Eastern Ontario's Leadership Council Economic Development

Technical Briefing Note

Using Multiple Datasets to Understand Commuting Trends in Eastern Ontario

December 31, 2020

1. **Objective:** To understand regional commuting patterns and COVID-related labour market mobility trends, the Eastern Ontario Leadership Council (EOLC), with support from the Province of Ontario, is undertaking a project called the *Commuter Transportation Analysis and Business Case Development Project* (or the Commuter Strategy Project for short). The project is designed to validate the following:

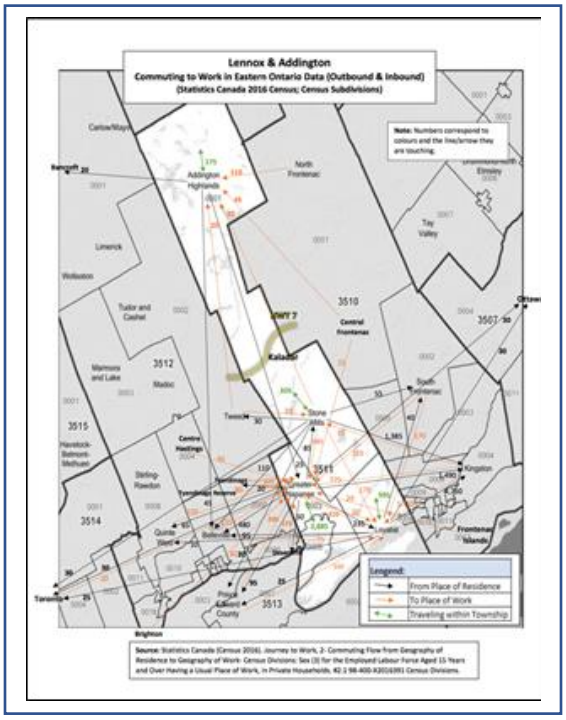
   - That lack of access to *cross-boundary* transportation is a barrier to employment in Eastern Ontario, either directly (getting back and forth to work) or indirectly (getting back and forth to training and education or accessing other employment-related services).
   - The expectation that the flow patterns of commuter (and employer) demand for transportation services are sub-regional in nature and that data analysis will suggest service designs that are well-suited to specific areas of the region.
   - That the EOLC, in conjunction with regional stakeholders, can develop business cases for commuter transportation models that are financially sustainable.
   - That existing data sets and analytics techniques can be used to estimate patterns of labour force movement within the region, with sufficient accuracy and granularity to support business case and service design decision-making, even during a pandemic.

2. **Special Data and Analytics Considerations:** Given that the Eastern Ontario labour market is at least 570,000 strong, distributed over an area of nearly 50,000 square kilometres, and situated between three major urban areas (Ottawa, Toronto/GTA and Montreal), availability of current granular data was identified at the outset as a challenge. The most recent data set on *commuting patterns* is from the 2016 Census and would not include economic and other changes having taken place since its release. Nor would this data reflect the impact of the 2020 COVID-19 pandemic with its health-focused restrictions. A method of "updating" data to current circumstances is therefore vital to the Commuter Strategy Project. Some datasets are available at the Census Subdivision level (ex. business counts) while others are available at the Census Division level (ex. Google Mobility data).

3. **Our Approach:** The methodology employed used 2016 Census Data to establish a baseline understanding of cross-boundary commuting patterns and volumes at that time. To update this information to a *pre-pandemic baseline, absolute changes* to business counts (or Percentage Change in Business Locations with Employees) were used to estimate the Estimated Total Number of Commuters as of December 2019. In addition, percentage *changes* to commuting traffic through the pandemic period (calculated using Google Mobility Data), was used to estimate "current" (end of 2020) commuting patterns and volumes during the pandemic period. Our methods are elaborated below:

- **Step 1: Establish a Census Subdivision Baseline using 2016 Census Data.**
  In order to establish a baseline, the 2016 Census commuting data by Census Subdivision for the entire region was aggregated. Where appropriate, Census Subdivisions were grouped within their Census Division. The specific data fields created using the data were:
  - Total labour force
  - Total number of commuters (all modes)
  - Percentage of commuters travelling by car (either as a driver or passenger)
  - Numbers of commuters travelling within their own census subdivision and to other census subdivisions within and outside of their Census Division
  - Identify the numbers of commuters moving into and out of each census division, and into/out of which census divisions they were moving.

