TOWARDS EQUITABLE TRANSIT

EXAMINING TRANSIT ACCESSIBILITY & SOCIAL NEED IN TORONTO, CANADA, 1996-2006

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The location of transit infrastructure allocates **publicly-funded benefits.** It is important for **transit authorities** to understand how transit benefits are distributed, and how this allocation changes over time. Public transit distribution should consider **equity goals.**

PURPOSE

To examine whether **benefits** of Toronto's **transit system** are **equitably distributed**, and how this distribution changes from 1996 - 2006.

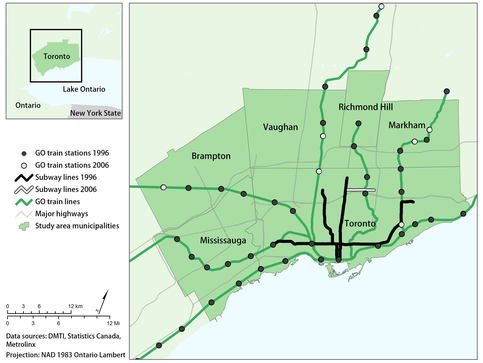
RELEVANCE & CONTRIBUTION TO RESEARCH

This study contributes to the literature by developing a methodology to **measure transit system equity** by incorporating:

- Social disadvantage indicator
- Real home-work commute trips
  - relative gravity-based accessibility
  - relative transit travel time
- Data for two years to show change over time

CONTEXT

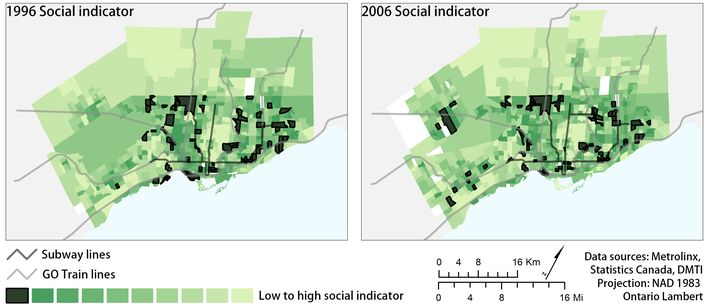
The study area is the City of Toronto and its adjacent municipalities that have significant public transit connections to the City of Toronto. From 1996 to 2006, both population and employment concentration show a suburbanization trend.



SOCIAL INDICATOR

A social indicator is a tool to identify groups based on a combination of characteristics. In this study, we create a social indicator to identify census tracts with social need. We use four equally weighted variables to measure social disadvantage. It includes the two most common variables used in the literature and two Canadian context-appropriate variables:

- *Median household income*
- *Unemployed labour force (percentage)*
- *Population that has immigrated within the last five years (percentage)*
- *Households that spend more than 30 percent of income on housing rent (percentage).*



Over time, the most socially disadvantaged census tracts are located farther from downtown (outlined in black, by decile).

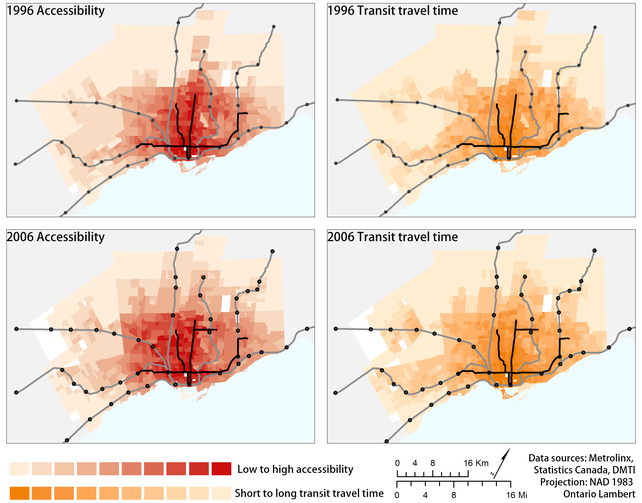
ACCESSIBILITY & TRAVEL TIME

The **gravity-based measure of accessibility** attempts to model travellers' perceptions that closer opportunities are more desirable than farther ones. Gravity-based accessibility is often used in studies to measure accessibility to jobs. Using a Geographic Information System (GIS), Transportation Analysis Zone (TAZ) centroids are matched to the closest census tract.

