

## **POLICY REPORT**

Innovation Policy Lab  
Munk School of Global Affairs & Public Policy  
University of Toronto

# **Mobility and Proximity in Canada During the COVID-19 Pandemic**

OCTOBER 27, 2020

**Gabriel Cavalli<sup>1</sup>, Brennan Lake<sup>2</sup>, Anita M. McGahan<sup>1,3</sup>, Emanuele Pepe<sup>4</sup>**

<sup>1</sup> Rotman School of Management, University of Toronto

<sup>2</sup> Cuebiq, Data for Good Program

<sup>3</sup> Munk School of Global Affairs & Public Policy and School of Cities, University of Toronto

<sup>4</sup> The ISI Foundation

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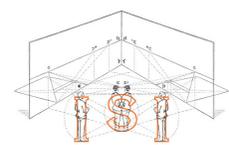
 **cuebiq**



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ISI Foundation

## **Acknowledgements**

We are grateful to colleagues at the ISI Foundation in Italy as well as leaders at Cuebiq for advice, data donation, code-sharing, and technical collaboration. E.P. gratefully acknowledges the support of the Lagrange Project of the ISI Foundation funded by CRT Foundation. Thanks to Bakersfield Visual for production design of this report.

## **Ethics Statement**

This research was reviewed and approved by the University of Toronto's Research Ethics Board in the Social Sciences on April 2, 2020, as protocol 00039205 under application HPR-00020664.

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# 1. Executive Summary

**The COVID pandemic** has had dramatic implications for the mobility and proximity of all Canadians. Before, during, and after the March 13th announcement by the Canadian federal government of fiscal stimulus programs to soften the economic impact of COVID, the people of Canada adjusted their behavior to reflect an evolving understanding of the significance and implications of the disease and its consequences. Yet March 13th marked a turning point, as the evidence presented in this report demonstrates.

The purpose of this report is to describe changes in behavior for the Canadian public, policymakers, and leaders focused on the immediate and lasting impact of COVID social-distancing restrictions on Canadian life. The analysis is the result of a six-month study led by researchers from the University of Toronto's Rotman School of Management and Munk School of Global Affairs & Public Policy working in tandem with partners from the ISI Foundation and from the Data for Good Program at Cuebiq. Under its Data for Good Program, Cuebiq donated smartphone activity data for this project. The data, which is described more fully in the body of the report, is collected through an opt-in protocol and is anonymized and privacy-enhanced so that no individual's movements are identifiable. The methodology for conducting the analysis was reviewed and approved by the Social Sciences Research Ethics Board at the University of Toronto.

The pages that follow describe estimates of the mobility and proximity of Canadians across the country and in major cities. The first focus is on mobility, which we assess using a technical measure called the "Radius of Gyration" (ROG). The ROG for an individual on a specific day (or week) is assessed as the average distance that person's smartphone travels from a focal point such as a residence, with the average weighted by the amount of time spent away from that focal point. However, as noted, we do not report on the movements of any individual. Instead, we report on the median ROG calculated for all individual smartphones

whose focal point is in a specific census division. Changes in the ROG for an area represent changes in the mobility of the smartphones in that place.

The overall pattern across virtually all jurisdictions is an initial sharp reduction in mobility in March followed by recovery. By June, mobility in most places had recovered somewhat, and by mid-July, mobility had recovered substantially in many but not all locations. Considerable variability in mobility by census division continued into the beginning of the fourth quarter of 2020.

Not all types of mobility have increased, however. The results reported below suggest that the rebound was strongly driven by local ground rather than air travel. The presence of smartphones at airports shows enduring reductions that are significant and persistent. In contrast, we find evidence of significant increases in travel between closely located census divisions within Canada, such as Toronto and Peel; and Vancouver and Victoria.

The pattern of proximity differs from that of mobility. We estimate proximity within a particular hour as the proportion of active smartphones within an area that are co-located with others (i.e., within 50 meters) for at least five minutes during that hour. Daily and weekly proximity measures are the daily and weekly averages of the encompassed hourly proximity measures. Across most Canadian locations, proximity dropped very significantly in March and has not recovered as of the beginning of the 4th quarter of 2020. Canadians may be more mobile than early in the pandemic, but overall they continue to avoid interacting with others, with results varying somewhat by location. Shifts in relationships between mobility and proximity are as notable as the overall decline in proximity.

Much more research is needed to understand these changes in Canadian society. What is clear even at this early stage is that the pandemic has had nuanced and significant impact on the ways in which Canadians interact.

# 2. Introduction

**The purpose of this Policy Report** is to describe the mobility and proximity of Canadians before and during the COVID pandemic in 2020. The primary audiences for the report are policymakers, scholars, and the general public, each of which has an interest in understanding the changes in Canadian mobility and proximity that have occurred during the pandemic.

The foundational data for the report was donated for the purposes of research by Cuebiq through its Data for Good Program. Cuebiq, which is headquartered in the United States and Italy, gathers information on the locations of anonymous smartphones through a secure, opt-in, private, and transparent protocol. The primary purposes are (i) to support commercial enterprises in understanding consumer behavior and (ii) to support academic research and humanitarian initiatives related to human mobility.

In April of 2020, researchers at the University of Toronto, Cuebiq, and the ISI Foundation began a collaboration to address several research questions regarding the mobility and proximity of Canadians during the pandemic. These include:

- How did Canadians react to the restrictions on mobility that were implemented in March, 2020, and subsequently to contain spread of COVID? How did Canadians respond to the lifting of restrictions? Has mobility recovered to pre-pandemic levels?
- How did the proximity of Canadians to one another change with restrictions on mobility? Has contact recovered to pre-pandemic levels with the lifting of restrictions?
- What evidence do we have of changes in air travel?

The pandemic itself served as the backdrop for the research as it unfolded after the beginning of the COVID outbreak in Wuhan, China, in December of 2019. The earliest reported case of COVID in Canada was recorded on January 25, 2020, in Toronto. The patient, who had traveled by air from Beijing to Toronto, was isolated and his contacts were rig-

orously traced. Health Canada determined that the only infection by the traveler was to his spouse. Both were treated and recovered without further transmission. Canadian borders remained open with travelers screened for illness over the subsequent month. Evacuation flights for Canadians in China were arranged during late January and February. The federal government allocated substantial funds for COVID control and investments into research funding. Air and other forms of travel began to diminish as provincial and territorial health ministers discouraged all but essential travel. By early March, cases in Canada were increasing, with some tied to the U.S., Europe, and India. The day after the World Health Organization (WHO) identified COVID as a global pandemic on March 11th, Sophie Gregoire Trudeau, the spouse of Prime Minister Justin Trudeau, was diagnosed with COVID, and the pair entered self-quarantine. On March 13th, a forthcoming fiscal stimulus plan was announced, and on March 16th the government called on all Canadians abroad to return home and announced the imminent implementation of restrictions on travel into Canada. Further restrictions on mobility and warnings about proximity were issued by health ministers in each province and territory. Some restrictions have since been relaxed, while others have continued. As of October 20th, 2020, Canada has reported more than 200 thousand cases and suffered nearly ten thousand deaths. Worldwide, more than 40 million COVID infections and more than a million deaths have occurred.

Canadian life is built on norms of deep and robust social interaction, much of which has been curtailed in the interests of preventing disease transmission. The impact of the pandemic on the mobility and proximity of Canadians has been a matter of grave concern to policy makers, business leaders, governmental authorities, and the general public in the country. This report is designed to demonstrate the extent of changes in Canadian society and to demonstrate the necessity of further investigations into the causes and consequences of impact of the pandemic on the ways in which Canadians interact and collaborate.

# 3. Technical Approach

**The data donated** for this study under Cuebiq’s Data for Good program identifies measures of human location under a strict protocol that prioritizes privacy and anonymization. Cuebiq is a marketing firm that gathers anonymized data on the locations of opted-in individuals under stringent privacy protocols. The company assures that no personally identifiable information is in its datasets. Researchers must sign a privacy pledge and code of conduct. Cuebiq’s data is collected by “opt-in” from participants. The following statement appears on Cuebiq’s privacy page at [www.cuebiq.com/about/privacy-commitment](http://www.cuebiq.com/about/privacy-commitment): “Cuebiq develops a Software Development Kit that is integrated in over 100 smartphone applications related to location-based services. Users of those apps may opt-in to share their location anonymously (no personally identifiable data is collected) through a number of clear and transparent opt-in paths. Users may also opt-out at any time through a number of paths, request a copy of their data, and request that data be deleted. Cuebiq is CCPA and GDPR compliant.” This research was also reviewed and approved by the University of Toronto’s Research Ethics Board in the Social Sciences and Humanities on April 2nd, 2020, as protocol 00039205 under application HPR-00020664. Data is fully de-identified and anonymized. In order to further preserve privacy, the data provider aggregates personal areas (such as home locations) to 360,000m<sup>2</sup> grids, thereby obfuscating true home locations while allowing for demographic analysis using census data. The information reported here is aggregated to census divisions.

The measures of mobility and proximity employed in this study were developed and employed by researchers at Cuebiq and the ISI Foundation, a partner in Cuebiq’s Data for Good Program, to study the mobility of people in Italy during the pandemic. We are deeply grateful to the researchers involved in this project and in Cuebiq’s Data for Good community for sharing both advice and original code with us for this project. The approach is described

in detail in a technical paper published in April, 2020, at <https://www.medrxiv.org/content/10.1101/2020.03.22.20039933v2> (Pepe et. al., 2020).<sup>1</sup> The methodology we employed to study the mobility and proximity of Canadians is the same as that employed on the Italian data, which makes the results we obtain on Canada comparable with those reported for Italy at <https://covid19mm.github.io/>

From the location data provided by Cuebiq, and by applying the algorithms produced and adopted by Pepe et al. (2020), we derived metrics of mobility and proximity, including (i) the ROG, (ii) the proximity measure, (iii) an assessment of travel between co-located domestic census divisions, and (iv) an assessment of airport traffic. The measures are all reported as aggregations across individual data by census division.

The technical choices that we made to conduct the analysis are aligned with those made in Pepe et. al. (2020). We considered data that were collected every day for 40 consecutive weeks, from January 1, 2020, to October 6, 2020, inclusive. The pre-outbreak period was assessed as prior to March 13, 2020. Both iOS and Android devices were included, with adoption of the same conventions as in Pepe et. al. (2020) for eliminating spurious observations of both devices and locations of devices. This included eliminating short-term changes in location that occurred over periods of fewer than five minutes, with the location of the user in the five-minute period recorded as at the geometric center of the circumscribed area during that period. Each user was assigned to a census division and home location based on the most prevalent location of the device during the period between 8pm and 8am during the relevant day or week. After screening the data to eliminate devices not in use and devices that we believed might not be smartphones, we identified about 700,000 devices in Canada that could be assessed as of the beginning of the year. This number increased to 870,000 units by mid-March.

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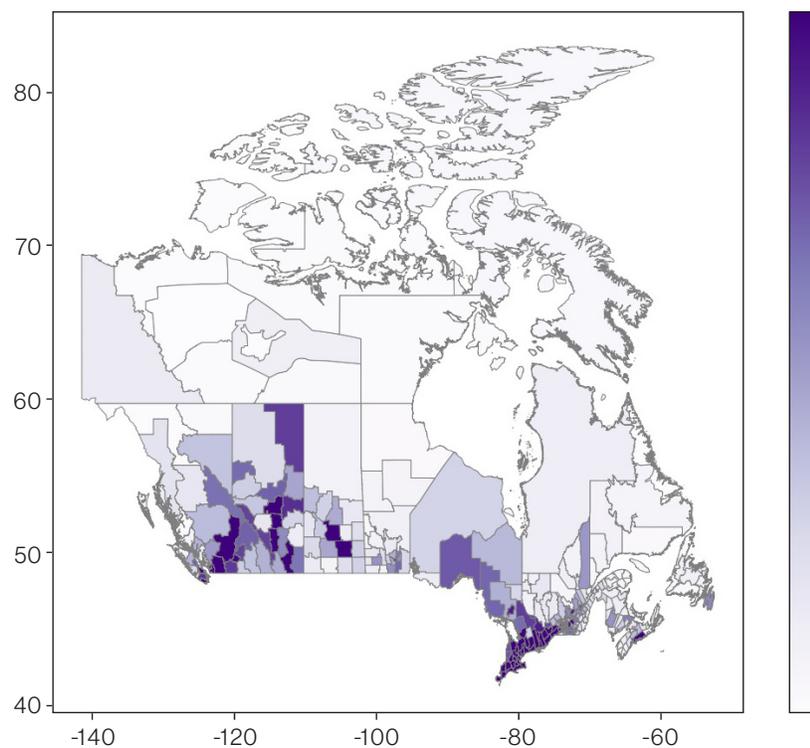
<sup>1</sup> Pepe, E., P. Bajardi, L. Gauvin, F. Privitera, B. Lake, C. Cattuto, and M. Tizzoni (2020). Covid-19 outbreak response, a dataset to assess mobility changes in Italy following national lockdown. *Scientific data* 7 (1), 1-7.

# 4. Mobility and Proximity of Canadians by Census Division

Canada is a vast country that covers a territory of more than 3.8 million square miles, of which 91% is land. Great variations in population density arise, with much of the population concentrated in urban areas and in the southern areas of the country. About half the population of the country resides in the most populated 30 of 293 census divisions. The map

below shows the concentration of identified users in the data employed in this study, with the darker areas representing a greater density of identified devices. Because the number of users is lower in the north than in the south, the results we report below for the north should be interpreted as representing the movements and proximity of fewer people.

## Active Devices in the week March 11 – March 17



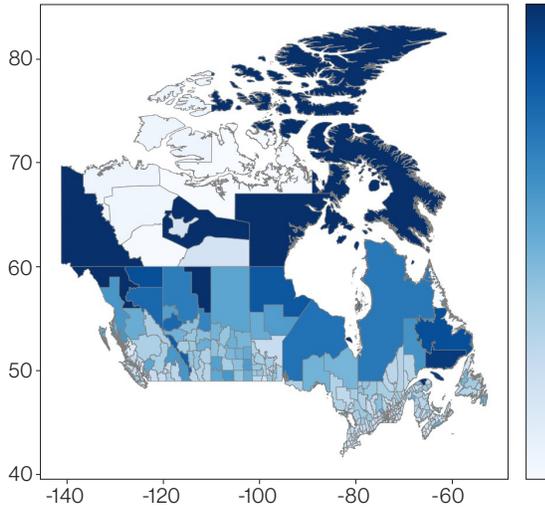
# Changes in Mobility by Week During the Pandemic

**During the period of the pandemic,** large drops in mobility as measured by the ROG occurred over the entire Canadian territory and in all major cities. The lowest levels of mobility occurred during the week of April 8-14. Especially during and after the week May 6-12, mobility began to rise. By the end of July, the overall level of mobility across the country had returned to pre-outbreak levels.

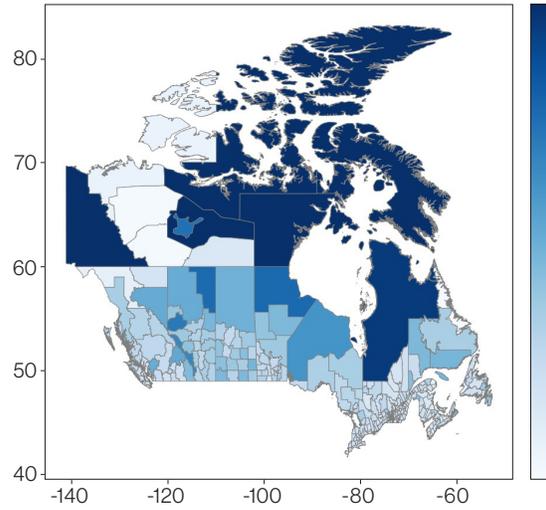
The charts below represent levels of mobility by census division for each week during the year 2020. Greater levels of mobility are associated with darker color on the maps. The results for far-northern regions of the country are more variable than for southern regions in part because of anomalies arising from the relatively smaller numbers of persons in these areas, and because of unusual weather events and other circumstances. We also note that, in the north, air travel for short trips is more prevalent per-capita than in the south. In subsequent analyses, we focus particularly on major cities defined by their census boundaries.

