Metrolinx

Transit Accessibility/Connectivity Toolkit

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OUTLINE

1. Who is Metrolinx?
2. What is “connectivity”?
3. The Connectivity Toolkit
4. Access to destinations and Access to transit
5. Application to transit planning
6. Future
GREATER TORONTO AND HAMILTON AREA

Expansive
• 8,242 km² (3,182 sq. miles)
• Spectrum of urban, suburban and rural land use

Fast-growing
• 7.2 million people in 2016,
• growing to 9 million by 2031
• and 10.1 million by 2041

Complex
• 4 levels of government
• 30 municipalities
• 9 municipal transit agencies + Metrolinx

*Some Metrolinx initiatives reach beyond the GTHA
A REGION UNDER PRESSURE

The GTHA “suffers from traffic congestion problems, poorly integrated transit services and relatively underdeveloped transport infrastructure.” OECD Territorial Review, 2010

- Avg. commute time per person, per day is 82 min
- Projected to increase to 109 minutes in the next 25 years
- Costs $6 billion in travel costs and lost productivity every year
- By 2031, this number could increase to $15 B
- Over 500,000 tonnes of annual GHG emissions is due to traffic congestion
WHAT IS METROLINX?

Metrolinx was created in 2006 by the Province of Ontario, as the first Regional Transportation Agency for the Greater Toronto and Hamilton Area (GTHA).
One goal of the Regional Transportation Plan (RTP), entitled The Big Move, is to build over 1,200 km of rapid transit – more than triple what exists now – so that over 80 per cent of residents in the region will live within two km of rapid transit.
GAP IN UNDERSTANDING

- Travel Demand Modelling allows us to understand and project:
  - Transit use
  - Vehicle kilometres travelled
  - GHG emissions

- But we lacked a way to understand and project:
  - Usefulness of the transit network
  - Gaps in service
  - Equity of service
accessibility

In transit planning, ‘how well you can access desired destinations’. This metric is a more meaningful measure than mobility because it accounts for land use density in addition to speed of travel. However, the word accessibility is also used in reference to access for those with limited mobility.

connectivity

To avoid confusion we can use the word connectivity instead of accessibility. How well are you connected to the places you need to be?
WHAT WE NEEDED

• A consistent way to measure connectivity metrics for transit networks
• To see the spatial distribution of transit service levels and connectivity across the region to identify gaps in service, and generally help to better understand the regional transit landscape
• To compare future networks and alternatives
• To more accurately incorporate walk distance (to, between, and from transit), and its effect on travel time

WHAT OUR SOLUTION DOESN’T DO

• Origin-destination demand forecasting (calculate ridership, estimate mode shares)
• Not capacity constrained - doesn’t account for crowding
• Doesn’t account for reliability - assumes all services operate according to schedule
CONNECTIVITY TOOLKIT

• Metrolinx with Arup have developed spatial metrics of connectivity for transit networks in the GTHA, leveraging the TransCAD platform.

• There are two main tools:
  • **Access to destinations**: Measuring access to key destinations and opportunities in terms of their journey times and costs from origins across the region
  • **Access to transit**: Measuring transit service levels at any given point (a ‘transit score’, like a walk score)
CONNECTIVITY TOOLKIT PROCESS

- Preparing Line Layer
- Importing GTFS Routes
- Defining Scenario Tests
- Calculating Access to Transit, Access to Destinations
- Interpreting Outputs
The toolkit includes a “Transit Network Builder” that helps speed up the process of setting up networks to be tested by importing GTFS (General Transit Feed Specification) files and combining them with manually coded future transit schemes.
ACCESS TO DESTINATIONS

- A measure of destination accessibility on transit
- Can use any set of destinations of interest: jobs, non-work destinations, hospitals, schools
- Can use any set of origin points desired, such as traffic zone or census tract centroids
- Based on a network travel time model: transit journey times, including walking, waiting and transfers

- The metric can be ‘flipped’ to calculate the population accessible from a number of starting destinations (i.e. schools, hospitals)
ACCESS TO DESTINATIONS - METHOD

- From each origin point, the total number of destinations within a travel time frame (e.g. 45 mins) is calculated.
- A gravity score calculated, which weights the destinations by the travel time from the origin.
- For each destination point, there can be a size value. This could represent number of jobs, hospital beds, school spots, etc.
- Origin points may be restricted to subsets of the population, such as low-income population.

