The Ontario Line:  
*Socioeconomic Distribution of Travel Time and Accessibility Benefits*

Report prepared for **Metrolinx** - August 29, 2019

**Dr. Steven Farber**  
Assistant Professor  
Department of Human Geography  
University of Toronto, Scarborough

**Jeff Allen**  
PhD Student  
Department of Geography and Planning  
University of Toronto, St. George
# Table of Contents

Executive Summary .................................................................................................................. 2  
1 / Introduction ...................................................................................................................... 3  
2 / Data .................................................................................................................................. 4  
3 / Access to Transit .............................................................................................................. 8  
4 / Travel Times ..................................................................................................................... 12  
   4.1 / Unweighted Travel Time Differences ........................................................................ 12  
   4.2 / Flow weighted Travel Time Differences ................................................................. 14  
5 / Access to Destinations by Transit .................................................................................. 16  
   5.1 / Access to Education .................................................................................................. 17  
   5.2 / Access to Employment .............................................................................................. 19  
   5.3 / Access to Low-Income Employment ......................................................................... 20  
   5.4 / Passive Accessibility ................................................................................................. 22  
6 / Demand Differentials ...................................................................................................... 24  
7 / Further Reading ............................................................................................................... 26
Executive Summary

This report contains a detailed analysis of the socioeconomic distribution of benefits associated with the Ontario Line. The report was commissioned by Metrolinx following the release of their initial business case study of the Ontario Line. The work was completed independently by the authors, but relied heavily on the population, employment, travel demand, and travel time forecasts generated by Metrolinx for their initial business case analysis.

This report compares the Ontario Line to a Business as Usual scenario, with identical forecasted land-use patterns, but different travel demand and travel time projections. It is not intended to compare the performance of the Ontario Line to other infrastructure investment options, most notably, the Downtown Relief Line. Rather, given the projected benefits of the Ontario Line, the aim of this study is to determine how those benefits are distributed over space, and by socioeconomic status.

Drawing on the most fundamental determinants of transport poverty in the Toronto region, this report specifically focusses on unemployment, low-income status, visible minorities, and recent immigration groups, to characterize the distribution of the Ontario Line’s benefits.

This study defines benefits in terms of walking access to rapid transit, transit travel time improvements in the region, accessibility to education and employment, population access to Ontario Line station areas, and finally, changes in overall demand for public transit. The results are presented in a series of maps, graphs, and tables, throughout the report.

The main finding, consistent across most facets of the analysis, is that the benefits of the Ontario Line are forecasted to be fairly evenly spread across all levels of socioeconomic status in the region, with modest concentrations specifically among low-income populations. In neighbourhoods most significantly benefiting from the Ontario Line investment (i.e. in neighbourhoods within 5km of the transit line) we find that benefits are also concentrated among visible minorities and recent immigrants. However, compared to low-income groups, the benefits are not as concentrated among the unemployed, visible-minorities and recent immigrant groups. The geography of the region is such that there are many parts of the region with higher concentrations of these populations compared to the neighbourhoods most directly served by this single piece of infrastructure.

We find the distribution of benefits to be equitable, in that they do concentrate among population groups more likely to depend on public transit for their daily mobility needs, especially lower-income populations. At the same time, this concentration is largely dependent on the Ontario Line’s benefits extending into peripheral parts of the line (e.g. the stations north of the Don Valley) as well as to areas served east and west of the line that will benefit greatly by a new rapid transit connection in replacement of existing slower surface transit options (e.g. Gerrard and Queen Streets east).
**Research Highlights**

- 242,000 people and 442,000 jobs will be within a 10 minute walk of Ontario Line stations. According to where low-income households live today, about 25% of those within walking distance of OL stations will be in low-income households. This large share is mostly due to the expansion of the Ontario Line to low-income communities north of Danforth Avenue, and to low-income communities east and west of the OL’s interchanges with the TTC Line 1 subway.

- Travel time benefits are significant, with most neighbourhoods along the OL corridor achieving 3-5 minutes of perceived travel time reduction per peak-period transit trip, averaged across demand-weighted destinations. About 10% of TAZs in the GGH see average demand-weighted transit travel times decrease by 5+ minutes. Similar benefits extend for several kilometers from the two termini and eastward along Gerrard and Queen Streets. Within 5km of OL stations, the travel time benefits are concentrated among low-income, recent immigrant, and low-income populations, based on today’s socioeconomic distributions.