# WEEKLY MOBILITY

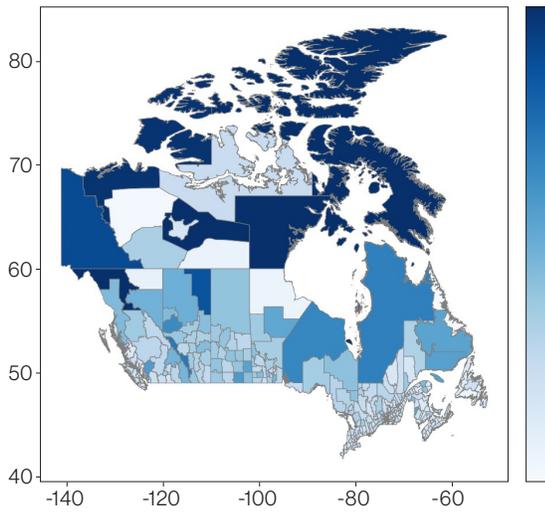
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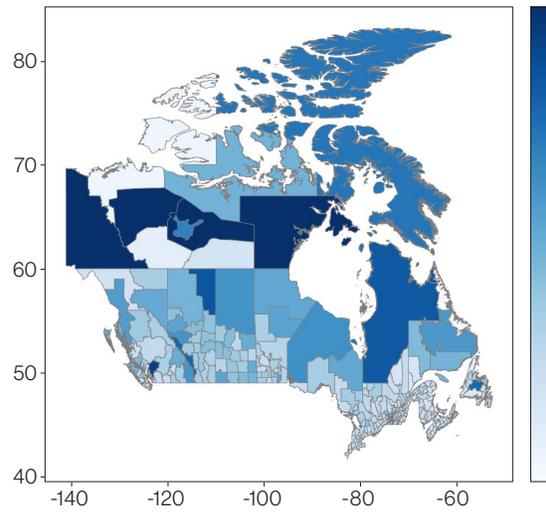
Jan 08 – Jan 14



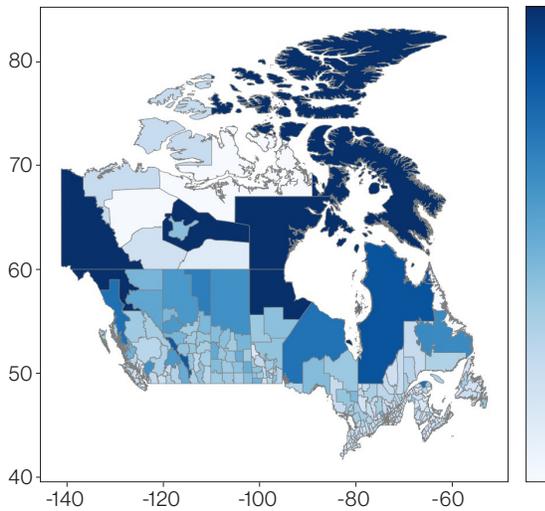
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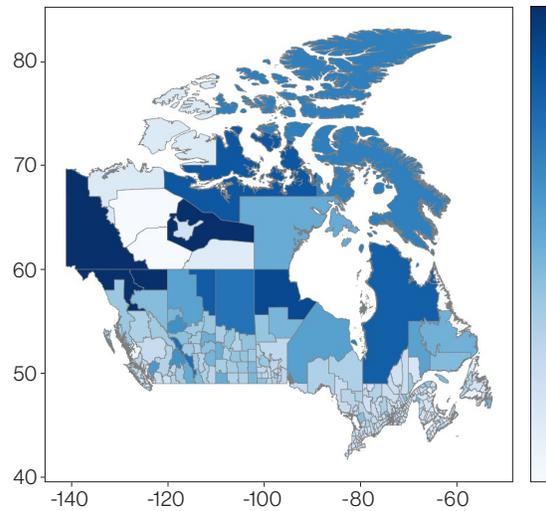
Jan 22 – Jan 28



Jan 29 – Feb 04

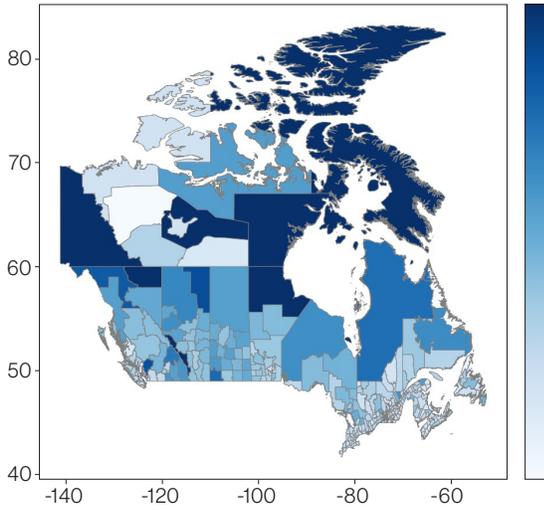


Feb 05 – Feb 11

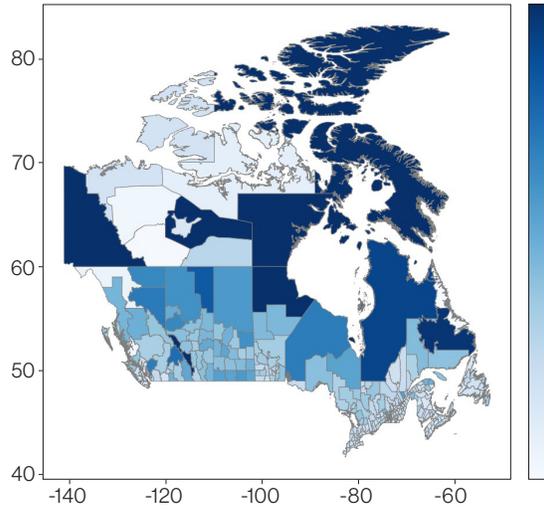


# WEEKLY MOBILITY

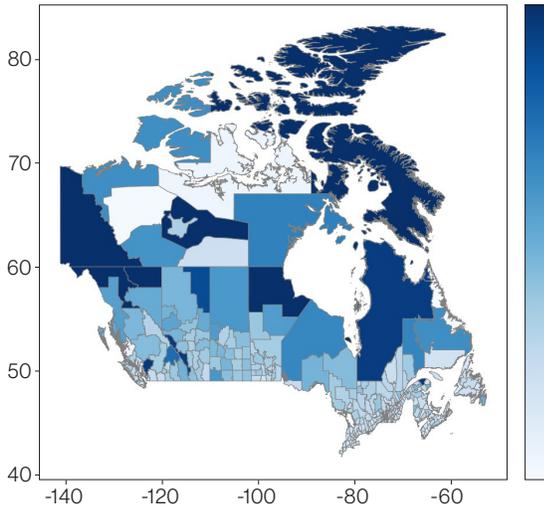
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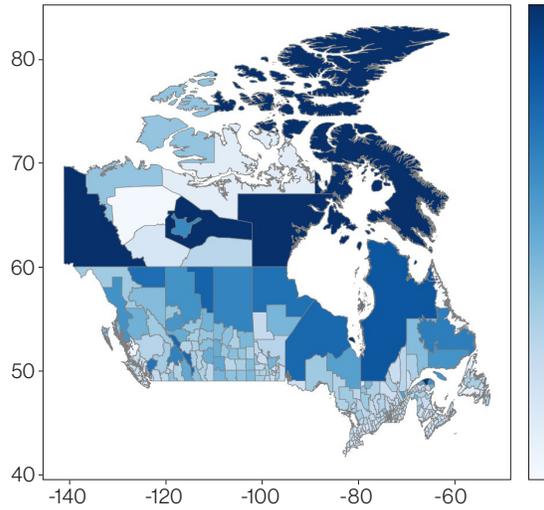
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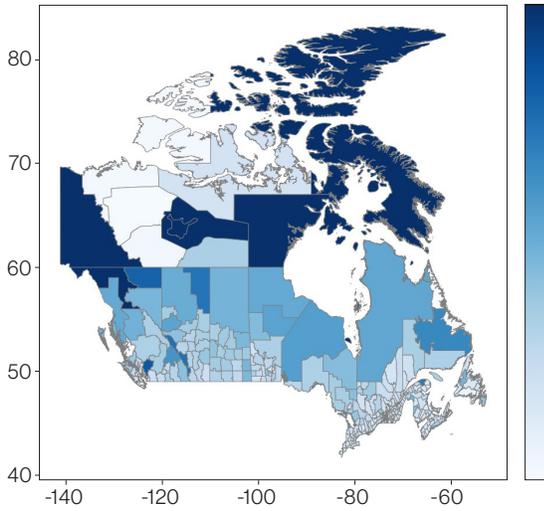
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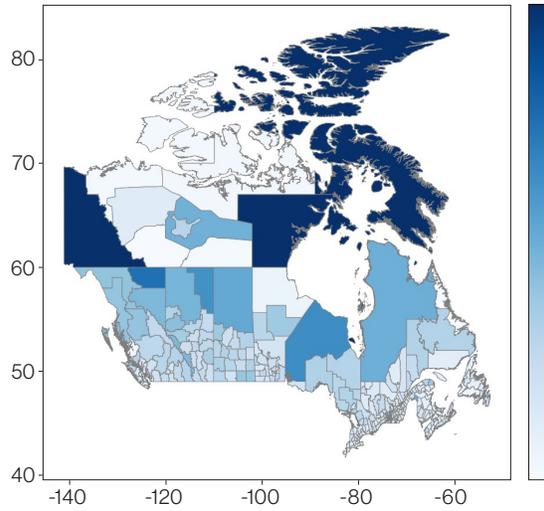
Mar 04 – Mar 10



Mar 11 – Mar 17

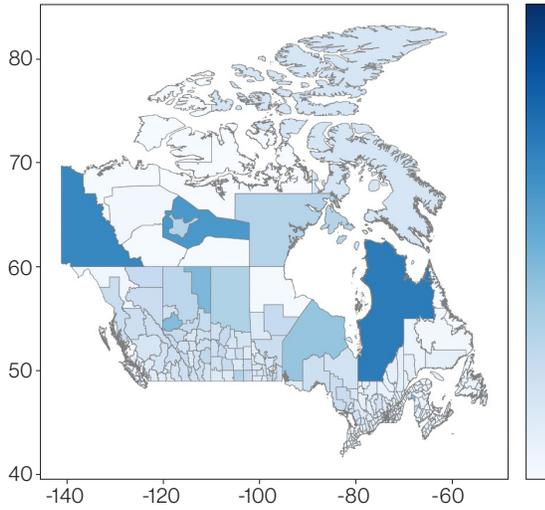


Mar 18 – Mar 24

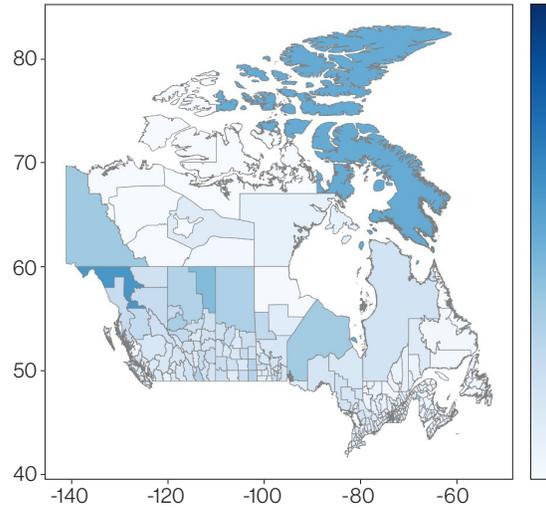


# WEEKLY MOBILITY

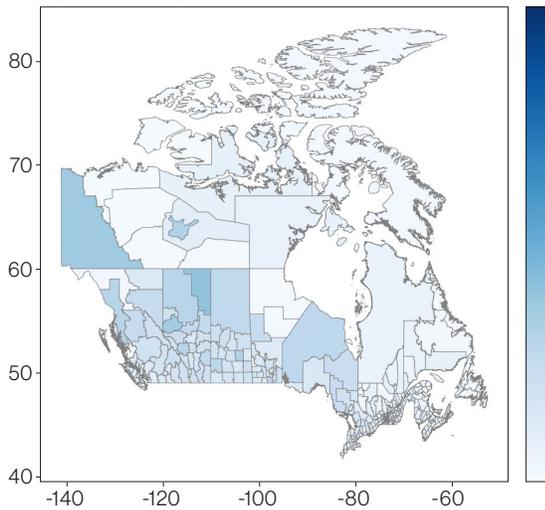
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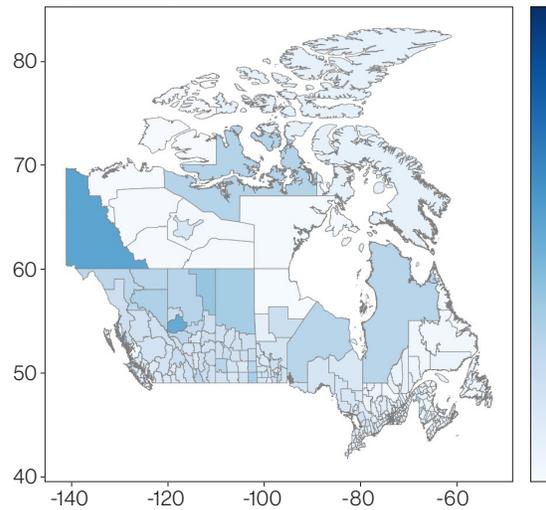
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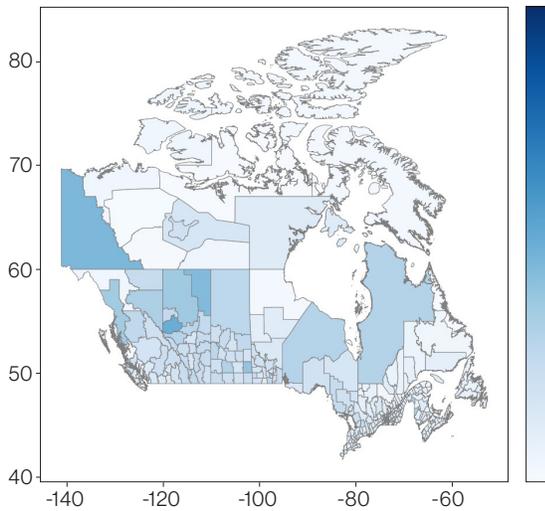
Apr 08 – Apr 14