- In the case of large zones, multiple points are generated and spread across the zone. For example, a zone with 500 jobs may have 5 origin points spread across the zone with 100 jobs assigned to each.
- Uses a process for choosing routes called “Pathfinder” that takes into account overlapping routes and chooses the fastest route.
ACCESS TO TRANSIT

• A measure of **service density**

• Includes **walk distance, frequencies, and span of service**

• This is combined into an Transit Accessibility Index (AI) that measures the number of services per hour, which is calculated for each origin node in the region (there are over 115,000)

• The AI is then converted into an Access To Transit (ATT) score between 1 and 10.

• Does not include travel times beyond access
APPLICATION TO TRANSIT PLANNING AT METROLINX

• Used in Discussion Paper for the Next Regional Transportation Plan (August 2016)

• “Vast majority of people have access to transit, but the usefulness of transit varies across the region”

• Is transit available and does it provide access?
  • A Vital Option: transit must be fast, reliable, convenient, frequent, and take people where they need to go
  • Network Coverage
  • Access to employment

• Is transit accessible to those who need it the most?
Results: Access to Jobs

Jobs Accessible Within 45 Minutes by Transit (A.M. Peak, 2011)

<table>
<thead>
<tr>
<th>By Residents of</th>
<th>45 Minutes</th>
<th>90 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Jobs Accessible</td>
<td>Fraction of All GTHA Jobs</td>
<td>Number of Jobs Accessible</td>
</tr>
<tr>
<td>Downtown Toronto</td>
<td>584,700</td>
<td>19%</td>
</tr>
<tr>
<td>Toronto</td>
<td>217,200</td>
<td>7%</td>
</tr>
<tr>
<td>GTHA Average</td>
<td>111,100</td>
<td>4%</td>
</tr>
</tbody>
</table>

Legend:
- GO Rail Line and Station
- Rapid Transit
- Frequent Transit Network (every 10 minutes or better)
- Population (2011)

1 Dot = 500 People

Number of Jobs:
- Fewer than 5
- 5 - 25,000
- 25,001 - 100,000
- 100,001 - 250,000
- 250,001 - 500,000
- 500,001 - 750,000

June 2016
Results: Access to Labour

Potential Labour Force Accessible Within 45 Minutes by Transit (A.M. Peak, 2011)

<table>
<thead>
<tr>
<th>To Jobs In</th>
<th>45 MINUTES</th>
<th>90 MINUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of People</td>
<td>Fraction of</td>
</tr>
<tr>
<td></td>
<td>that have Access</td>
<td>All GTHA Residents</td>
</tr>
<tr>
<td>Downtown Toronto</td>
<td>628,700</td>
<td>10%</td>
</tr>
<tr>
<td>Toronto</td>
<td>392,200</td>
<td>6%</td>
</tr>
<tr>
<td>GTHA Average</td>
<td>214,900</td>
<td>3%</td>
</tr>
</tbody>
</table>

- GO Rail Line and Station
- Rapid Transit
- Frequent Transit Network (every 10 minutes or better)

Number of People

- Fewer than 5
- 5 - 50,000
- 50,001 - 200,000
- 200,001 - 350,000
- 350,001 - 550,000
- 550,001 - 915,000

1 Dot = 500 Jobs
Results: Transit Equity
FUTURE

- Will be used to inform the 2017 update of the regional transportation plan
- Future enhancement of connectivity toolkit through the addition of features, e.g. crowding and reliability measures
- Integration into multi-criteria decision-making frameworks
- Application to specialized uses such as labour sub-markets to support economic development
- Development of “Transit Scores” - a metric that is more understandable than VKT reductions or ridership numbers
- Always looking for new ideas and applications!
Thank You

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