- Accessibility benefits are also significant, with spatial patterns mimicking those for travel time improvements. We find that access to education and jobs via transit will improve at least 3% for residents living in zones near the Ontario Line. The benefits are concentrated among low-income, visible minority, and recent immigrant populations, compared to the average benefit received across the entire population.

- The three stations north of the Don River are expected to experience the largest relative gains in passive accessibility, indicating that these station areas will become easier to reach via transit from the rest of the city. This signifies opportunity for commercial intensification in these station areas, and if implemented responsibly, could add substantially to the livability of those neighbourhoods.

- The OL line is expected to generate 15,000 new peak-period transit trips per day in the region. The socioeconomic distribution of these new trips tends to mimic the distribution of the population overall. In other words, the new trips being generated do not appear to concentrate among the socioeconomic groups analyzed in this study.

**1 Introduction**

This report studies the distribution of travel time and accessibility benefits of the proposed Ontario Line (OL). We estimate the differences in benefits across a range of relevant social and economic groups in the Greater Toronto and Hamilton Area (GTHA). Our analysis is based on two 2041 demand, travel time, and land-use scenarios developed by Metrolinx in their Initial Business Case (IBC) of the OL: the Ontario Line vs. the Do Nothing case, hereafter referred to as the Business as Usual (BAU) case. Readers may refer to Metrolinx’s July 25th initial business case [here](#). The scenarios were developed using the Greater Golden Horseshoe Model Version 4 (GGHMv4), an EMME based model used by the Ministry of Transportation and Metrolinx for...
regional, macro travel demand forecasting. All estimates of travel times and travel demand correspond to an AM peak period between 6:45am and 8:45am.

Key characteristics of the provided business case scenarios most relevant to this study include:

- The OL and BAU scenarios share the same forecasted 2041 land use distributions of population, employment (by NAICS and NOCS codes) and student counts (by level of education).

- All data were provided at the Traffic Analysis Zone level of aggregation, including zone-to-zone transit travel times and peak-hour travel demand by transit.

- Raw estimated travel times were not available for this study. Instead, perceived travel times are used. These include additional weights applied to ingress/egress, waiting, and transfer times.

Further details regarding data sources are provided below in Section 2.

The study is composed of a consistent set of well-defined analyses aimed at comparing the OL to the BAU scenario, and carefully disaggregating the estimated benefits of the OL line by socioeconomic groups. To this end we focus our analysis on socioeconomic measures most relevant to disadvantage in the GTHA: unemployment, poverty, visible minority, and recent immigration. It is important to note that the most recent available source of socioeconomic data, the 2016 National Household Survey, is used to describe forecasted TAZ population characteristics throughout this study. In other words, if a TAZ is 10% unemployed according to the 2016 census, 10% of the TAZ’s forecasted 2041 population is assumed to be unemployed as well. The demographic models used in GGHMv4 allow for overall population growth but not changes in the composition of key socioeconomic characteristics of the population, such as those examined in this report.

This report can be separated into 4 main categories of analyses comparing the two scenarios:

1. Differences in station access (by foot and by transit)
2. Differences in travel times (raw and demand-weighted)
3. Differences in accessibility (education, employment, population)
4. Differences in transit travel demand

Results for the above will be presented and described following a more detailed summary of the data used in the report.

2 / Data

Several datasets were assembled to carry out the analyses in this report.

Population data provided at the TAZ level by Metrolinx from the 2041 GGHMv4 projections:

- Total population counts (shown in Figure 1)
- Employment counts by North American Industrial Classifications (NAICS) and National Occupational Classifications (NOCS)
- Student counts by place and level of education.

Travel demand characteristics provided at the TAZ-to-TAZ level for each of the 2041 GGHMv4 scenarios:
- Estimates of number of peak-period transit trips (by scenario)
- Estimates of peak-period perceived transit travel times (by scenario). Perceived travel time applies a weight of 2.5 to time spent walking to/from transit and waiting for transit. This reflects the relative disutility of time spent walking and waiting compared to time spent travelling in-vehicle, and is a standard approach to modelling travel costs on a transit network.