- **Step 2: Map 2016 Commuting Patterns on a Census Subdivision Level**
  As shown in the sample map, commuting patterns (including bi-directional numbers) were presented in map form using the approximate centre of each CSD as the point of origin (place of residence) and destination (place of work). This method of presentation was viewed as supplementing conventional data tables and provided an additional opportunity to 'see' the data in geospatial form; this was viewed as helping local stakeholders consider major changes since 2016. These maps are available to regional stakeholders via a Dropbox link.



- **Step 3: Use Canadian Business Count data to Estimate Labour Force Changes between 2016 and December of 2019.**
  Census Subdivision level Canadian business count data for the 2016 to 2019 period (available through EMSI Analyst) was used to estimate the total number of commuters at the end of 2019. These estimates were based on two assumptions: a) that the

numbers of commuters in each CSD would have risen or fallen to the same degree that the numbers of business locations (places of employment) had changed in each CSD, and b) that the proportion of commuters travelling by car had not changed.

- **Step 4: Estimate the Change in the Total Number of Commuters in the Labour Force between January of 2020 and the end of February of 2020.**
  To align the baseline estimates of commuters moving across CSD boundaries to go back and forth to work, to the start of the pandemic restrictions (March 2020), the statistical model includes an assumption about changes between December 2019 and the end of January 2020. For the purposes of the first estimates generated, the assumption was that overall commuter volumes and directions (origins, destinations) did not change in the first two months of 2020.

Estimated Commuters Still Working from Home in Eastern Ontario

Census Division	Worked at Home data (Census Division; 2016 Census)	No Fixed Workplace Address (Census Division; 2016 Census)	# of Commuters, All Modes (Census Division; 2016 Census)	Estimated Total Number of Commuters Jan-Feb 2020 (Baseline)
Haliburton	745	1,290	24,705	7,186
Kawartha Lakes	3,170	5,045	30,095	32,563
Northumberland	3,620	4,965	17,455	19,408
Peterborough	5,115	7,845	23,265	38,557
Hastings	3,965	6,855	11,175	58,867
Prince Edward County	1,440	1,365	9,395	9,670
Lennox and Addington	1,510	2,375	18,205	16,815
Frontenac	4,850	7,215	11,470	70,220
Leeds and Grenville	4,145	5,445	30,525	46,132
Lanark	3,080	4,370	36,020	42,778
Stormont, Dundas & Glengarry	4,135	5,750	24,705	41,541
Renfrew	3,385	5,190	20,440	29,372
Prescott-Russell	3,435	5,205	32,275	36,344
Total Eastern Ontario	**42,595**	**62,915**	**289,730**	**449,453**

- **Step Five: Acquire Public Domain Estimates (by Google) of Percentage Change in Travel to Work**

  To supplement our consolidated data, our methodology used public domain data (Google Community Mobility Reports) to estimates of the percentage change in people travelling to work in specific timeframes (see table below). This information was available on a bi-weekly, then a weekly basis, and was calculated by Google in relation to a pre-pandemic (Jan-Feb 2020) baseline. This data was also used to calculate the degree to which commuters returned to work-related travel through the fall. This calculation was referred to as commuter 'rebound' (see Step Seven).