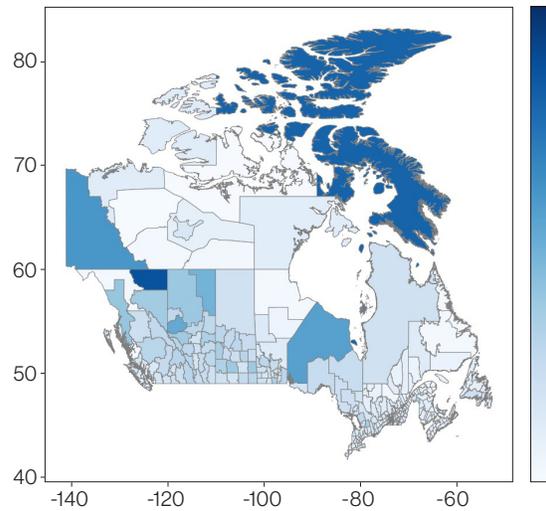
Apr 15 – Apr 21



Apr 22 – Apr 28

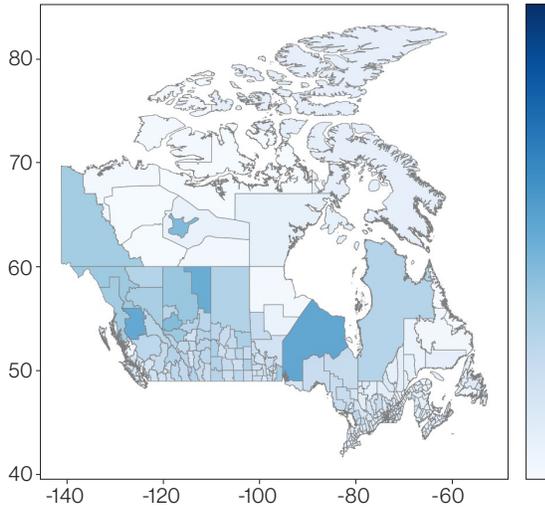


Apr 29 – May 05

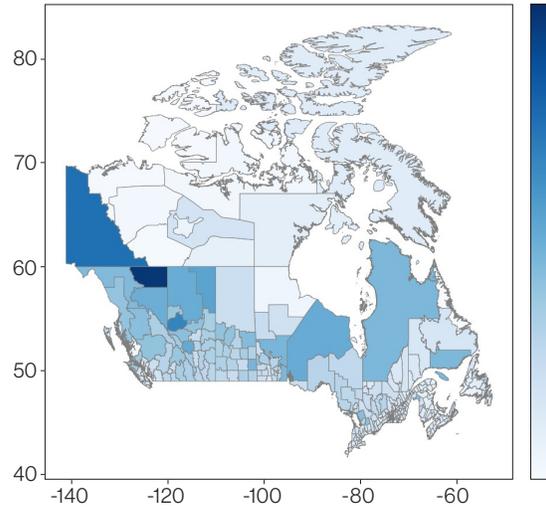


# WEEKLY MOBILITY

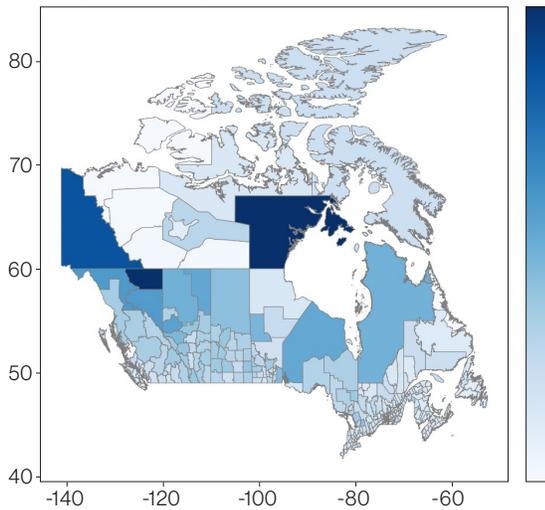
May 06 – May 12



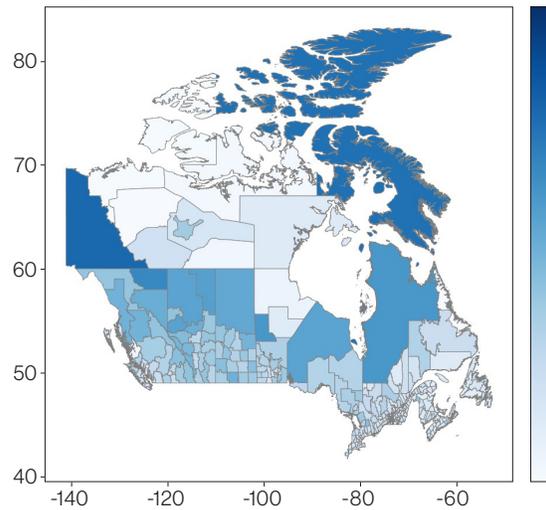
May 13 – May 19



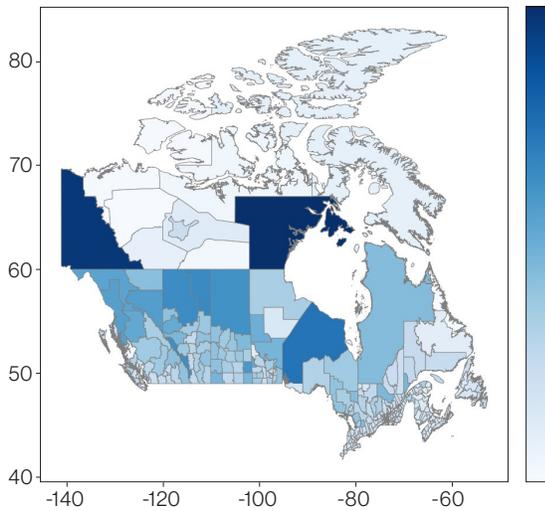
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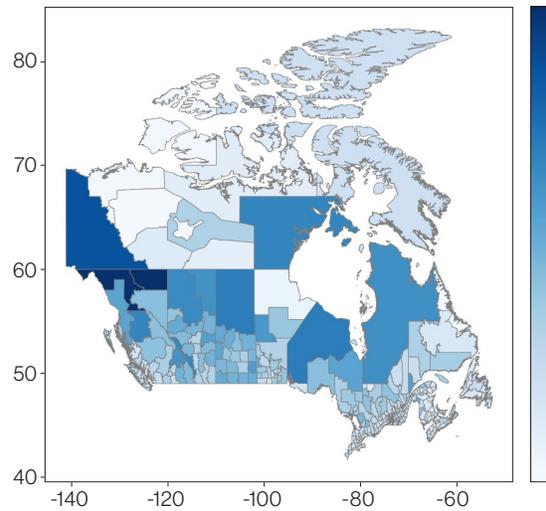
May 27 – Jun 02



Jun 03 – Jun 09

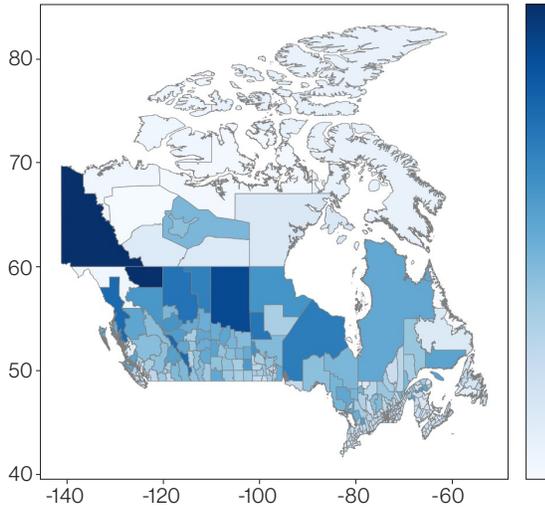


Jun 10 – Jun 16

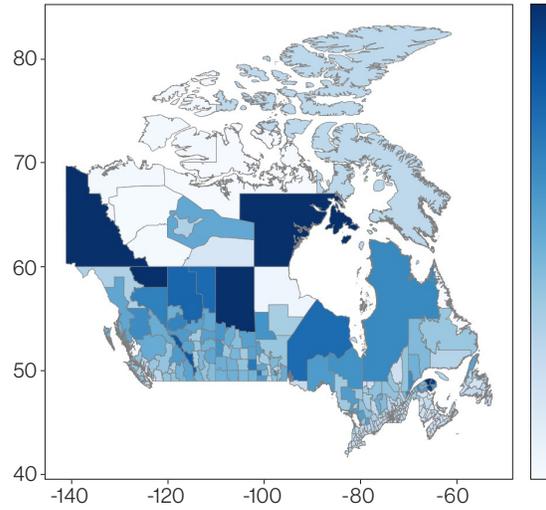


# WEEKLY MOBILITY

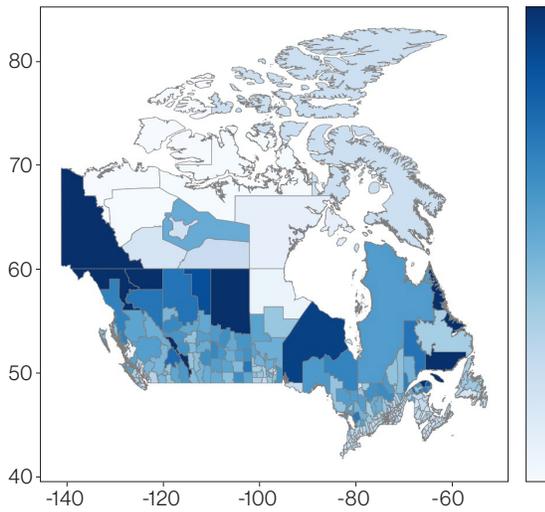
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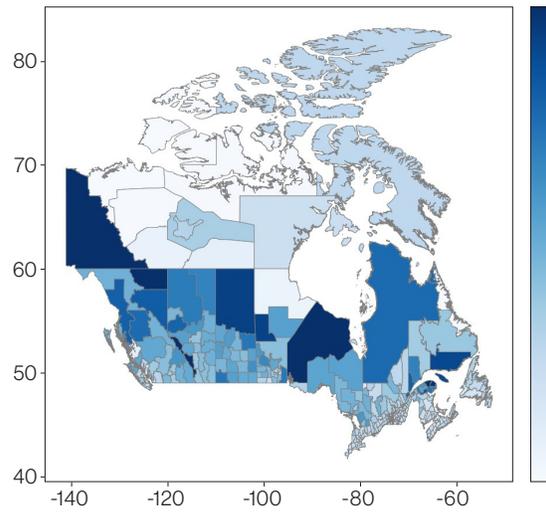
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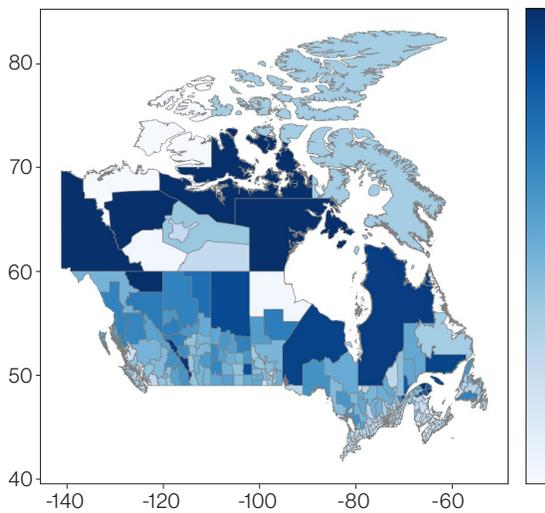
Jul 01 – Jul 07



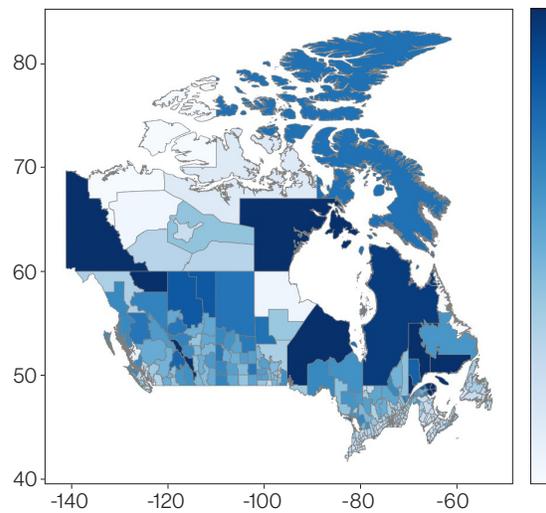
Jul 08 – Jul 14



Jul 15 – Jul 21

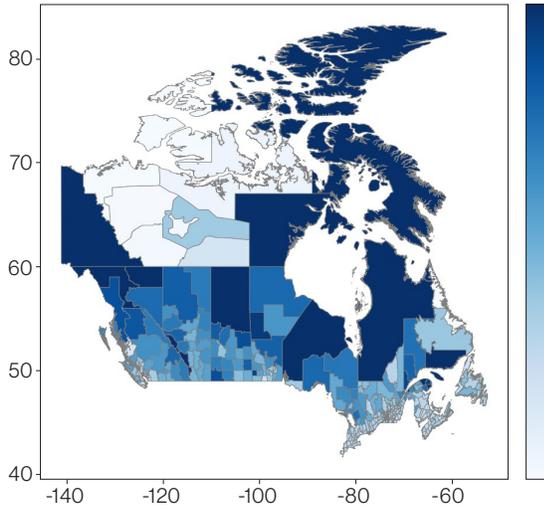


Jul 22 – Jul 28

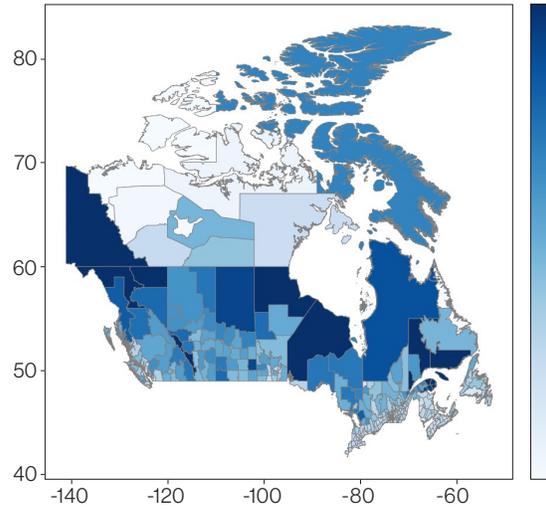


# WEEKLY MOBILITY

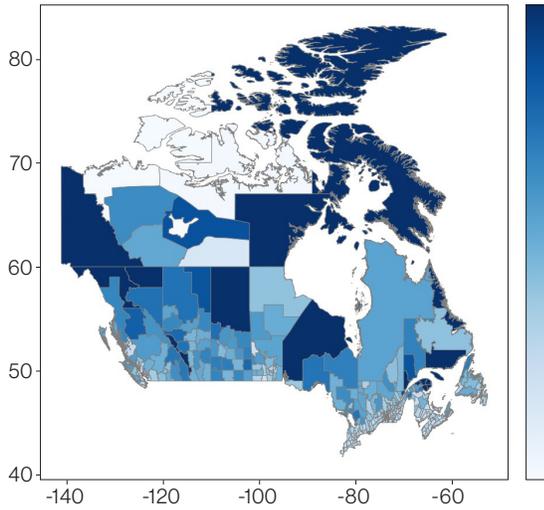
Jul 29 – Aug 04



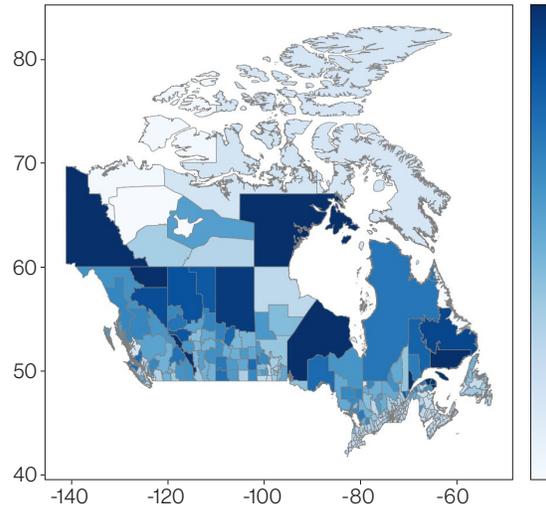
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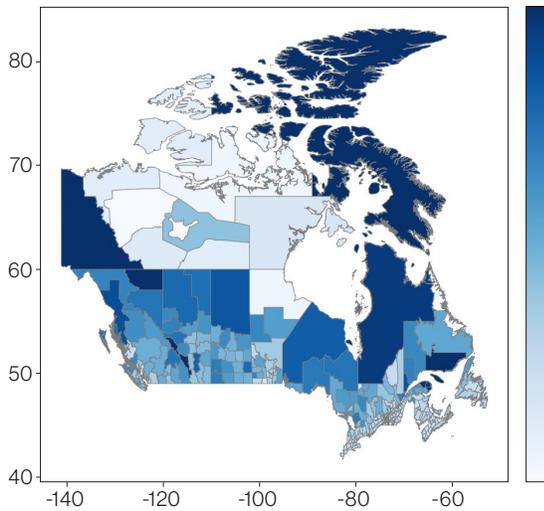
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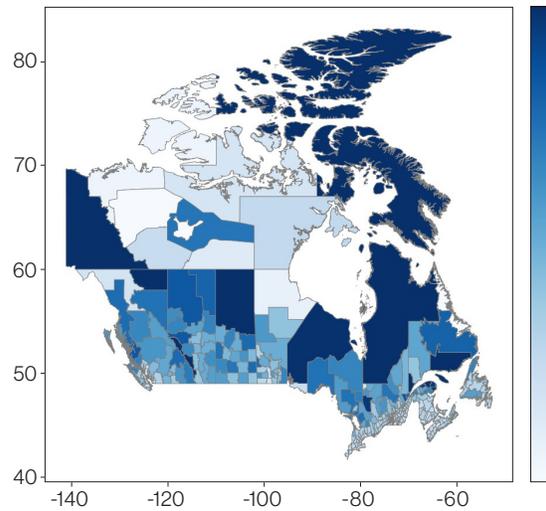
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Aug 26 – Sep 01