Statistics Canada 2016 Population and Employment Estimates by Dissemination Area:
- Employment counts by NAICS and NOCS (by DA and CT)
- Population counts
- 5 categories of socioeconomic status:
  o Percent of the labour force that is unemployed
  o Percent of the population living under the Low Income Measure (LIM) (shown in Figure 2)
  o Percent of the population living under the Low Income Cut-off (LICO)
  o Percent of the population identifying as a visible minority
  o Percent of the population who is a recent immigrant (immigrated between 2011 and 2016).

Spatial data used to perform walking access calculations:
- Current (2019) OSM walking network data, with some minor edits near East Harbour and Exhibition to account for proposed paths/roads
- Alignment and stop location of OL from Metrolinx. Note that exact alignment is conceptual and subject to change (shown in Figure 1)

Areal apportionment was required to assign census-based DA data to TAZs and to walking catchment buffers generated in Section 3 below. Population-based census data was linked to walking buffers and to TAZs via block-weighted areal interpolation. This is done first by allocating population into census blocks and then accumulating the intersecting area into the target geographies (TAZs or walking buffers). Employment data was linked via a straightforward areal interpolation since block-level employment counts are unavailable.

The results for each analysis are summarized by impacts for the City of Toronto as well as for a 5km buffer surrounding the Ontario Line stations. This buffer is based on a 5km Euclidean distance, and TAZs are included in the catchment if at least 50% of a TAZ’s area falls within. This accounts for 36% (228/631) of TAZs in Toronto, or 10% (228/2265) of TAZs in the GTHA (see Figure 3).
Figure 1: Location of Ontario Line Stations and Forecasted Population Density
Figure 2: Location of Ontario Line Stations and Density of Households Living Below the Low Income Measure in 2016
3 / Access to Transit

This section provides estimates for the socioeconomic status of the population that is projected to gain walking-distance access to rapid transit due to the construction of the Ontario Line. Figure 4 shows the locations of the stations surrounded by 400m, 800m, and 1200m walking buffers. The 800m buffer is assumed to represent a 10 minute walking catchment using a walking speed of 4.8 km/h along the pedestrian network. The figure also denotes the difference between walking buffers that have pre-existing access to rapid transit on any of Lines 1, 2 or 5. In this analysis, the populations residing in the green catchments are those who are projected to gain walking access to rapid transit exclusively due to the Ontario Line.

Table 1 presents the total population and employment counts (2016 and projected to 2041) within walking distance of the Ontario Line stations. Regional totals for the City of Toronto and the GTHA are provided for context. Similarly, the 2041 projected counts of population and employment are presented in Figure 5, this time disaggregated for each station. In summary, the Ontario Line is projected to serve catchment populations of 242,000 residents and 442,000 jobs by 2041. Of these, 160,000 people and 119,000 jobs will be uniquely served by the OL and not one of the other existing rapid transit lines in the region. As seen in Figure 5, the largest

![Figure 3: TAZs which have at least 50% of their area fall within a 5km buffer from OL Stations](image-url)
employment catchments of the OL are in the downtown core and already within walking distance of Line 1. The stations directly outside of the core of the CBD are projected to newly serve very large numbers of jobs and residents overall, with the numbers of both levelling off along the north-eastern extension of the line.

Figure 4: Delineation of Catchment Areas Surrounding Ontario Line Stations.
Table 1: Current andProjected Population and Employment within a 10 Minute Walk to the Ontario Line

<table>
<thead>
<tr>
<th></th>
<th>10 Minute Walk to OL (800m)</th>
<th>Regional Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Stations</td>
<td>New Stations</td>
</tr>
<tr>
<td>2016</td>
<td>Population</td>
<td>167,000</td>
</tr>
<tr>
<td></td>
<td>Employment</td>
<td>340,000</td>
</tr>
<tr>
<td>2041</td>
<td>Population</td>
<td>242,000</td>
</tr>
<tr>
<td></td>
<td>Employment</td>
<td>442,000</td>
</tr>
</tbody>
</table>