	Estimated Percentage of People Commuting at Each Date (Compared to Baseline)						
Census Division	**As of Aug 31**	**As of Sept 5**	**As of Nov 6**	**As of Nov 20**	**As of Dec 6**	**As of Dec 18**	**As of Dec 25**
Kawartha Lakes CD	-22	-18	-15	-17	-3	-14	-83
Peterborough CD	-32	-31	-23	-24	-9	-25	-82
Haliburton CD	9	16	-5	-5	-2	-3	-79
Northumberland CD	-24	-26	-15	-15	-8	-13	-84
Hastings CD	-24	-20	-10	-6	-4	-9	-81
Prince Edward County CD	-9	-3	0	-3	-8	-5	-90
Lennox & Addington CD	-29	-30	-17	-19	-10	-17	-84
Frontenac CD	-43	-40	-32	-31	-21	-33	-85
Leeds & Grenville CD	-28	-27	-16	-16	-3	-18	-81
Prescott-Rusell CD	-41	-36	-27	-29	3	-27	-85
Stormont, Dundas & Glengarry	-26	-27	-17	-16	0	-16	-81
Lanark CD	-35	-31	-25	-22	2	-23	-85
Renfrew CD	-27	-27	-21	-15	-5	-20	-81
Average Change for the Region	-25.5	-23.1	-17.2	-16.8	-5.2	-17.2	-83.2

The regional averages are simple averages only; these data have not yet been weighted by CD commuter totals.

- **Step Six: Calculate the Change in the Numbers of Commuters from the January-February Baseline**

