WHAT'S A CITY GOT TO DO?

Setting Minimum Transit–Based Jobs Accessibility to Enhance Travel Time Equity and Public Transport Mode Share in Canadian Cities

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INTRODUCTION

- Growing number of communities aspire to increase sustainable mode shares in their planning and climate action plans, but the historic focus on mobility over accessibility remains.
- Enhanced transit-based accessibility to jobs has been shown to be strongly correlated with increased public transport mode share and decreased travel time.
- **Objective**: Identify the levels of accessibility necessary to achieve a reasonable travel time and reach targeted levels of public transport mode share defined in Canadian cities' transport plans.

METHODS

- Data: Statistics Canada 2016 Commuting Flow tables, from which the number of jobs associated to each Census Tract (CT) and income levels of the commuters in each CT were extracted.
- R5R travel time routing and accessibility calculations were used for each home-destination pair, and were supported by OpenStreetMap (OSM) networks and General Transit Feed Specifications (GTFS) data from the fall of 2016 for all eight regions.

Cumulative Accessibility Measures

$$A_{jobs,i} = \frac{1}{\sum_{j=1}^{J} E_j} \sum_{j=1}^{J} E_j \, f(t_{ij}) \quad \text{where } f(t_{ij}) = \begin{cases} 1, t_{ij} \leq t_{mean} \\ 0, t_{ij} > t_{mean} \end{cases}$$

$A_{jobs,i}$ = accessibility to jobs from origin CT i

$\sum_{j=1}^{J} E_j$ = total number of jobs in the CMA

E_j = number of jobs in destination CT j

$f(t_{ij})$ = a dichotomous function to determine whether jobs in CT j are reachable from CT i

t_{ij} = commute travel time by PT between 8AM and 9AM between CTs i and j

t_{mean} = mean commute travel time being used at the travel time threshold

Non–linear Accessibility Models

Mean Travel Time

$$A_{jobs,i} = \beta_0 + \beta_1 TT_i + \beta_2 TT_i^2$$

$A_{jobs,i}$ = access. to jobs from origin CTi at the mean TT

TT_i = mean TT for PT commuters leaving CTi

TT_i = squared mean TT for PT commuters leaving CTi

$\beta_0, \beta_1, \beta_2$ = parameters to be estimated

Public Transit Mode Share

$$A_{jobs,i} = \beta_0 + \beta_1 PT_i + \beta_2 PT_i^2$$

$A_{jobs,i}$ = access. to jobs from origin CT i at the mean TT

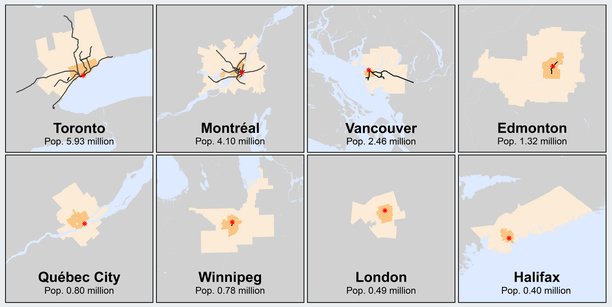
TT_i = PT mode share of commuters leaving CTi

TT_i = squared PT mode share of commuters leaving CTi

$\beta_0, \beta_1, \beta_2$ = parameters to be estimated

ANALYSIS/RESULTS

Context and Descriptive Statistics



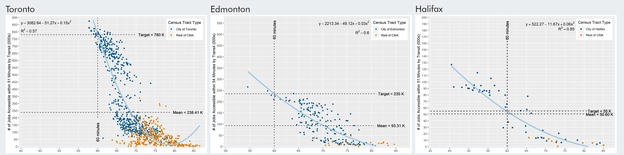
Data Sources: City of Vancouver, City of Edmonton, City of Winnipeg, City of London, City of Toronto, Metrolinx, TTC, Ville de Montreal, STM, AMT, Ville de Quebec, Halifax Regional Municipality, and StatsCan

