalability: Emissions Impacts



- Population of Innisfil is ~40k and 18% of the incorporated places in the US have populations between 25-75k population
  - These are locations potentially suitable for rollout of similar transit services
- Emissions savings associated with rollout of service in the 15 states with the highest share of communities with 25-75k population based on 'EV Efficient Ops' Scenario
- ~42,000 mtCO2e/year across these 15 states = annual emissions of 8800 avg vehicles
  - Service rollout therefore represents a "win-win" for emissions reduction and relatively high quality of service in Innisfil-like communities

COVID Resiliency

	Average US Rural Transit Performance			
2018 Operating Costs	**Total**	**Fixed-Route**	**Demand-Response**	**Innisfil**
Per Trip	$ 11.41	$ 6.81	$ 18.85	$ 14.71
Per Vehicle Mile	$ 2.90	$ 4.14	$ 2.51	$ 2.36
Per Vehicle Hour	$ 51.17	$ 72.25	$ 43.67	$ 38.79

- Generally, Innisfil Transit has favorable operating costs compared to rural transit operations in the US on a per trip, mile, and vehicle-hour basis
- Transit ridership plummeted (-60% ridership for 2020) during the pandemic causing huge losses for transit agencies
  - Losses mitigated for Innisfil Transit by flexible supply of service relative to demand (drivers choose when to work)
  - Rider demand and service costs fell by 50% and 30% respectively from 2019 into the 2020 pandemic
    - Costs would have fallen in parallel without added subsidies for essential workers

Key Takeaways

In short: Innisfil Transit has demonstrated a new transit paradigm for rural transit with a range of benefits over traditional fixed route transit including aspects of…

Sustainability

- Innisfil Transit offers a higher service level (4x accessibility) than the bus alternative with ~55% of the emissions/PMT. The benefits increase in scenarios with electrified vehicles.

Scalability

- Approximately 45 million Americans (18% of total) live in communities with populations of 25-75k. These are areas that may be ripe for rollout of Innisfil-like services.

Resiliency

- Supply of on-demand services (and associated costs) using this model scale with demand, making it much more flexible and resilient to sudden shocks in demand. Innisfil Transit service costs fell at rates similar to the service demand through the 2020 pandemic.