We further describe the socioeconomic characteristics of the population residing in the catchment areas. Since this data are provided in the 2016 census, we have tabulated the results according to the 2016 population counts in each catchment. The forecasted results would be nearly equivalent since they would be based on applying 2016 breakdowns to 2041 total population estimates. Table 2 shows a clear pattern that the Ontario Line serves a larger than expected number of low income individuals compared to the City of Toronto and the GTHA overall. However, the catchment population characteristics for the unemployed, visible minorities, and recent immigrants are very similar to the overall averages for Toronto and the GTHA.
The distribution of the low income population by station area is further illustrated in Figure 6. The length of each bar indicates the number of people living in households below the LIM, while the colour denotes the percent. Clearly, Moss Park, Thorncliffe Park, and Flemingdon Park stations are serving predominantly low-income residents. Also notable is that Queen/Spadina and other downtown stations will likely serve large numbers of low-income residents, despite these areas being more mixed, in general, compared to those previously mentioned.

Table 2: Socioeconomic Characteristics of 2016 Population Living Within OL Station Catchment Areas

<table>
<thead>
<tr>
<th></th>
<th>10 Minute Walk to OL (800m)</th>
<th>All Stations</th>
<th>New Stations</th>
<th>Toronto</th>
<th>GTHA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>7,000</td>
<td>4,900</td>
<td>122,300</td>
<td>289,000</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>6.7%</td>
<td>6.8%</td>
<td>8.2%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>Total</td>
<td>36,200</td>
<td>25,800</td>
<td>469,300</td>
<td>844,100</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>22.2%</td>
<td>22.8%</td>
<td>17.4%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Low Income Cut-Off (LICO)</td>
<td>Total</td>
<td>40,500</td>
<td>29,300</td>
<td>543,400</td>
<td>1,039,300</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>24.8%</td>
<td>25.8%</td>
<td>20.2%</td>
<td>15.1%</td>
</tr>
<tr>
<td>Low Income Measure (LIM)</td>
<td>Total</td>
<td>76,300</td>
<td>53,300</td>
<td>1,385,900</td>
<td>3,194,000</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>46.7%</td>
<td>47.0%</td>
<td>51.5%</td>
<td>46.5%</td>
</tr>
<tr>
<td>Visible Minority</td>
<td>Total</td>
<td>11,000</td>
<td>8,100</td>
<td>188,000</td>
<td>377,400</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>6.7%</td>
<td>7.1%</td>
<td>7.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Recent Immigrant (2011-2016)</td>
<td>Total</td>
<td>7,000</td>
<td>4,900</td>
<td>122,300</td>
<td>289,000</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>6.7%</td>
<td>6.8%</td>
<td>8.2%</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

Note: the percentages above are based on the category (e.g. unemployed / labour force instead of unemployed / total population)
In this section we present the results pertaining to the differences in travel time in the region that are projected to occur due to the Ontario Line. We present results for unweighted and flow-weighted travel times, each in a map and tabulated by socioeconomic status.

**4 / TRAVEL TIMES**

4.1 / UNWEIGHTED TRAVEL TIME DIFFERENCES

For the analysis of unweighted travel times, we calculated the difference in average travel time between the BAU and OL for each TAZ in the region. This can be expressed mathematically as follows:

\[
\Delta_i = (n - 1)^{-1} \left( \sum_{j \neq i} t_{ij}^{OL} - \sum_{j \neq i} t_{ij}^{BAU} \right)
\]

where \( \Delta_i \) is the mean travel difference for TAZ \( i \), \( t_{ij}^{OL} \) and \( t_{ij}^{BAU} \) are the travel times from zone \( i \) to zone \( j \) for the OL and BAU scenarios respectively, and \( n \) is the number of zones in the study area. Negative values of \( \Delta_i \) denote a reduction in average travel time from zone \( i \) to all other zones in the region. Since the Ontario Line is situated well within the bounds of the City of Toronto, we only used the TAZs within the City as potential destinations to average over. Including the GTHA would unduly reduce the differences observed. Figure 7 displays a map of...
Δ₁, showing that travel time reductions are present in the zones surrounding the Ontario Line, save for a few zones that show an increase. After consulting with Metrolinx concerning these increases, we believe they are due to modelled changes in the surface bus network stop spacings that produce modest, but noticeable, increases in perceived travel times. This is especially the case for the TAZ northeast of Eglinton and Don Mills. We believe this to be an artifact of the model used to compute travel times, and that care could be taken to ensure higher levels of service in for those in this TAZ in the implementation of the line. In this analysis, we proceed with the travel times as they are estimated and provided by the GGHMv4 model.