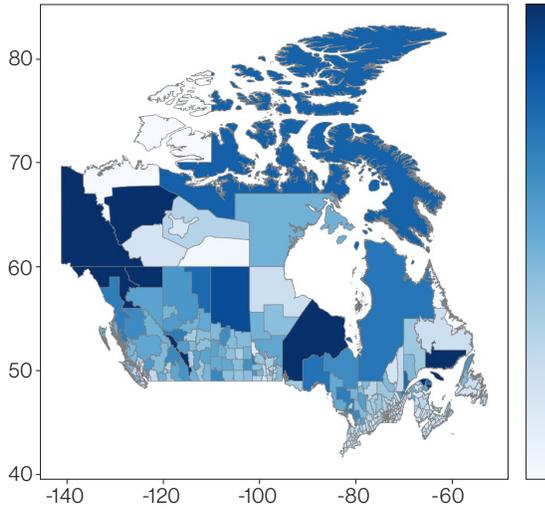


Sep 02 – Sep 08

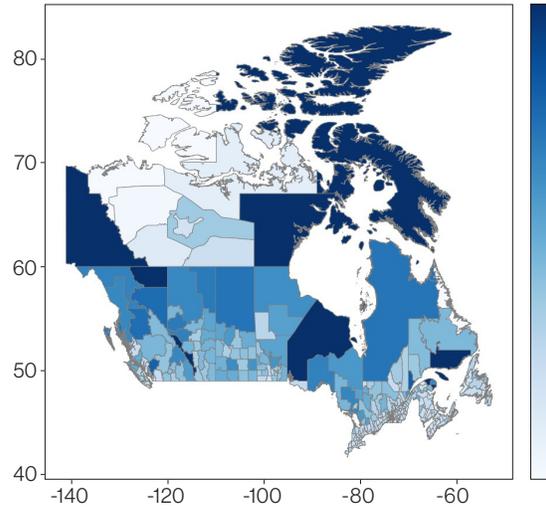


# WEEKLY MOBILITY

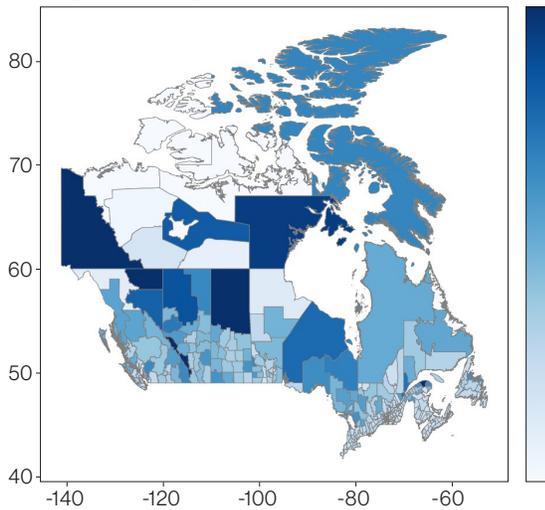
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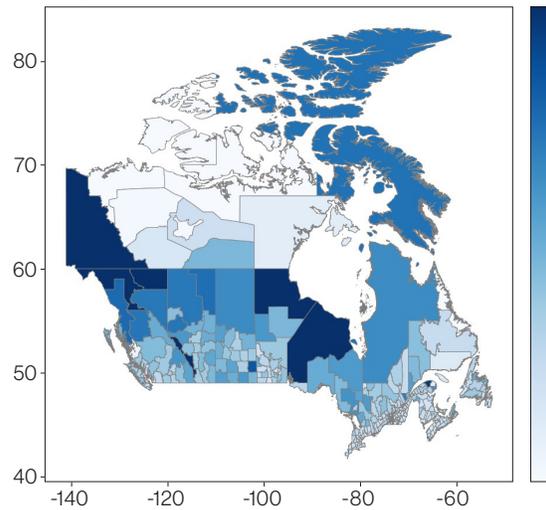
Sep 16 – Sep 22



Sep 23 – Sep 29



Sep 30 – Oct 06



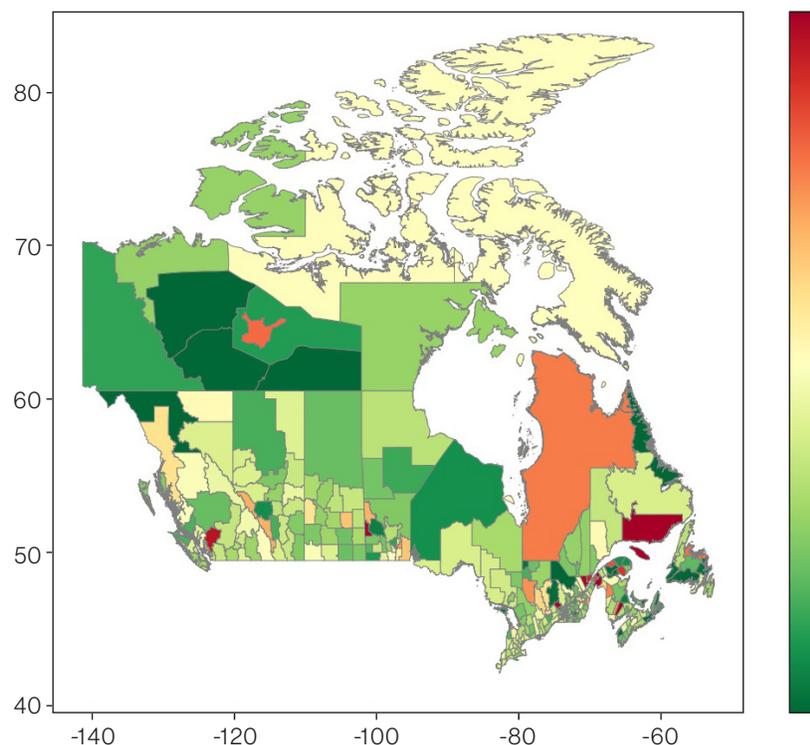
# Changes in Proximity

The goal of public policies implemented during the pandemic was to reduce proximity of infected people with those vulnerable to infection. In our analysis, we do not attempt to infer the medical conditions of individuals. Instead, we measure the proximity of all covered devices rather than those associated with infected patients. Nonetheless, the results demonstrate important behavioral changes with medical, social, economic, and other consequences.

To evaluate changes in the proximity of Canadians to one another, we followed the approach used in Pepe et. al. (2020) by measuring the co-location of users in public spaces within a radial circle of 50 meters sustained over a 1 hour period. We aggregated over users by assessing the proportion of users with proximity within a specific place

over a period of time, such as a week. The proximity of Canadians within cities is reported in the subsequent section. The chart immediately below shows the drop in proximity across the country that occurred between March 13th and 14th – i.e., immediately after the announcement by the federal government of new policies to mitigate the economic impact of the pandemic. Red areas represent increases in proximity, and are relatively rare in the figure. Green areas represent drops in proximity, and are relatively prevalent. In Toronto, Montreal, Calgary, Ottawa and Winnipeg, the average proximity level dropped between 30% and 40% on this single day. In Vancouver and Edmonton, the average proximity level dropped between 10% and 20%.

## Change in Proximity from March 13 to March 14

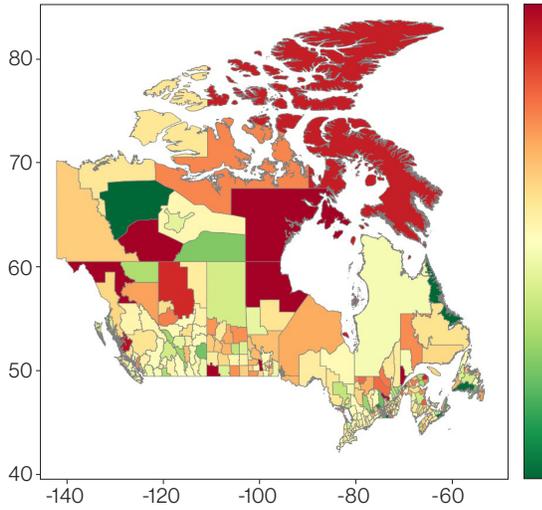


# Changes in Proximity by One-Week Intervals

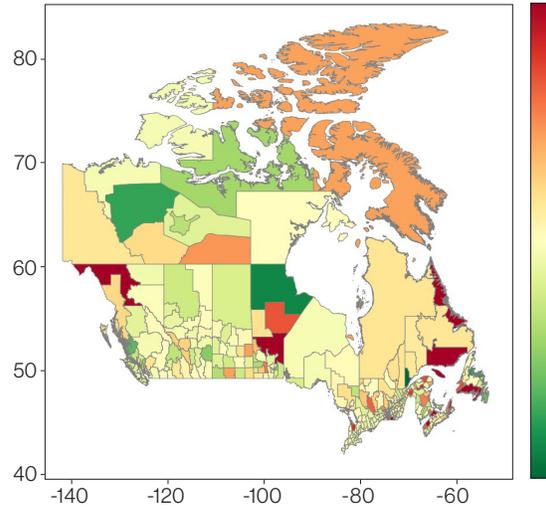
**The charts below** show changes in the proximity of people in Canada using the same approach as in the prior chart, with red indicating increases in proximity and green representing decreases in proximity. The maps are reported by week from January 1, 2020, through October 6, 2020. The results for northern regions reflect proximity of fewer people than the results for southern regions. In the north, even small changes in the behavior of a community of individuals can yield change in the proximity measures. By contrast, in the south, the calculation of the measure over a larger population leads to more consistent proximity measures.