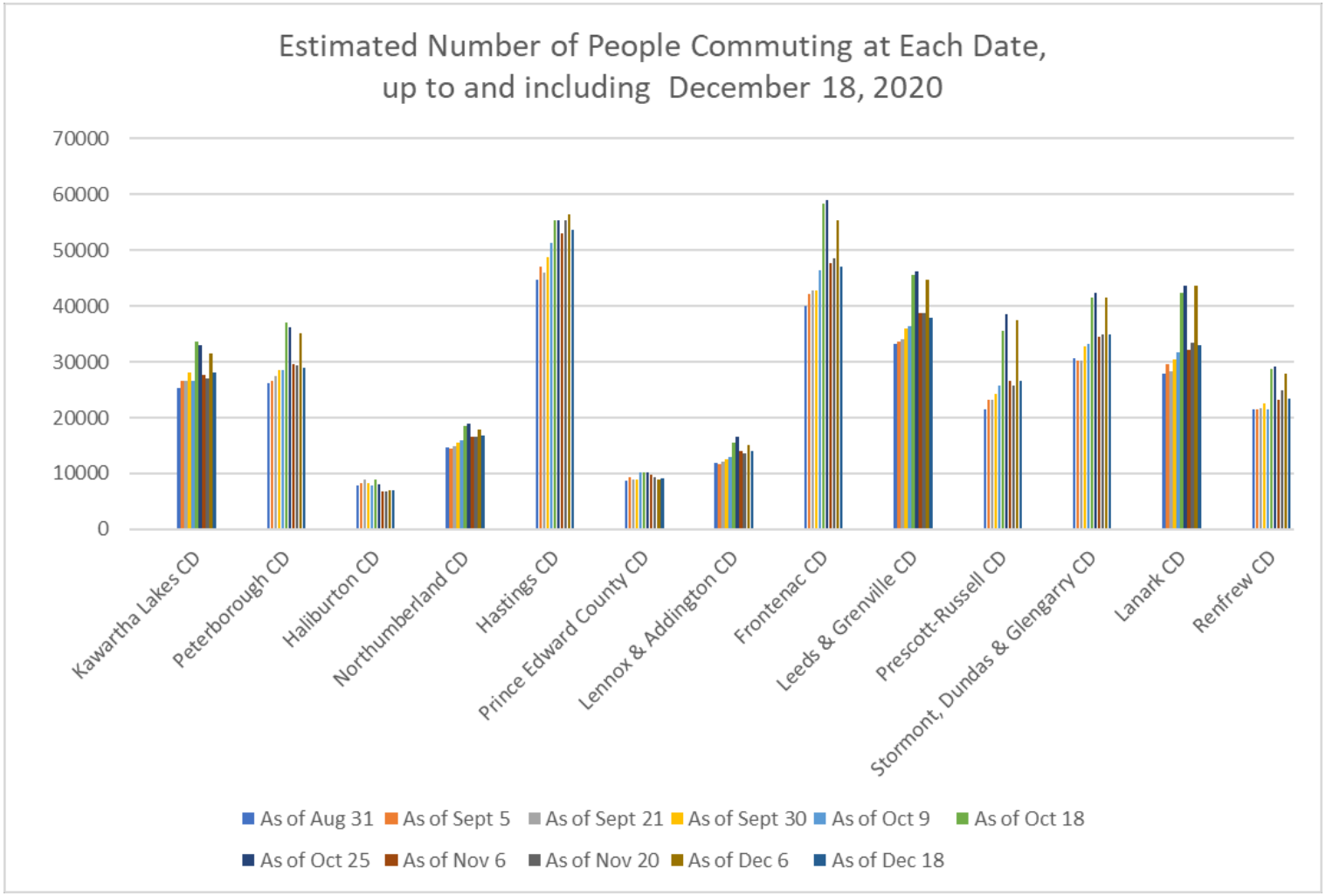
Census Division	Estimated Total Number of Commuters Jan-Feb 2020 (Baseline)	Estimated Number of People Commuting as at September 21, 2020	Estimated Number of People Commuting at December 18, 2020	Estimated Change in Number of People Commuting at December 18, 2020 compared to baseline
Kawartha Lakes CD	32,563	22,772	28,004	-4,559
Peterborough CD	38,557	12,759	28,918	-9,639
Haliburton CD	7,186	4,952	6,970	-216
Northumberland CD	19,408	8,511	16,885	-2,523
Hastings CD	58,867	33,861	53,569	-5,298
Prince Edward County CD	9,670	7,099	9,187	-484
Lennox & Addington CD	16,815	11,788	13,957	-2,859
Frontenac CD	70,220	32,984	47,047	-23,173
Leeds & Grenville CD	46,132	32,443	37,828	-8,304
Prescott-Russell CD	36,344	25,893	26,531	-9,813
Stormont, Dundas & Glengarry CD	41,541	26,047	34,894	-6,647
Lanark CD	42,778	33,577	32,939	-9,839
Renfrew CD	29,372	10,796	23,498	-5,874
Total for the Region	449,453	263,482	360,227	-89,226

- **Step Seven: Calculate the 'Rebound' in Commuter Volumes Once Regional Restrictions Began to Be Lifted in August 2020**
  Supplementing current data into our consolidation, the EOLC also drew upon Google Mobility Data to estimate the percentage change in people commuting at each date (compared to a baseline) and rebound, at the census division level. *(see below)*

	Percentage Rebound					
Census Division	Commuter 'Rebound' - August 31 to October 18 Inclusive	Commuter 'Rebound' - August 31 to October 25 Inclusive	Commuter 'Rebound' - August 31 to November 6 Inclusive	Commuter 'Rebound' - August 31 to November 20	Commuter 'Rebound' - August 31 to Dec 6 Inclusive	Commuter 'Rebound' - August 31 to Dec 18 Inclusive
Kawartha Lakes CD	25.0	23.0	7.0	5.0	19.0	8.0
Peterborough CD	28.0	26.0	9.0	8.0	23.0	7.0
Haliburton CD	14.0	4.0	-14.0	-14.0	-11.0	-12.0
Northumberland CD	19.0	21.0	9.0	9.0	16.0	11.0
Hastings CD	18.0	18.0	14.0	18.0	20.0	15.0
Prince Edward County CD	14.0	14.0	9.0	6.0	1.0	4.0
Lennox & Addington CD	21.0	28.0	12.0	10.0	19.0	12.0
Frontenac CD	26.0	27.0	11.0	12.0	22.0	10.0
Leeds & Grenville CD	27.0	28.0	12.0	12.0	25.0	10.0
Prescott-Rusell CD	39.0	47.0	14.0	12.0	44.0	14.0
Stormont, Dundas & Glengarry CD	26.0	28.0	9.0	10.0	26.0	10.0
Lanark CD	34.0	37.0	10.0	13.0	37.0	12.0
Renfrew CD	25.0	26.0	6.0	12.0	22.0	7.0
Average Change for the Region	24.3	25.2	8.3	8.7	20.2	8.3