The travel time differences for each zone are averaged according to their socioeconomic characters and presented in Table 3. These results are presented in terms of average reductions in travel time for each population group within the City of Toronto, and then for the populations residing in TAZs within 5km of the Ontario Line. The table illustrates that low-income populations are likely to see more reduction in transit travel time than the Toronto population on average. Other population groups appear to obtain similar improvements to the overall population in Toronto, mirroring the results found above regarding the catchment area population characteristics (being similar to the average characteristics of the City of Toronto). Within the 5km catchment however, visible minorities and recent immigrants are projected to have larger reductions in travel times than the overall population living within the buffer. This makes sense as large swathes of the 5km buffer include affluent central neighbourhoods whose travel times seldom would be impacted by the new services provided by the Ontario Line (see Figure 3).
4.2 / Flow weighted Travel Time Differences

In this section we reproduce the analysis above, except the travel times are weighted by the projected number of transit trips for each pair of TAZs.

\[
\Delta_i^w = \frac{\sum_j f_{ij}^{OL} t_{ij}^{OL}}{\sum_j f_{ij}^{OL}} - \frac{\sum_j f_{ij}^{BAU} t_{ij}^{BAU}}{\sum_j f_{ij}^{BAU}}
\]
In this case, $\Delta_{ij}$ is the weighted mean travel time difference, $f_{ij}$ is the number of transit trips between zones $i$ and $j$, and all other terms are defined as before. The superscripts on the flow terms denote the scenario from which they are drawn.

The weighted travel time differences are theoretically preferred to unweighted because they add importance to origin-destination pairs that are more frequently travelled between. They are therefore a better representation of the experienced changes of travel times of residents. A map of the average change in weighted travel time is presented in Figure 8, and socioeconomic disaggregations are presented in

Table 4. Compared to the unweighted travel time averages, we observe that the reductions are more exaggerated when incorporating the projected travel patterns of future populations.

![Flow-Weighted Travel Time Differences Between OL and BAU Scenarios](image-url)
Table 4: Average Travel Time Savings in Minutes and Percentages for 2041 Populations by Socioeconomic Status

<table>
<thead>
<tr>
<th></th>
<th>GTHA Minutes</th>
<th>GTHA Percent</th>
<th>City of Toronto Minutes</th>
<th>City of Toronto Percent</th>
<th>5km of OL Minutes</th>
<th>5km of OL Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Population</td>
<td>0.69</td>
<td>0.71</td>
<td>1.09</td>
<td>1.75</td>
<td>1.76</td>
<td>3.19</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.65</td>
<td>0.72</td>
<td>1.05</td>
<td>1.69</td>
<td>1.72</td>
<td>3.14</td>
</tr>
<tr>
<td>Low Income Cut-Off (LICO)</td>
<td>1.03</td>
<td>1.37</td>
<td>1.20</td>
<td>1.97</td>
<td>1.84</td>
<td>3.42</td>
</tr>
<tr>
<td>Low Income Measure (LIM)</td>
<td>0.98</td>
<td>1.21</td>
<td>1.21</td>
<td>1.98</td>
<td>1.94</td>
<td>3.59</td>
</tr>
<tr>
<td>Visible Minority</td>
<td>0.86</td>
<td>0.97</td>
<td>1.08</td>
<td>1.69</td>
<td>2.04</td>
<td>3.71</td>
</tr>
<tr>
<td>Recent Immigrant (2011-2016)</td>
<td>0.87</td>
<td>1.08</td>
<td>1.00</td>
<td>1.60</td>
<td>1.91</td>
<td>3.47</td>
</tr>
</tbody>
</table>

5 / Access to Destinations by Transit

Accessibility is a measure used in transportation planning to denote the level of opportunity available for residents to reach meaningful activity destinations in their city. It can be conceptualized as the degree of benefit provided to residents by the transportation/land-use system, as a measure of opportunity, and as a measure of freedom to select from a broad set of activity destinations.