# CHANGE IN PROXIMITY BETWEEN THE WEEKS BEGINNING ON...

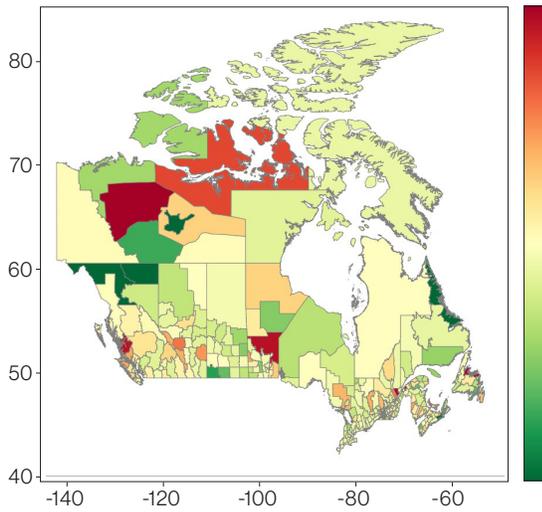
Jan 01 – Jan 08



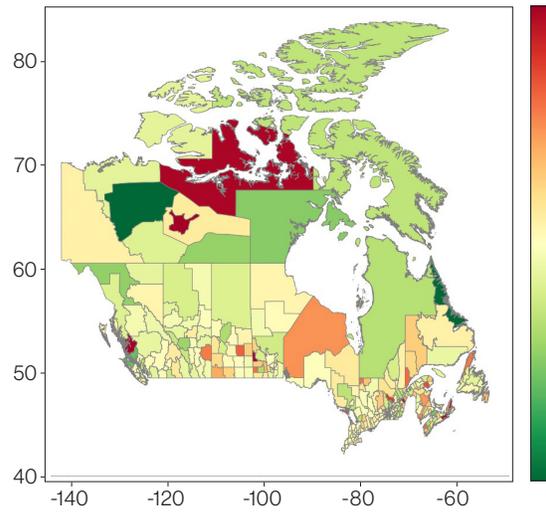
Jan 08 – Jan 15



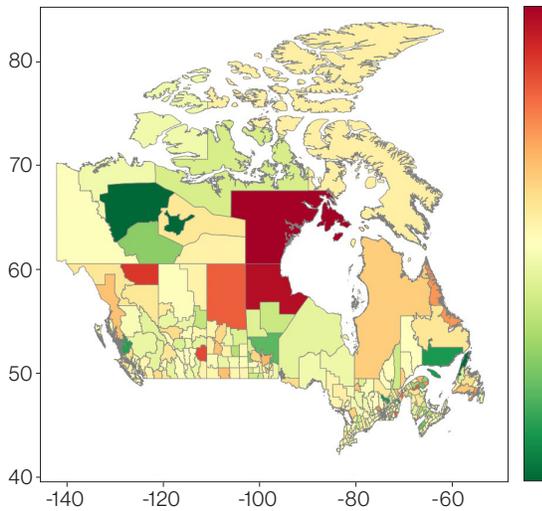
Jan 15 – Jan 22



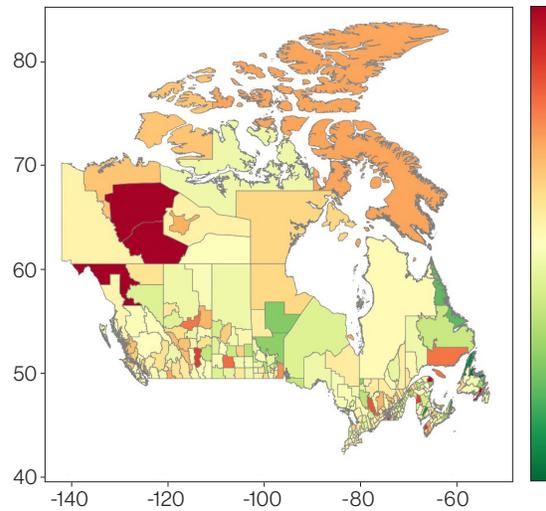
Jan 22 – Jan 29



Jan 29 – Feb 05

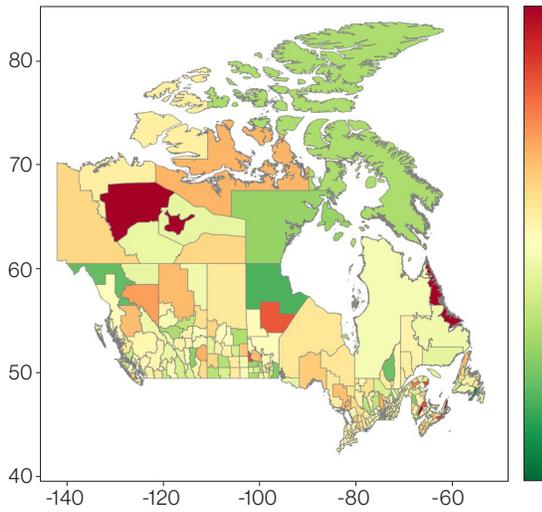


Feb 05 – Feb 12

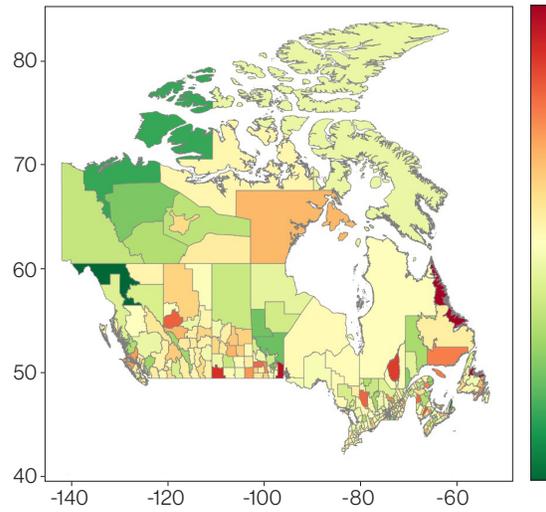


# CHANGE IN PROXIMITY BETWEEN THE WEEKS BEGINNING ON...

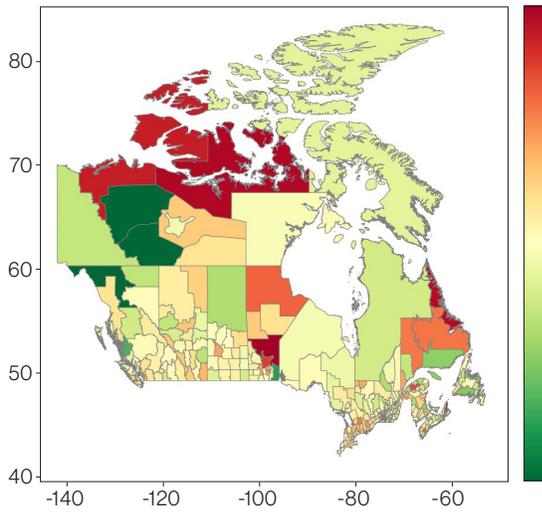
**Feb 12 – Feb 19**



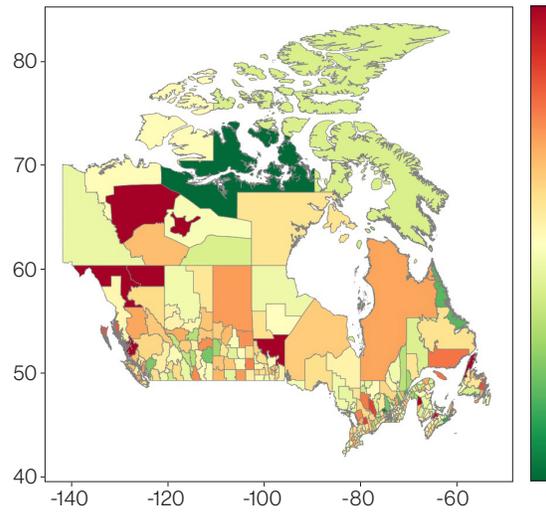
**Feb 19 – Feb 26**



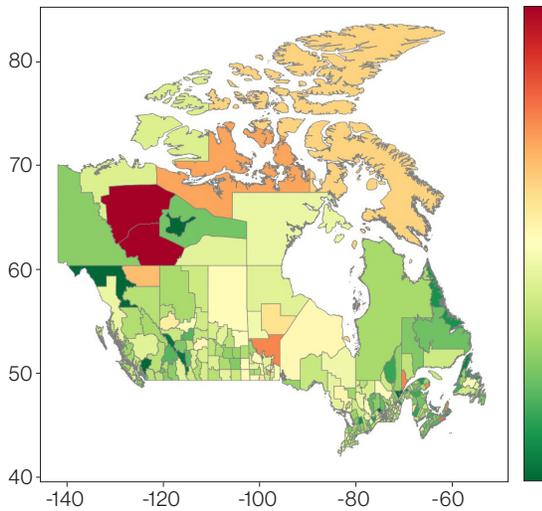
**Feb 26 – Mar 04**



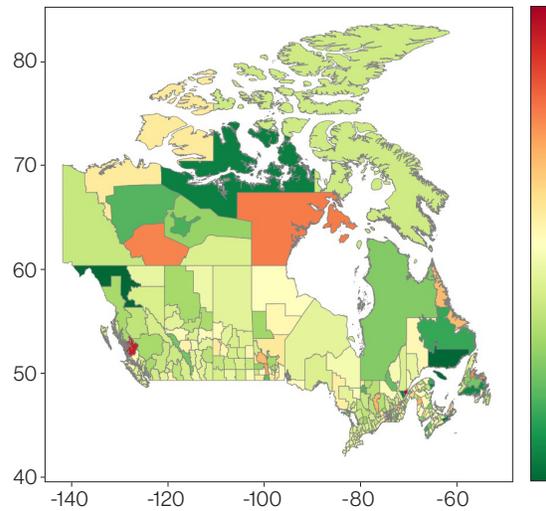
**Mar 04 – Mar 11**



**Mar 11 – Mar 18**

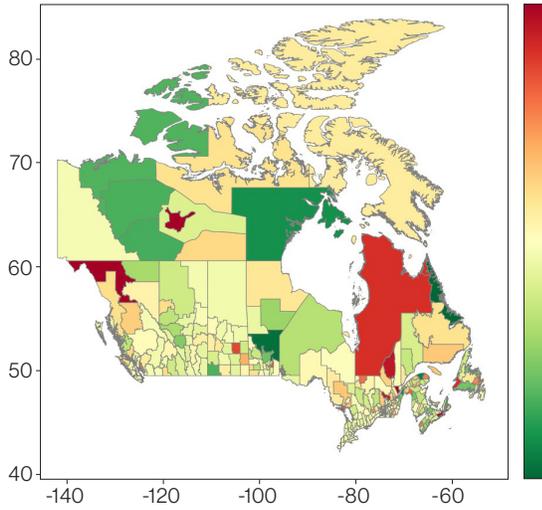


**Mar 18 – Mar 25**

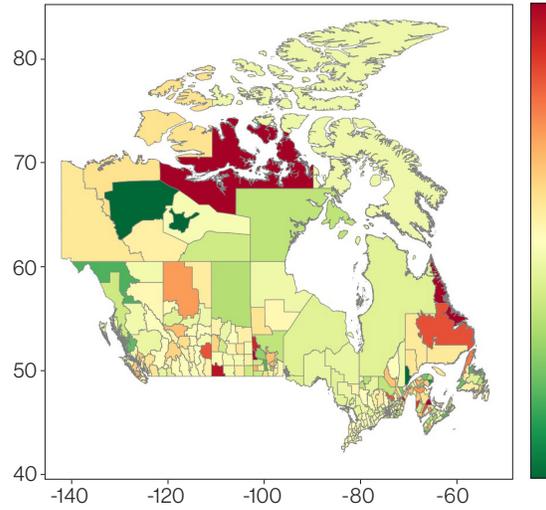


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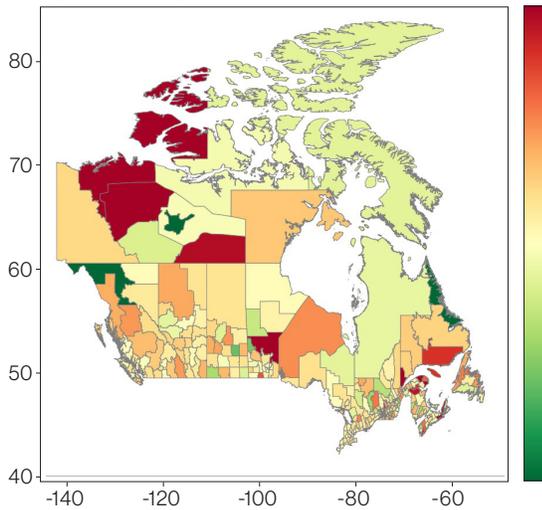
Mar 25 – Apr 01