Detailed comparison of the eight metropolitan areas

Summary of descriptive statistics of the eight studied regions

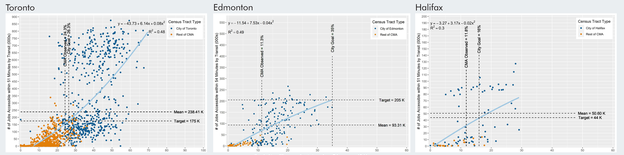
	Vancouver	Edmonton	Winnipeg	London	Toronto	Montréal	Québec City	Halifax
Population								
CMA	2.46 mil	1.32 mil	778,489	494,069	5.93 mil	4.10 mil	800,296	403,390
City	631,486	932,546	705,244	383,822	2.62 mil	1.70 mil	531,902	279,313
Density (pop/km²)								
CMA	854.6	140	146.7	185.6	1,003.80	890.2	234.8	73.4
City	5,492.6	1,360.9	1,518.8	913.1	4,334.4	4,662.1	1,173.2	335.9
Public transport share (%)	20.4	11.3	13.6	7.2	24.3	22.3	11.1	11.8
Car share (%)	69.3	82.6	79.1	85.1	68	69.7	80.4	77.7
Target public transport share (%)	34	35	15	20	26.3	35	26	16+
Travel times (for PT)								
Mean travel time for all jobs (mins)	48	54	47	49	51	49	51	51
Mean travel time for low-wage jobs (mins)	47	54	47	50	51	47	55	49
Mean travel time for non-low-wage jobs (mins)	49	55	47	47	51	51	47	53
Accessibility								
Total jobs at mean PT travel time (1000s of jobs)	136.5	93.3	88.3	50.2	238.4	288	94.6	50.6
Low-wage jobs at low-wage mean PT travel time (1000s of jobs)	48.6	34.1	27.6	18	67.3	83.5	36	15.2
Non-low-wage jobs at non-low-wage mean PT travel time (1000s of jobs)	109.7	61.1	58.6	29.1	162.9	204	51.1	35.7

Travel Time Accessibility



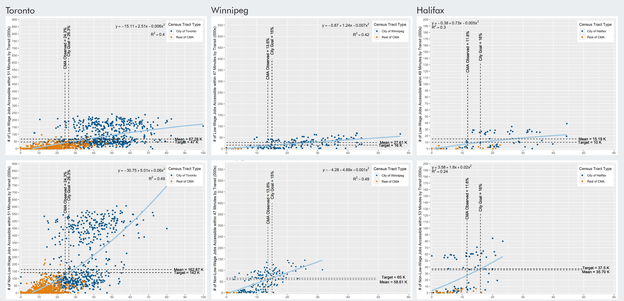
Relationship between mean PT travel times and mean employment accessibility at the CT level

Public Transit Mode Share Accessibility



Relationship between public transport mode share and mean employment accessibility at the CT level

Equity Analysis



Relationship between PT mode share and mean job accessibility at CT level for low and non–low–wage jobs

CONCLUSION

- The required level of transit-based accessibility is context-specific and depends on the size, built environment, and spatial structure of the respective regions, as well as the level of ambition that their goals represent.
- Smaller regions in Canada are far closer to or already at the mean level of employment accessibility by PT within the reasonable travel time of 60 minutes.
- To reach a mean travel time of 60 minutes by public transit, the number of accessible jobs must be increased and the respective PT networks need to better serve the area, especially the CTs outside of the city centre.
- Fewer low-income jobs were accessible at the corresponding mean travel times, though the public transport shares in these CTs were much higher than for the non-low-income group.
- Areas that have pronounced discrepancies between the existing and desired PT mode share should consider investing in the development of regional public transport systems in order to achieve their goals, rather than simply increasing the number of accessible jobs.
- This study shed light on the importance of using accessibility metrics when developing transport plans and setting goals using region- and group-dependent thresholds of travel times and modes shares, increasing the chances of the goals being met.

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