Accessibility is often operationalized into a gravity model by counting the number of destinations reachable from each neighbourhood in a region, discounting those destinations by the costs of travelling there:

\[ A_i = \sum_j O_j f(t_{ij}) \]

where \( t_{ij} \) is the travel time (or some other cost of travelling) from zone \( i \) to \( j \), \( O_j \) is a count of opportunities in zone \( j \), and \( f(t) \) is the distance decay function.

The selection of opportunities varies widely in the literature. For this study we have the projected counts of educational and employment opportunities within each TAZ from the GGHMv4 model, and use them accordingly to measure the impacts of the Ontario Line on increasing access to these two types of destinations.

In this study we draw \( t_{ij} \) from the perceived travel time matrices generated by the GGHMv4 model, and apply a decay weight empirically calibrated against the cumulative distribution function (CDF) of observed trips in the BAU GGHMv4 demand matrix:
\[ f(t_{ij}) = 1 - CDF(t_{ij}). \]

The BAU scenario was selected because it produces weights with a slightly flatter decay. It can be interpreted as being a more conservative choice since it provides a slight accessibility advantage to the BAU case. Figure 9 depicts the distance decay function. The curve provides the weight, between 0 and 1, that is applied to trips at each perceived travel time. In this way, nearby destinations receive weights closer to 1, while trips further away approach weights close to zero. It is important to recall that these are perceived transit travel times, which, because of the weights placed on walking and waiting times, are larger than actual door-to-door travel times. They are, however, assumed to be a more relevant predictor of travel behaviour.

We also note that the decay curve has been calibrated on trips originating throughout the entire region. A decay curve based on the CDF for transit trips just within the City of Toronto, is far steeper than the one used in this study. It is our opinion that the use of a flatter decay curve in this study serves to lessen the perceived impact of the OL line on accessibility benefits. The accessibility analysis can therefore be interpreted as being very conservative.

Figure 9: Distance Decay Function Used in Accessibility Scores. This Function is Equal to 1-CDF(X).

### 5.1 Access to Education

In this section we report on the differences in the access to education scores between the BAU and OL scenarios. A map of the results appears in Figure 10, and a table of results disaggregated by socioeconomic status is provided in Table 5.

We observe large accessibility gains for TAZs abutting the Ontario Line, especially those at the two extremities of the line, for which trips to the universities and colleges downtown will become significantly shorter. We also observe large accessibility gains in TAZs east along...
Gerrard and Queen Streets for which transferring from streetcar service to the OL will provide improvements in access to downtown educational opportunities.

According to the results in Table 5, the educational access benefits are slightly more concentrated in low-income, visible minority, and recent immigrant populations, especially among the TAZs within a 5km buffer of the Ontario Line Stations.

![Percent Difference in Access to Education](image)

*Figure 10: Percent Difference in Access to Education*

<table>
<thead>
<tr>
<th>Percent Increase in Accessibility (2041)</th>
<th>GTHA</th>
<th>City of Toronto</th>
<th>5km of OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Population</td>
<td>0.47%</td>
<td>1.04%</td>
<td>2.28%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.18%</td>
<td>1.01%</td>
<td>2.31%</td>
</tr>
<tr>
<td>Low Income Cut-Off (LICO)</td>
<td>0.60%</td>
<td>1.21%</td>
<td>2.63%</td>
</tr>
<tr>
<td>Low Income Measure (LIM)</td>
<td>0.58%</td>
<td>1.21%</td>
<td>2.75%</td>
</tr>
<tr>
<td>Visible Minority</td>
<td>0.23%</td>
<td>0.98%</td>
<td>2.80%</td>
</tr>
</tbody>
</table>
5.2 / Access to Employment

Access to employment is a widely used measure to evaluate the distribution of benefits of transit infrastructure. An access to employment score can be interpreted both as an economic indicator, since access to employment is a pathway to making labour markets more efficient, as well as a general indicator of access to destinations via transit, since spatial distributions of employment proxy the spatial distributions of many types of activity destinations of interest to residents (e.g. retail, services, healthcare, etc.).