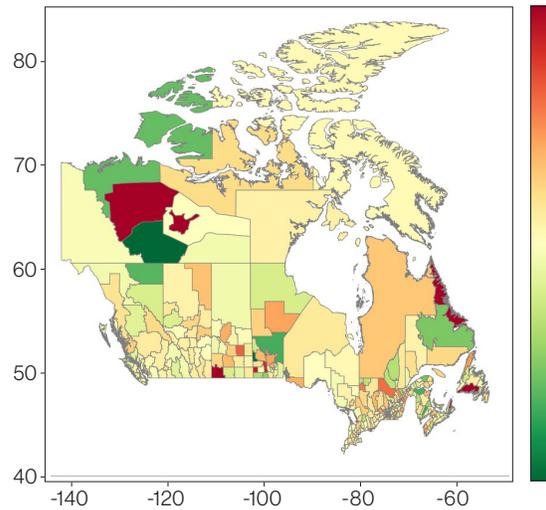
Apr 01 – Apr 08



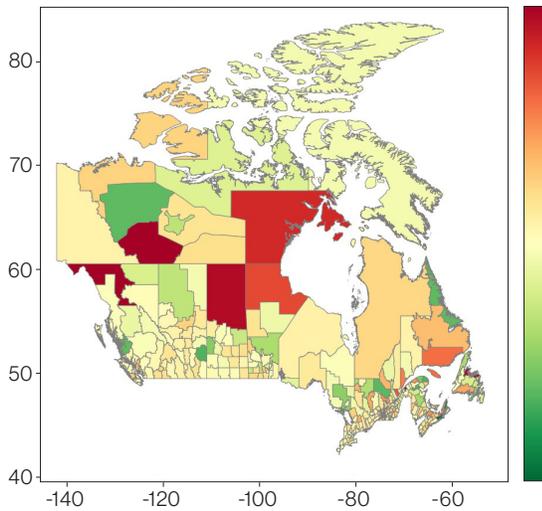
Apr 08 – Apr 15



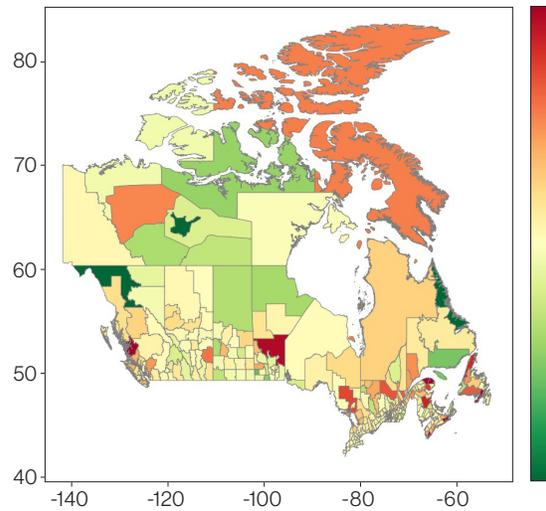
Apr 15 – Apr 22



Apr 22 – Apr 29

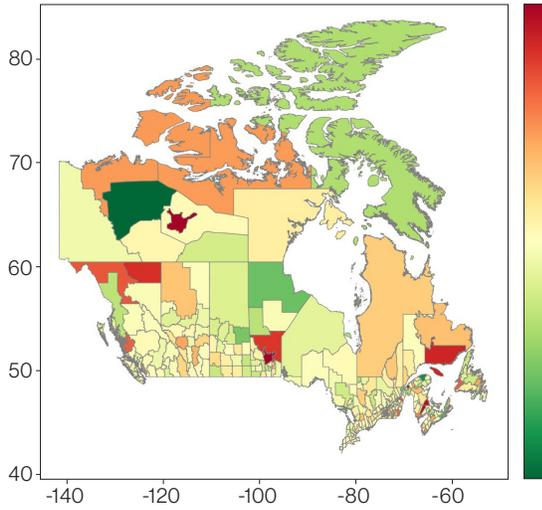


Apr 29 – May 06

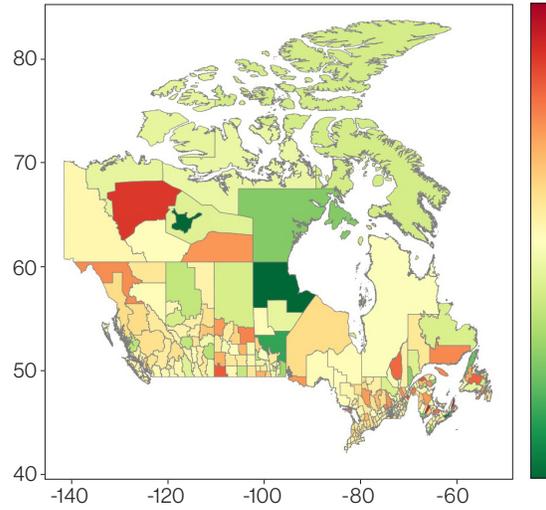


# CHANGE IN PROXIMITY BETWEEN THE WEEKS BEGINNING ON...

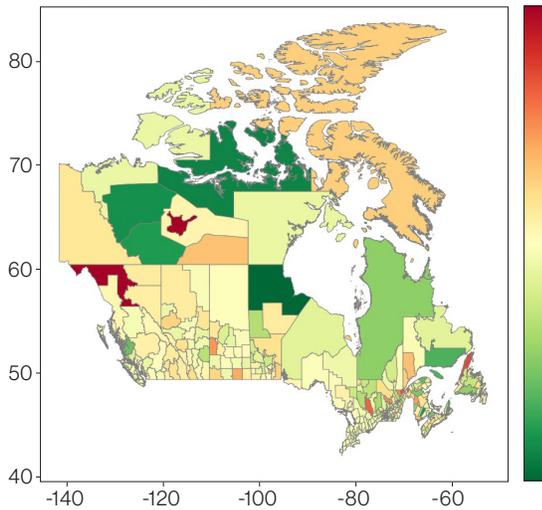
May 06 – May 13



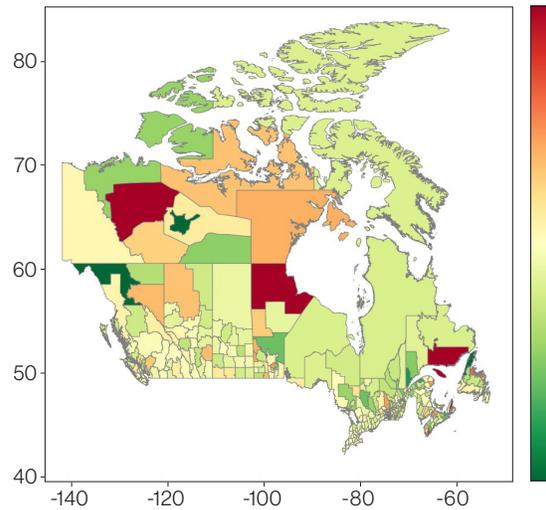
May 13 – May 20



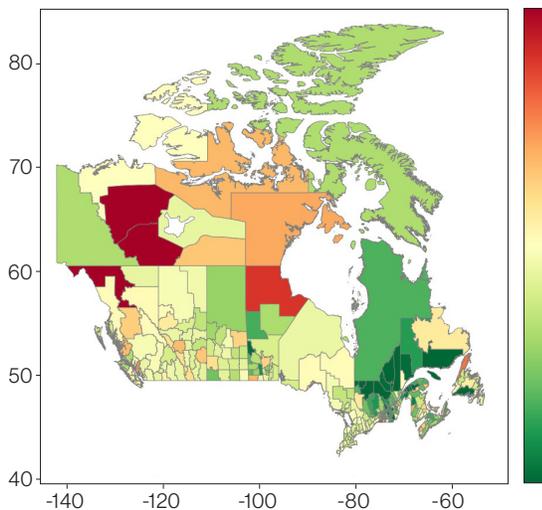
May 20 – May 27



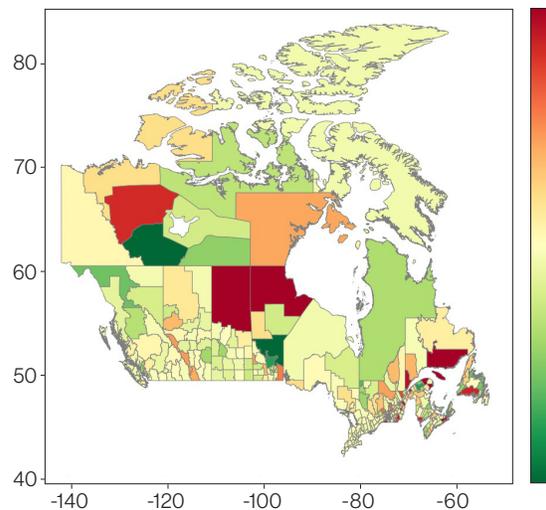
May 27 – Jun 03



Jun 03 – Jun 10

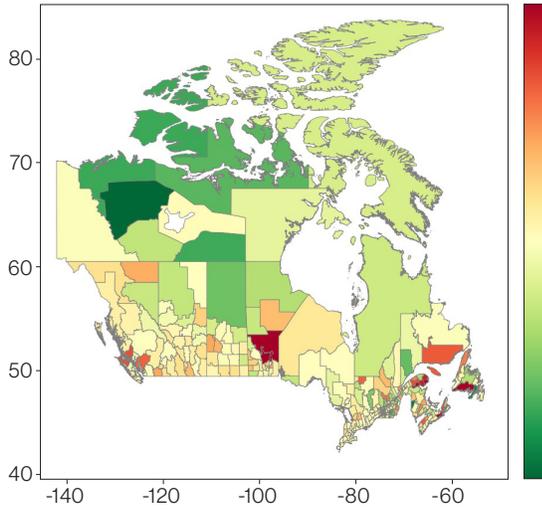


Jun 10 – Jun 17

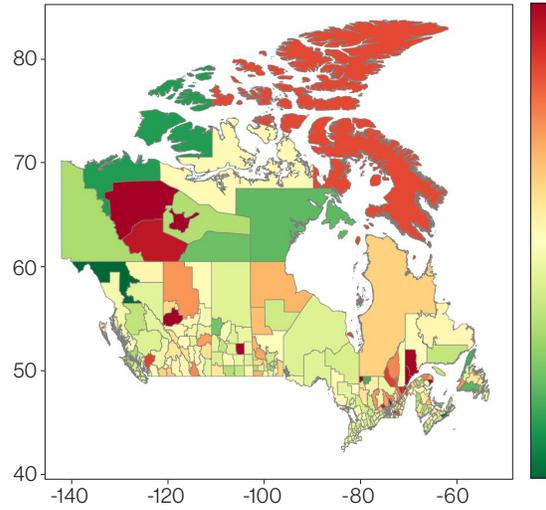


# CHANGE IN PROXIMITY BETWEEN THE WEEKS BEGINNING ON...

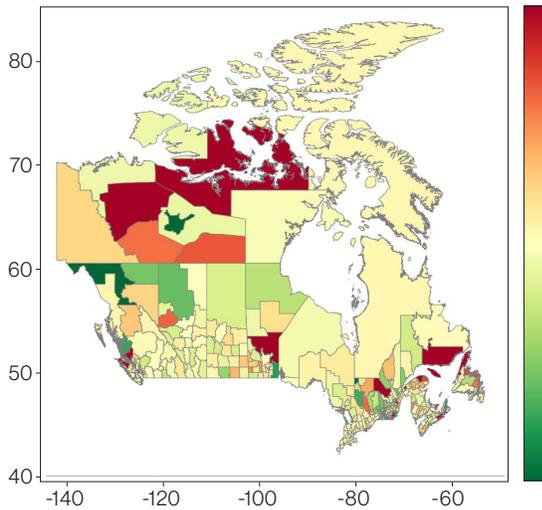
**Jun 17 – Jun 24**



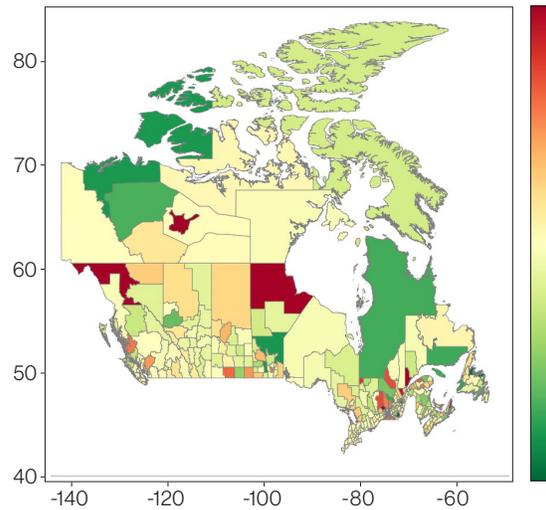
**Jun 24 – Jul 01**



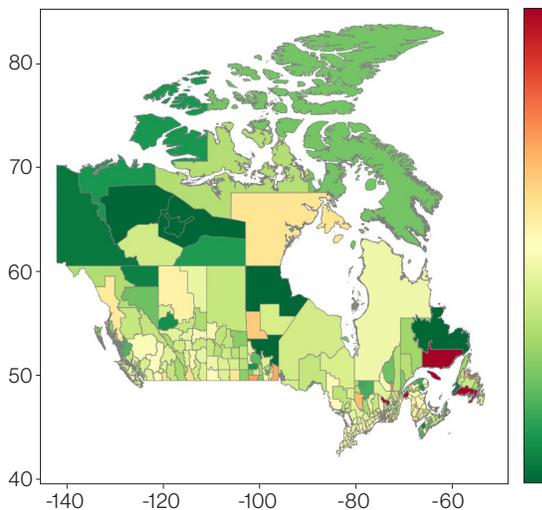
**Jul 01 – Jul 08**



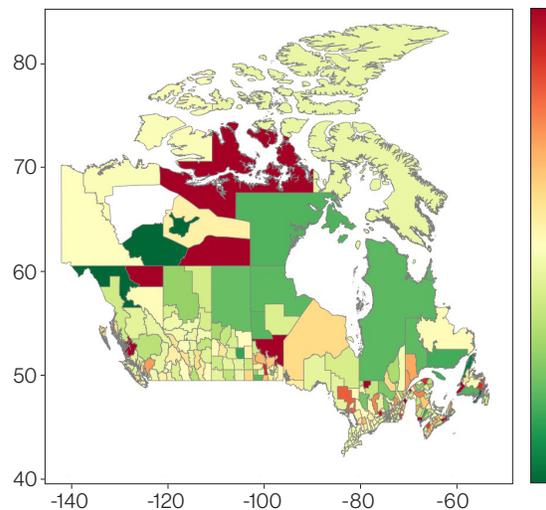
**Jul 08 – Jul 15**



**Jul 15 – Jul 22**

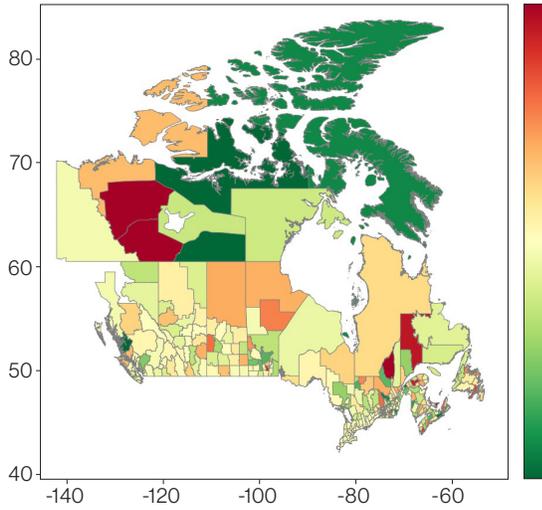


**Jul 22 – Jul 29**

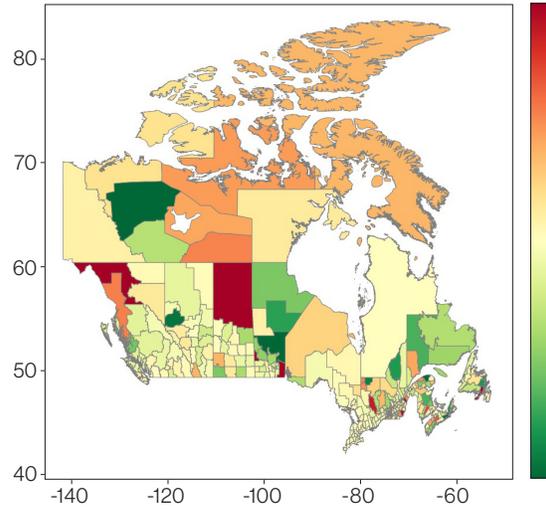


# CHANGE IN PROXIMITY BETWEEN THE WEEKS BEGINNING ON...

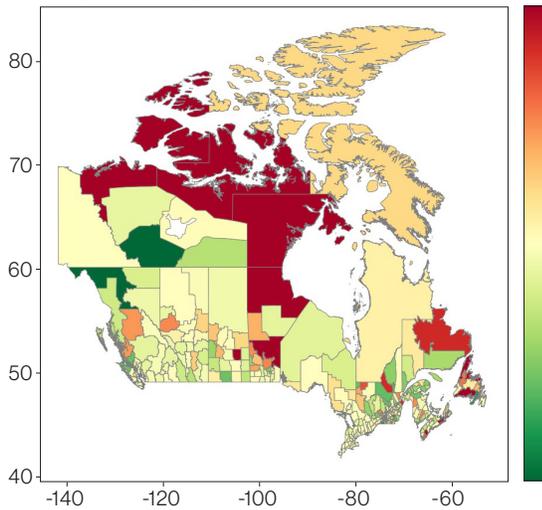
**Jul 29 – Aug 05**



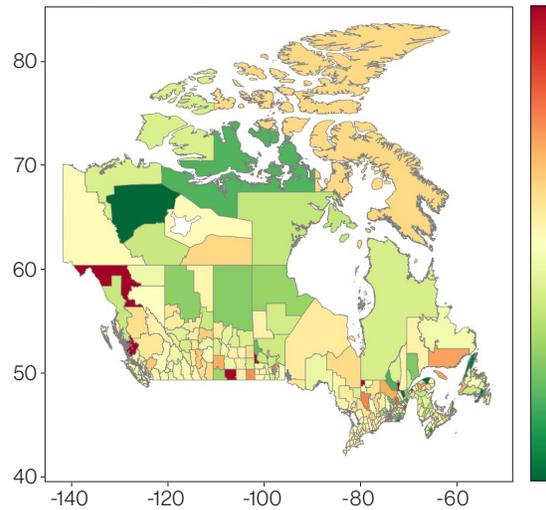
**Aug 05 – Aug 12**



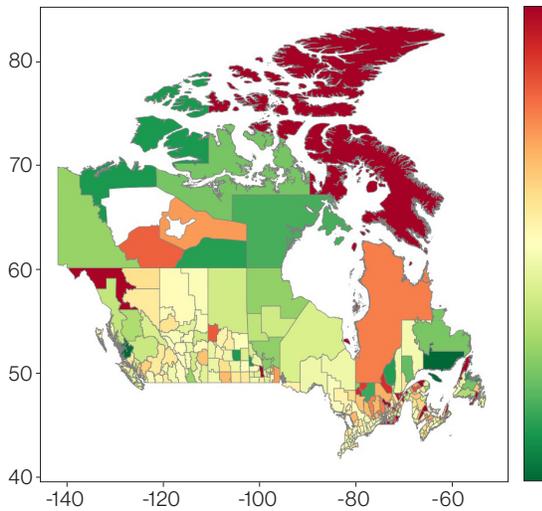
**Aug 12 – Aug 19**



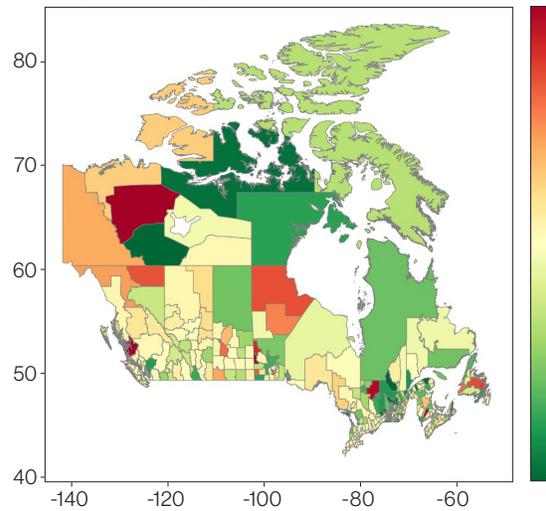
**Aug 19 – Aug 26**



**Aug 26 – Sep 02**

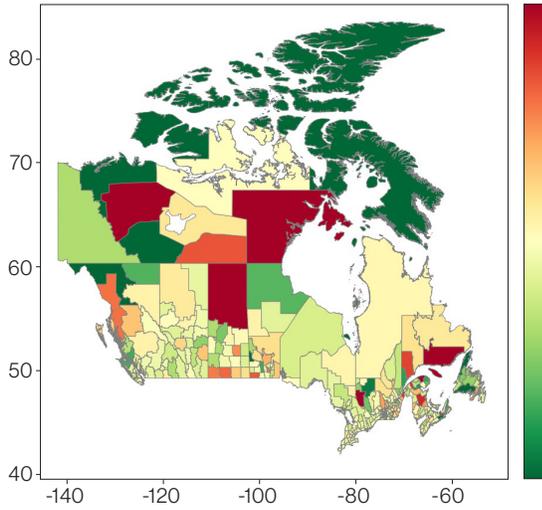


**Sep 02 – Sep 09**

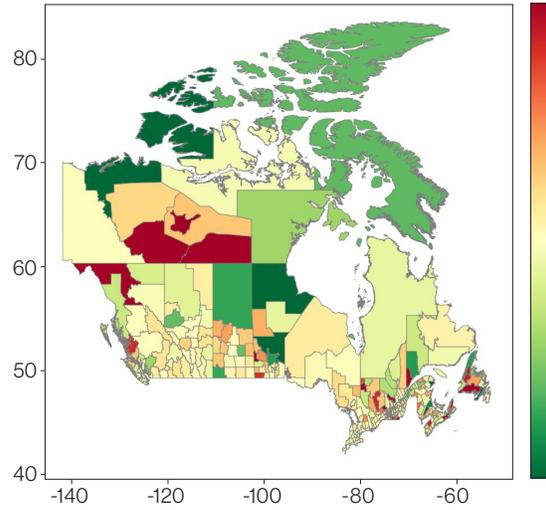


# CHANGE IN PROXIMITY BETWEEN THE WEEKS BEGINNING ON...

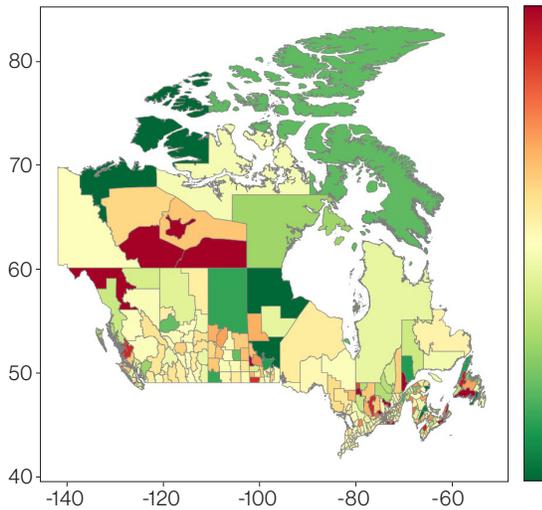
Sep 09 – Sep 16



Sep 16 – Sep 23



Sep 23 – Sep 30



# 5. Canadian Cities

**THIS SECTION** describes the mobility and proximity of Canadians in six charts for each of the country's 30 most populous census divisions, which generally correspond to metropolitan areas. The first two charts for each division represent mobility both daily and weekly. The next two represent proximity both daily and weekly. The final two represent transit into and out of cities from nearby census divisions (indexed by an anchor on the amount of transit on January 1, 2020).

The results indicate that mobility and proximity in cities generally began to decline about a week prior to the federal announcements on March 13th. Movements between co-located cities dropped at about the same time

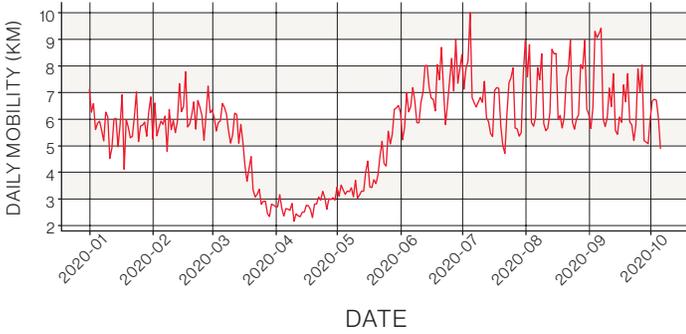
as the announcements. The overall patterns are somewhat different across cities, with some significant differences in persistence of reductions in mobility and proximity across cities. For example, reductions in Toronto, Ottawa, and Montreal have been more persistent than in Vancouver, Calgary, and Edmonton.

The 30 census divisions considered in this section belong to 8 of the 13 Canadian provinces and territories: Alberta, British Columbia, Manitoba, Newfoundland and Labrador, Nova Scotia, Ontario, Quebec, and Saskatchewan. Ordered from the most to the least populous, the census divisions considered in this section are:

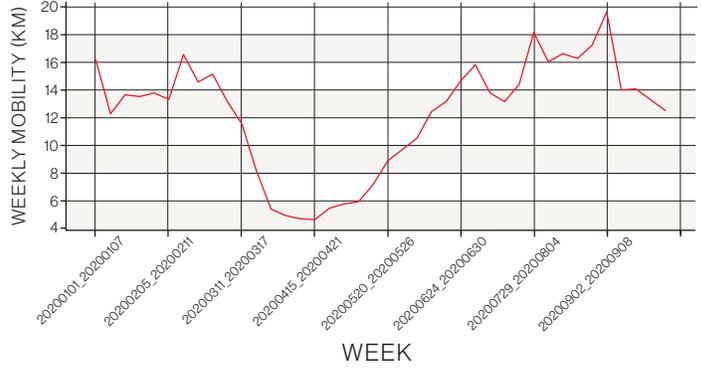
1. Toronto (ON)
2. Greater Vancouver (BC)
3. Montreal (QC)
4. Calgary (AB)
5. Peel (ON)
6. Edmonton (AB)
7. York (ON)
8. Ottawa (ON)
9. Winnipeg (MB)
10. Durham (ON)
11. Quebec City (QC)
12. Hamilton (ON)
13. Waterloo (ON)
14. Halton (ON)
15. Simcoe (Barrie) (ON)
16. Middlesex (London) (ON)
17. Niagara (ON)
18. Laval (QC)
19. Longueuil (QC)
20. Halifax (NS)
21. Essex (Windsor) (ON)
22. Capital (Victoria) (BC)
23. Fraser Valley (BC)
24. Saskatoon (SK)
25. Gatineau (QC)
26. Avalon Pensinsula (St. John's) (NL)
27. Regina (SK)
28. Wellington (Guelph) (ON)
29. Red Deer (AB)
30. Central Okanagan (Kelowna) (BC)