The regional averages are simple averages only; these data have not yet been weighted by CD commuter totals.

Note: the preceding information is also visually displayed in the following bar chart. *(see below)*



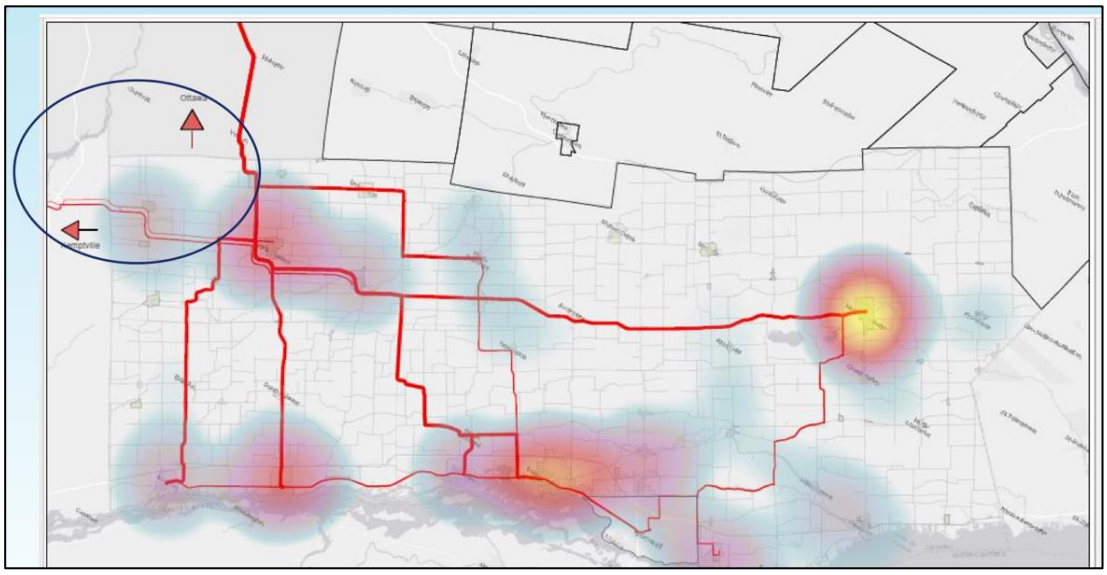
- **Step Eight: Calculate the Number of Commuters Who Returned to Work-Related Travel Between August 31, 2020 and the Latest Data for Which Google Data Was Available (currently December 18, 2020)**
  Supplementing current data into our consolidation, the EOLC also drew upon Google Mobility data to estimate the number of people commuting in each census division as the fall unfolded. *(see below)*