Transit travel time uses modeled commute times. It includes walking to and from transit locations, wait time, time in vehicle, and transfer time. We use standardized values to compare the relative standing of different groups since the transit travel times were modeled slightly differently in 1996 and 2006 in the original data.

Higher levels of accessibility spread outward in the region from 1996 to 2006, with the core accessing the greatest number of jobs. For transit travel time, some areas farther from the city centre have **decreasing transit travel times** relative to the rest of the region over the ten-year time period.

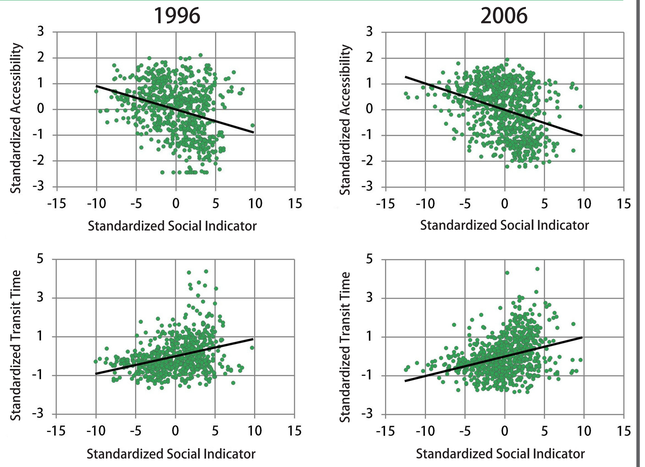
Also, **more census tracts have access to transit.** In 1996, 4.4% of census tracts had over 85% of commuters with no viable transit options. This decreased to 1.3% of the studied census tracts in 2006.



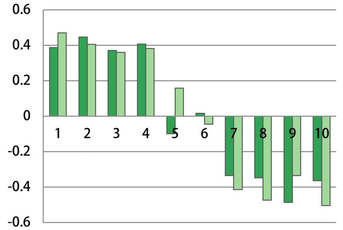
CHANGES FROM 1996-2006 BY SOCIAL INDICATOR

Using two-sample t-tests, we compared social indicator deciles in the same year. The t-tests confirm the statistical significance of most findings displayed in the scatterplots and bar graphs. For instance, the differences between socially disadvantaged groups and the rest of the population, as well as differences between 1996 and 2006. A series of paired and unpaired t-tests were conducted with statistical analysis software.

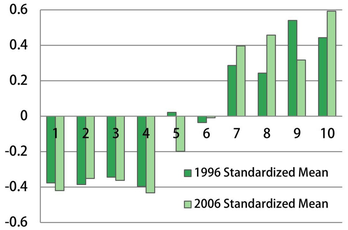
The scatterplots show that socially disadvantaged populations continue to have the most transit-related benefits in the region in both years.



Decile 1 in the bar graphs represents the most socially disadvantaged group. Comparing the deciles shows the range of benefits for one decile relative to another. In both years, the socially disadvantaged deciles have relatively high accessibility to jobs, and relatively low transit travel time. The clear divide between more socially disadvantaged deciles and less socially disadvantaged deciles is stark.



Accessibility to all jobs by social indicator deciles



Travel time to all jobs by social indicator deciles

Our findings for transit travel time and accessibility to jobs do not support that the spatial mismatch hypothesis is present in Toronto from 1996 to 2006.

Using real home and work locations for Toronto commuters, the most socially disadvantaged census tracts have significantly better accessibility to jobs by transit and lower transit travel times relative to the rest of the region in both 1996 and 2006.

ACKNOWLEDGEMENT

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This article can be accessed at:

www.tram.mcgill.ca/Research/Publications/Toronto_equity.pdf