# TORONTO

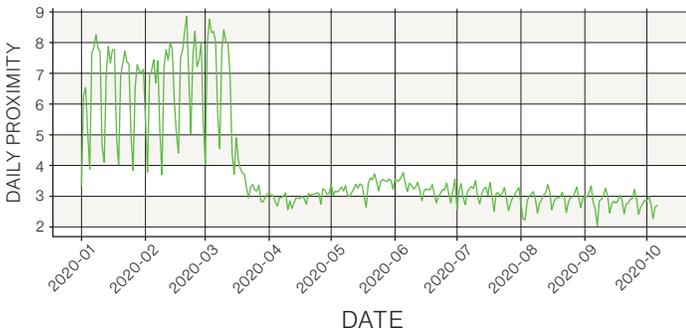
**DAILY MOBILITY – Jan 01-Oct 06**



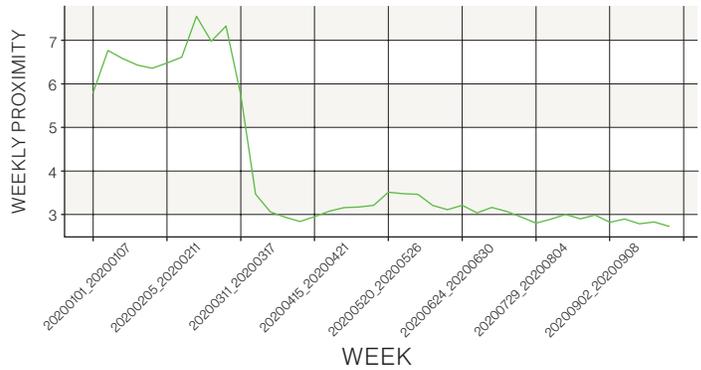
**WEEKLY MOBILITY – Jan 01-Oct 06**



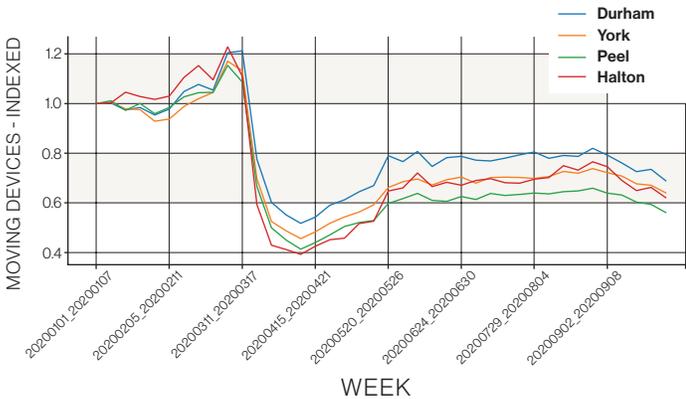
**DAILY PROXIMITY – Jan 01-Oct 06**



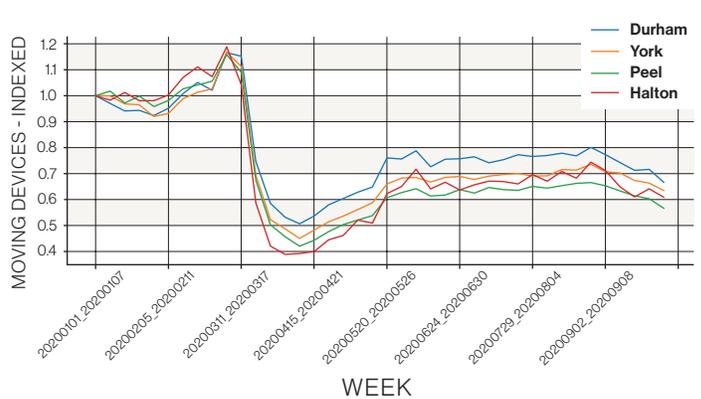
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Toronto to Neighboring Census Divisions – Jan 01-Oct 06**

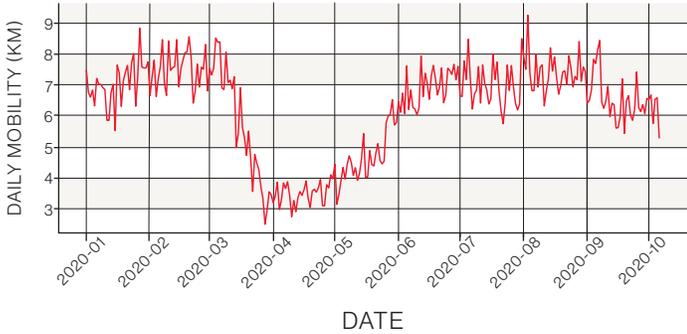


**Weekly Movements from Neighboring Census Divisions to Toronto – Jan 01-Oct 06**

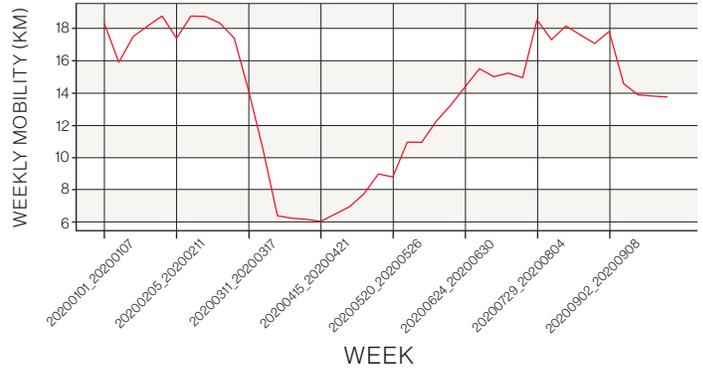


# VANCOUVER

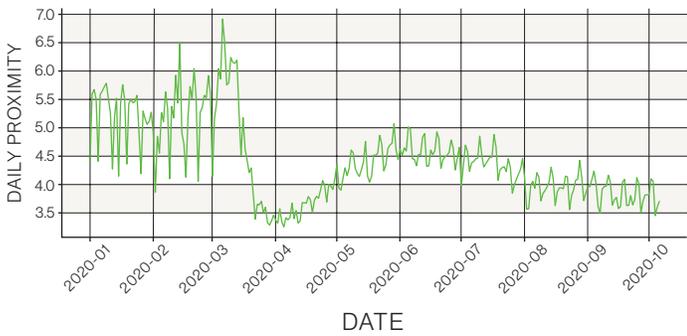
**DAILY MOBILITY – Jan 01-Oct 06**



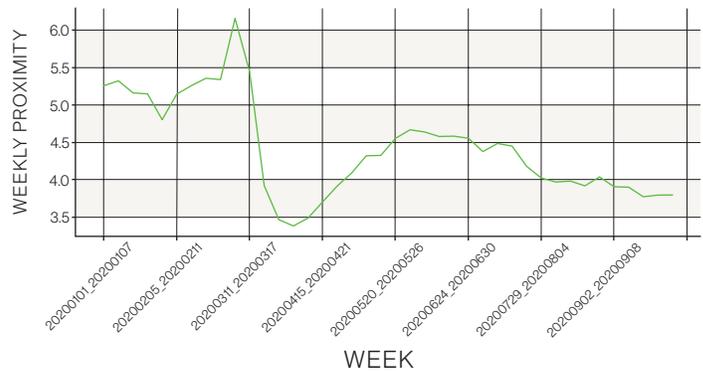
**WEEKLY MOBILITY – Jan 01-Oct 06**



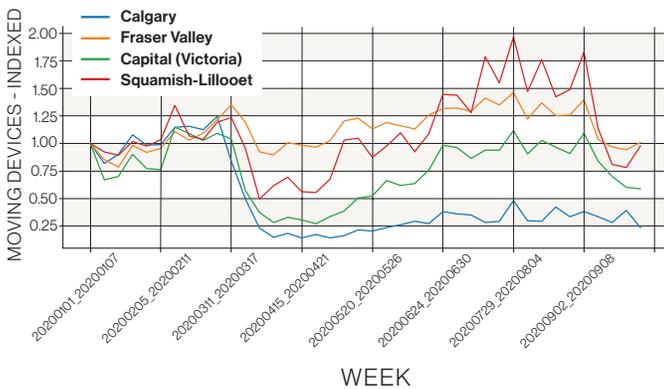
**DAILY PROXIMITY – Jan 01-Oct 06**



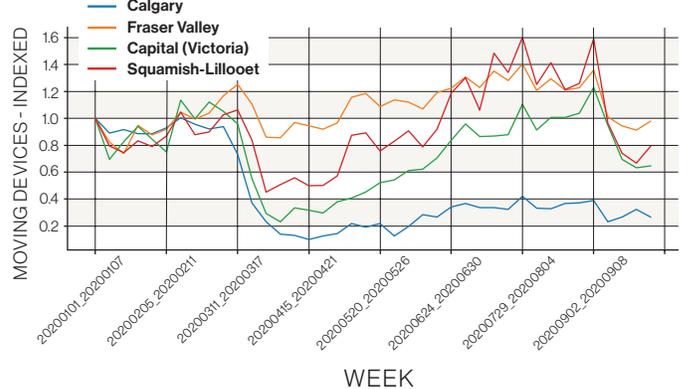
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Greater Vancouver to Neighboring Census Divisions – Jan 01-Oct 06**

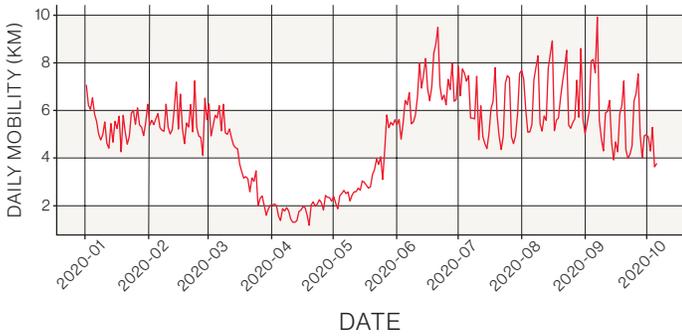


**Weekly Movements from Neighboring Census Divisions to Greater Vancouver – Jan 01-Oct 06**

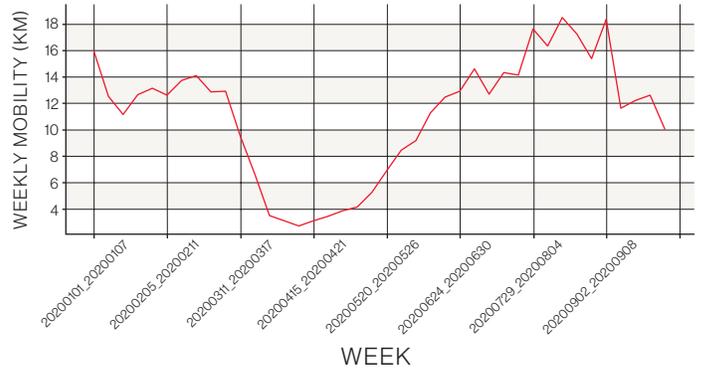


# MONTREAL

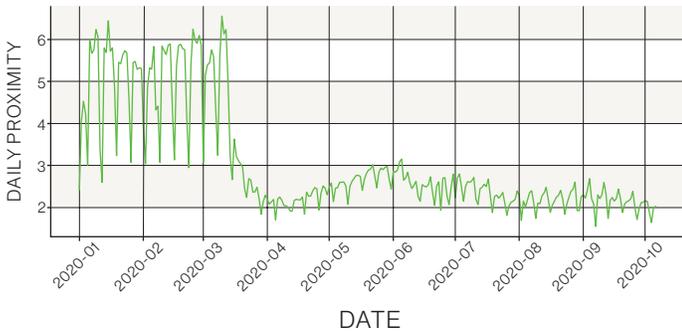
**DAILY MOBILITY – Jan 01-Oct 06**



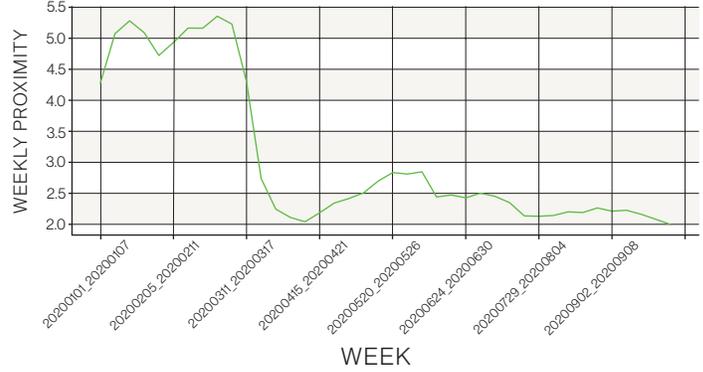
**WEEKLY MOBILITY – Jan 01-Oct 06**



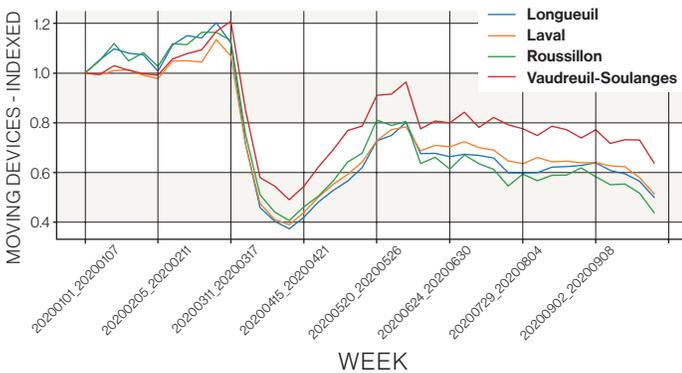
**DAILY PROXIMITY – Jan 01-Oct 06**



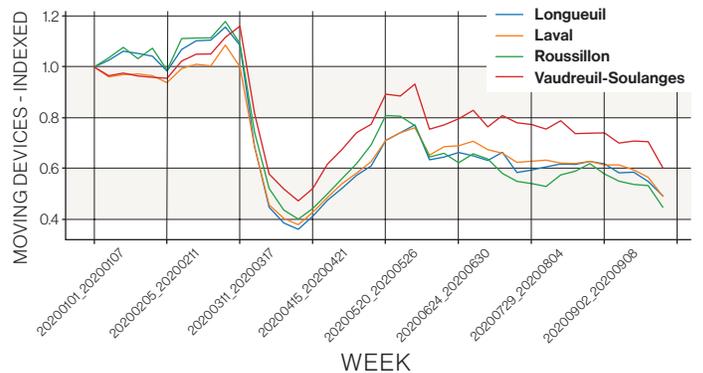
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Montreal to Neighboring Census Divisions – Jan 01-Oct 06**

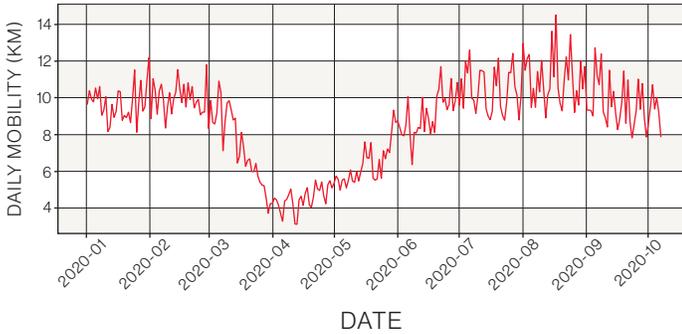


**Weekly Movements from Neighboring Census Divisions to Montreal – Jan 01-Oct 06**

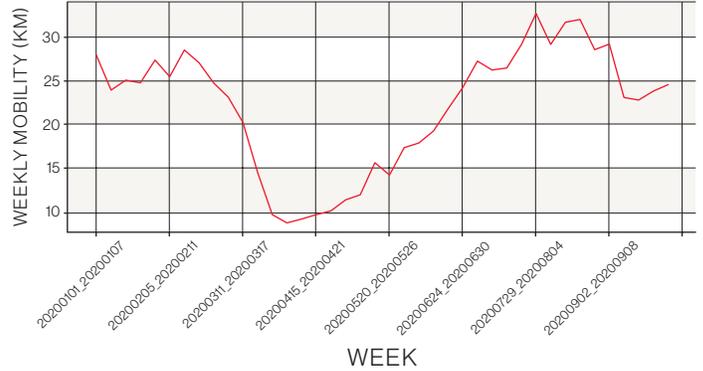


# CALGARY

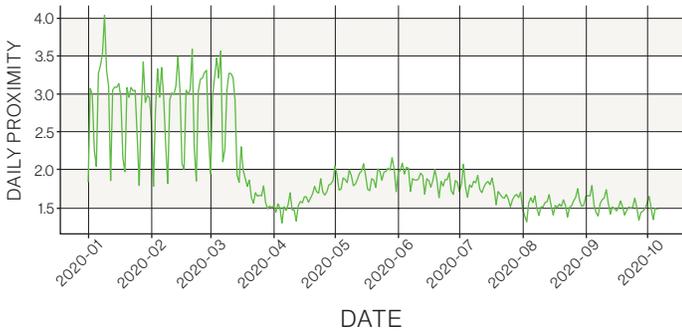
**DAILY MOBILITY – Jan 01-Oct 06**



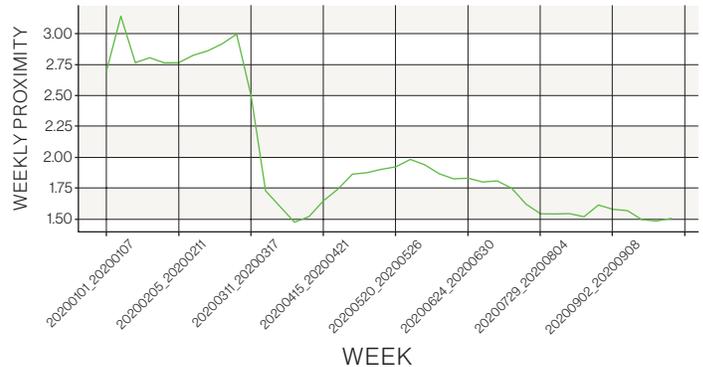
**WEEKLY MOBILITY – Jan 01-Oct 06**



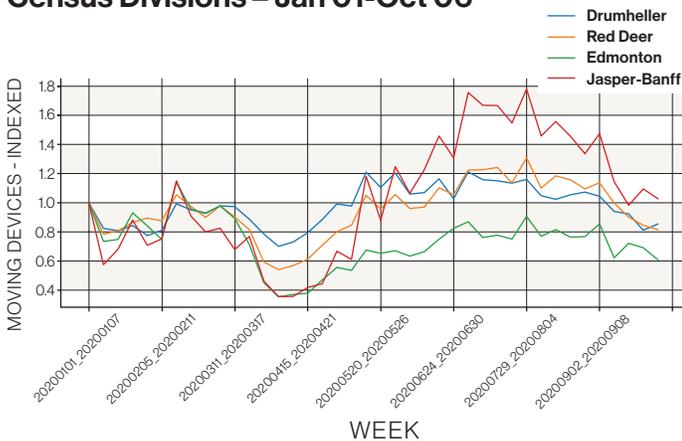
**DAILY PROXIMITY – Jan 01-Oct 06**



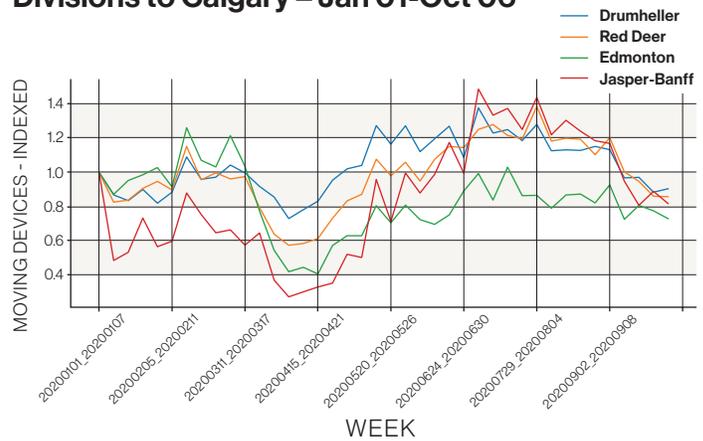
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Calgary to Neighboring Census Divisions – Jan 01-Oct 06**