As in Section 5.1, we present access to employment results with a map in Figure 11 and by socioeconomic status in Table 6. The spatial and socioeconomic distributions of employment accessibility largely replicate those found for education above. However, the scale of improvement for jobs accessibility is higher, likely because employment is more concentrated than education, given the distribution of K-12 institutions being evenly dispersed into residential neighbourhoods. Overall, access to employment is improved throughout Toronto because of the Ontario Line, with benefits accruing to low-income, visible minority, and recent immigrant groups, more than to the overall population.

Table 6: Change in Access to Employment by Socioeconomic Status

<table>
<thead>
<tr>
<th>Percent Increase in Accessibility (2041)</th>
<th>GTHA</th>
<th>City of Toronto</th>
<th>5km of OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Population</td>
<td>0.11%</td>
<td>1.14%</td>
<td>2.58%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.10%</td>
<td>1.12%</td>
<td>2.69%</td>
</tr>
<tr>
<td>Low Income Cut-Off (LICO)</td>
<td>0.61%</td>
<td>1.34%</td>
<td>2.98%</td>
</tr>
<tr>
<td>Low Income Measure (LIM)</td>
<td>0.56%</td>
<td>1.35%</td>
<td>3.15%</td>
</tr>
<tr>
<td>Visible Minority</td>
<td>0.21%</td>
<td>1.10%</td>
<td>3.22%</td>
</tr>
<tr>
<td>Recent Immigrant (2011-2016)</td>
<td>0.46%</td>
<td>1.19%</td>
<td>3.18%</td>
</tr>
</tbody>
</table>
5.3 / Access to Low-Income Employment

One of the common criticisms for the use of total employment counts in the study of jobs accessibility, especially for low-income populations, is that many jobs being counted in the access score may be unattainable to low-income populations due to a mismatch with skills and training. To overcome this challenge, it is becoming more common for researchers to present access scores to a selection of jobs that are deemed more relevant to the populations of interest.

In this study, we make use of Statistics Canada cross-tabulations of number of jobs by National Occupational Classification (NOC) and low-income status (based on the LIM). Statistics Canada provides the percentage of low-income workers in the Toronto Census Metropolitan Area who are employed in each occupational classification. We incorporate these percentages as additional weights on $O_{cj}$, the number of jobs in zone $j$ of type $c$, giving higher weight to jobs that low-income workers are more likely to have, and lower weights to jobs that are less prevalent among low-income workers. Results for these accessibility scores are presented in Figure 12 and Table 7. Immediately evident from these tables is that the patterns of low-income jobs accessibility nearly perfectly matches the pattern for total employment provided in Table 6, above.
Figure 12: Percent Difference in Access to Low-Income Employment

Table 7: Change in Access to Low-Income Employment by Socioeconomic Status

<table>
<thead>
<tr>
<th></th>
<th>GTHA</th>
<th>City of Toronto</th>
<th>5km of OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Population</td>
<td>0.08%</td>
<td>1.14%</td>
<td>2.57%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.09%</td>
<td>1.12%</td>
<td>2.66%</td>
</tr>
<tr>
<td>Low Income Cut-Off (LICO)</td>
<td>0.61%</td>
<td>1.34%</td>
<td>2.97%</td>
</tr>
<tr>
<td>Low Income Measure (LIM)</td>
<td>0.54%</td>
<td>1.35%</td>
<td>3.14%</td>
</tr>
<tr>
<td>Visible Minority</td>
<td>0.21%</td>
<td>1.10%</td>
<td>3.21%</td>
</tr>
<tr>
<td>Recent Immigrant (2011-2016)</td>
<td>0.46%</td>
<td>1.19%</td>
<td>3.17%</td>
</tr>
</tbody>
</table>
5.4 / Passive Accessibility

Accessibility can also be used to describe whether a place has become easier to reach due to a change in transport infrastructure and land use, often called *passive* accessibility in the academic literature. In this case, we are interested in measuring the degree to which areas around OL stations will become easier to reach using transit for potential consumers and employees, with the hypothesis that passive accessibility is an indicator of land development pressure for retail and commercial uses.