Census Division	Estimated Number of People Commuting As of Aug 31	Estimated Rebound (August to September 30) - Number of People Returning to Commuting	Estimated Rebound (August to October 25) - Number of People Returning to Commuting	Estimated Rebound (August to November 20) - Number of People Returning to Commuting	Estimated Rebound (August to December 18) - Number of People Returning to Commuting
Kawartha Lakes CD	25,399	2,605	7,489	1,628	2,605
Peterborough CD	26,219	2,313	10,025	3,085	2,699
Haliburton CD	7,832	359	287	-1,006	-862
Northumberland CD	14,750	776	4,076	1,747	2,135
Hastings CD	44,739	4,121	10,596	10,596	8,830
Prince Edward County CD	8,800	97	1,354	580	387
Lennox & Addington CD	11,939	673	4,708	1,682	2,018
Frontenac CD	40,025	2,809	18,959	8,426	7,022
Leeds & Grenville CD	33,215	2,768	12,917	5,536	4,613
Prescott-Russell CD	21,443	2,908	17,082	4,361	5,088
Stormont, Dundas & Glengarry CD	30,740	2,077	11,631	4,154	4,154
Lanark CD	27,806	2,567	15,828	5,561	5,133
Renfrew CD	21,442	1,175	7,637	3,525	2,056
Total for the Region	314,349	25,247	122,590	49,875	45,878

A METHODOLOGICAL NOTE: While the onset of pandemic restrictions has certainly led to significant numbers of people working from home rather than commuting to a workplace, no specific adjustments to the estimates were made through the first 10 months of the pandemic. While the work-from-home phenomenon is of significant interest to the EOLC, those members of the labour force who have been working from home in 2020 were deemed to be part of the changes in work-related travel measured by Google Mobility Data. A separate analysis has been undertaken to explore the degree to which the Eastern Ontario labour force is --- or could continue to --- work from home. Because demand for commuter transportation will be affected by the work-from-home phenomenon in the years to come, persons undertaking transportation service design and projecting volumes for a specific business case would be wise to review this analysis.

- **Step Nine: Estimate Threshold Commuter Volumes Necessary for Financial Viability of Commuter Transportation Services**
    - To begin the process of translating total numbers of commuters into a form that would be useful for commuter transportation service design, the 2016 commuting pattern data was used to identify destinations receiving the highest volume of commuters across census subdivisions and census divisions. This analysis used the data aggregated in Step Two.
    - The first step in identifying routes with the highest probability of financial sustainability was to identify communities with the largest incoming commuters flows (this information is available in the 2016 census data). These communities are considered to be the most likely end points or destinations to which commuters would need to be delivered. A minimum level of 500 inbound commuters was used as the lowest threshold for consideration as a destination.
    - The second step was to identify communities (CSDs) with at least 500 commuters that might be points of origin.
    - The third step was to identify any communities with at least 200 potential commuters, that lie between any point of origin and a destination. These communities were considered as potential intermediate pick-up/drop off locations.
    - The group of communities identified in all three steps were provided to GIS professionals for route development consideration (see Step Ten)

- **Step Ten: Use Route Finder Feature in ARCGIS Software to Plot the "Best Route"**
    - Based on the data developed in preceding steps, the GIS team at Stormont, Dundas, and Glengarry, used Environics hamlet population data and the route finder function within ARCGIS (ARCMap) to map potential service routes that met the threshold conditions noted in Step Nine.
    - ARCGIS is software commonly used by municipalities within and beyond Eastern Ontario. Municipalities often have transportation routes rendered in digital (layer) form in ARCGIS.
    - The resulting maps, an example of which is shown below, provides a geospatial overview of local area commutersheds and the highest potential commuter service routes (based on the preceding calculations). Note that precise start and end points/locations for these services would need to be established in consultation with employers, economic development officers, and other stakeholders in each commutershed.



- **Step Eleven: Consultations with key stakeholders across the region (QA and QC).**
  Following the consolidation of potential commuter demand information and preparation of GIS-based transportation routes, the datafiles were turned over to municipal GIS professionals across the region, as a first step in validating (or modifying) what a digital route-finding tool suggested. These GIS professionals are typically found in single and upper tier municipalities, and are in a position to compare the computer-generated routes with those known to be most heavily used in individual communities. Stakeholders expected to provide feedback include economic development officers and transportation managers in municipal governments, employers, employment service organizations/agencies and possibly commuters themselves. Raw data will also be provided to proponents in a forthcoming Request for Pilot Projects (January 2021).