Normally, to compute passive accessibility we reverse the accessibility equation and count the number of people that can reach each transit station, down-weighting the population according to distance decay. For this study, we have to approximate the travel times since we only have access to a TAZ-to-TAZ matrix, not a TAZ-to-Station matrix. We therefore compute access scores for the TAZ, and compute an areal apportioned average across TAZs within an 800m walking catchment of each Ontario Line station. A map of the passive accessibility scores in Figure 13 shows that most zones near to the Ontario Line will become easier to reach, with the biggest impacts near stations outside of the downtown core. Downtown is already extremely accessible via the existing transit infrastructure and so the addition of transit there only has a modest impact on passive accessibility when presented as a percentage change.

The results are further presented for each OL station, according to the aforementioned apportionment technique, in Figure 14. It can be seen that Flemingdon Park, Thorncliffe Park, Science Centre, and Exhibition/Ontario Place stations will receive the largest relative increases in passive accessibility. It follows that existing services and commercial activities at these locations will become easier to reach, and these sites will likely become more attractive to retail and commercial intensification.
Figure 13: Map of Percent Difference in Passive Accessibility
In this final results section, we present on the differences in overall number of transit trips being projected by the GGHMv4 model between the BAU and OL scenarios. We interpret an increase in transit use by residents in a zone as evidence of improved quality of life for residents there. An increase in transit demand indicates that transit has become more attractive (provides a greater utility) than the other modes of travel available, and therefore an increase in transit use means that there has been an increase in traveller utility. Without having access to the internal utility functions inside the GGHMv4 system, we are unable to convert this increased utility into more readily interpretable measures, such as a dollar values. Be that as it may, we take this opportunity to present the patterns of increased travel demand in Figure 15, and the socioeconomic distribution of this demand increase in Table 8.

The map of new demand clearly shows that the Ontario Line is making transit a more attractive choice for hundreds of trips per TAZ in zones serviced by the infrastructure, including locations connecting to the OL via other transit modes (e.g. eastward along Queen and Gerrard Streets). According to the travel demand matrices, the Ontario Line induces more than 15,000 peak period transit trips, compared to the BAU scenario, and these are being concentrated in TAZs serviced...
by the OL. Based on the neighbourhood characteristics of the TAZs receiving transit demand growth, we estimate that nearly 20% of these trips are being performed by low-income residents and 40% by visible minorities. These numbers are quite high for the GTHA population make-up, but quite representative of the population breakdowns in the City of Toronto, which tends to house more poverty and visible minority populations than the rest of the region.

![Map of Toronto showing increase in transit travel demand](image)

*Figure 15: Change in Transit Travel Demand between the BAU and OL Scenarios*

<table>
<thead>
<tr>
<th>Table 8: Change in Transit Travel Demand by Socioeconomic Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Overall Population</td>
</tr>
<tr>
<td>Unemployed</td>
</tr>
<tr>
<td>Low Income Cut-Off (LICO)</td>
</tr>
<tr>
<td>Low Income Measure (LIM)</td>
</tr>
<tr>
<td>Visible Minority</td>
</tr>
<tr>
<td>Recent Immigrant (2011-2016)</td>
</tr>
</tbody>
</table>

*based on sub-group that each belongs to (e.g. private households, labour force, etc.), not the overall population.
Further Reading

[https://files.osf.io/v1/resources/ua2gi/providers/osfstorage/5c423920154ce50018dd1423?action=download&version=1&direct&format=pdf](https://files.osf.io/v1/resources/ua2gi/providers/osfstorage/5c423920154ce50018dd1423?action=download&version=1&direct&format=pdf)


Farber, Steven and Allen, Jeff. 2019. *Planning for Equity in the GTHA: Quantifying the Accessibility-Activity Participation Relationship for Low-Income Households*.  


Hertel, Sean, Keil, Roger and Collens, Michael. 2015. *Switching Tracks: Towards Transit Equity in the Greater Toronto and Hamilton Area*.  

Hertel, Sean, Keil, Roger and Collens, Michael. 2016. *Next Stop: Equity - Routes to Fairer Transit Access in the Greater Toronto and Hamilton Area*.  