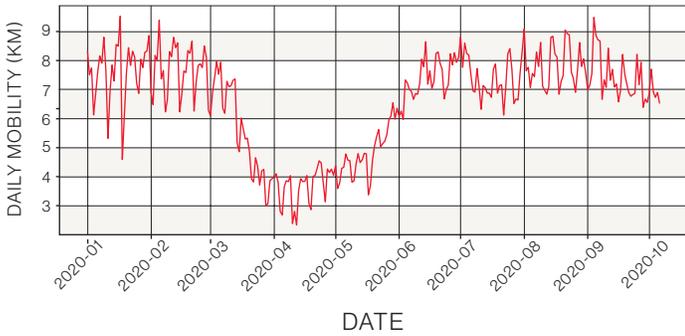


**Weekly Movements from Neighboring Census Divisions to Calgary – Jan 01-Oct 06**

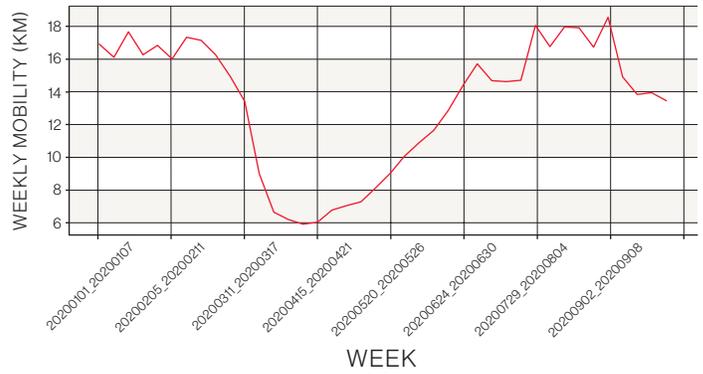


# PEEL

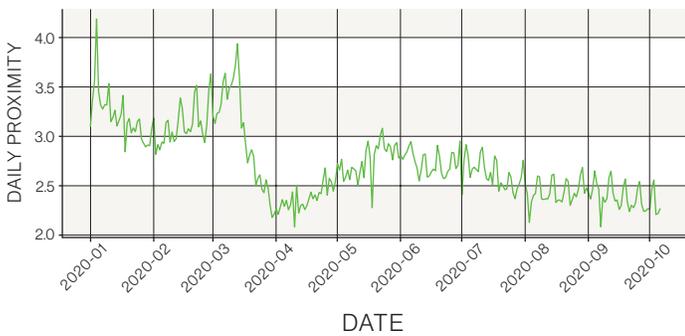
**DAILY MOBILITY – Jan 01-Oct 06**



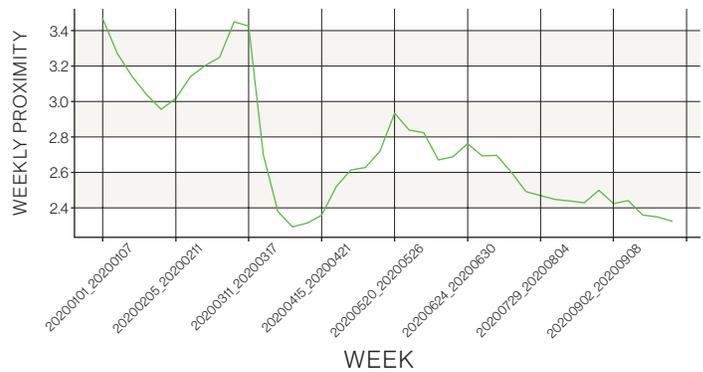
**WEEKLY MOBILITY – Jan 01-Oct 06**



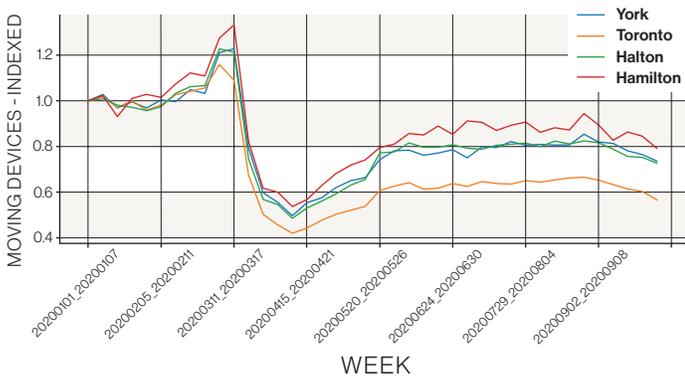
**DAILY PROXIMITY – Jan 01-Oct 06**



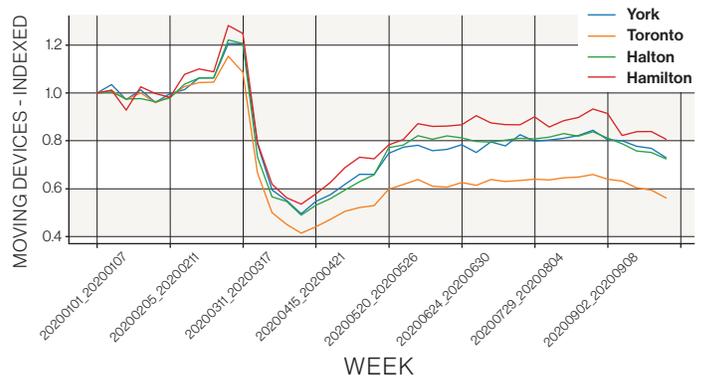
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Peel to Neighboring Census Divisions – Jan 01-Oct 06**

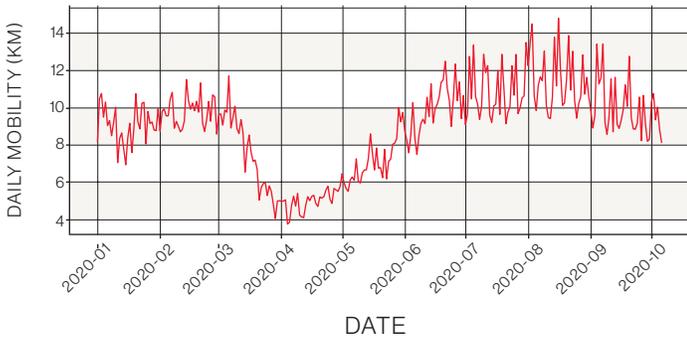


**Weekly Movements from Neighboring Census Divisions to Peel – Jan 01-Oct 06**

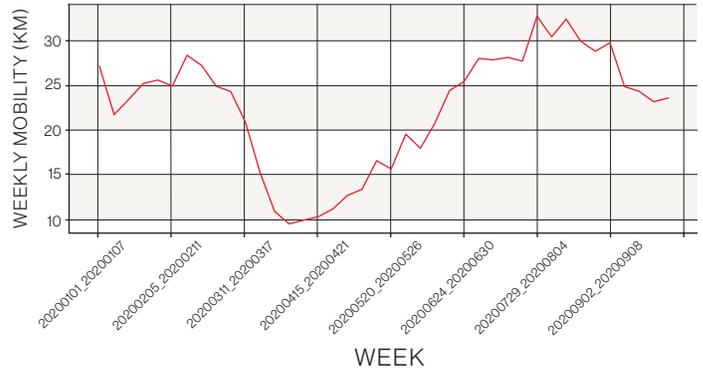


# EDMONTON

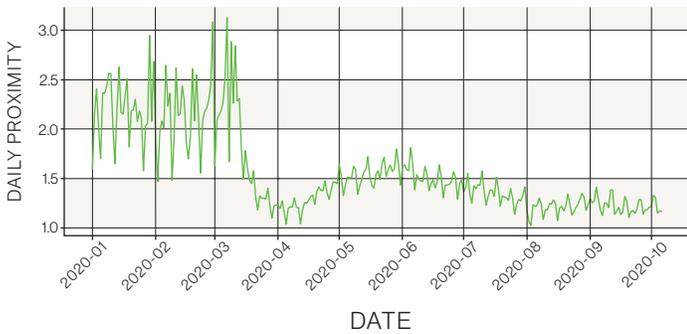
**DAILY MOBILITY – Jan 01-Oct 06**



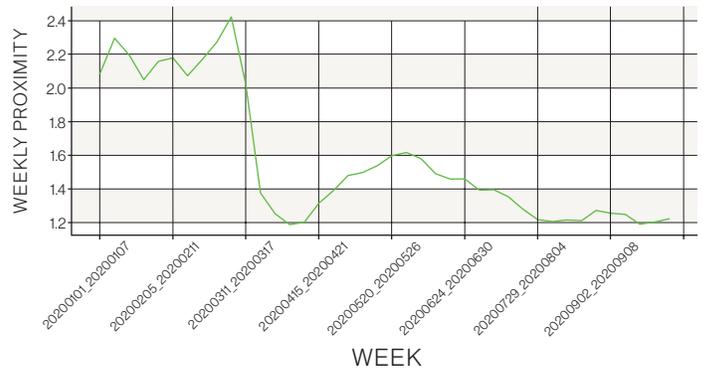
**WEEKLY MOBILITY – Jan 01-Oct 06**



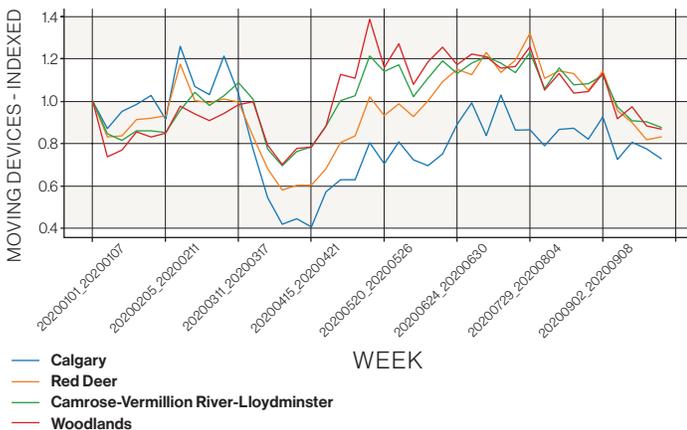
**DAILY PROXIMITY – Jan 01-Oct 06**



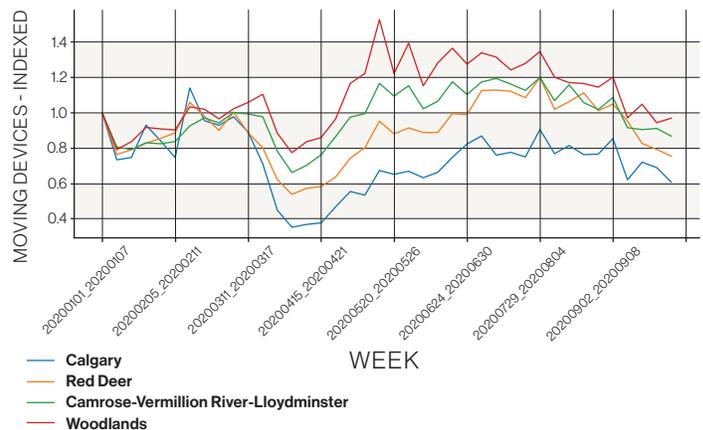
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Edmonton to Neighboring Census Divisions – Jan 01-Oct 06**

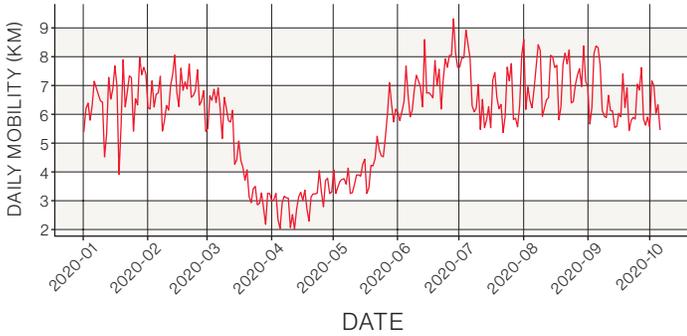


**Weekly Movements from Neighboring Census Divisions to Edmonton – Jan 01-Oct 06**

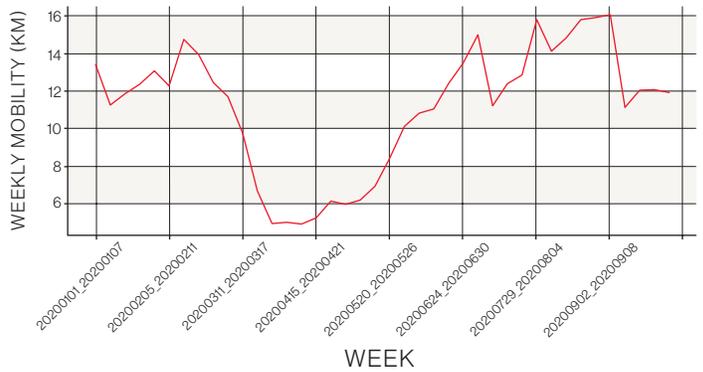


# YORK

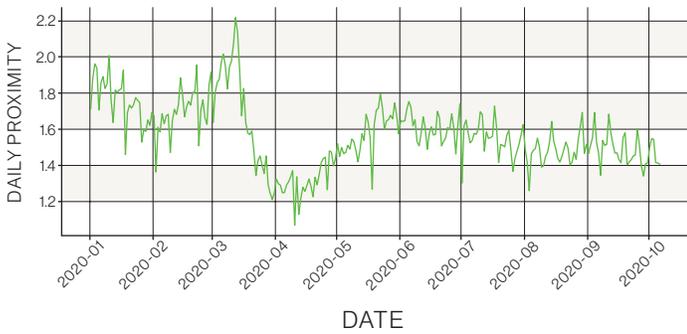
**DAILY MOBILITY – Jan 01-Oct 06**



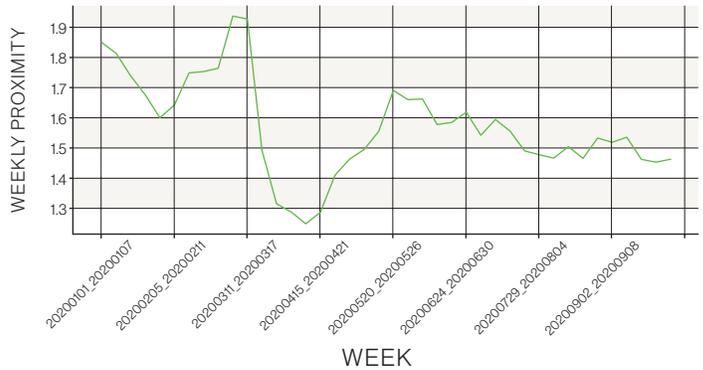
**WEEKLY MOBILITY – Jan 01-Oct 06**



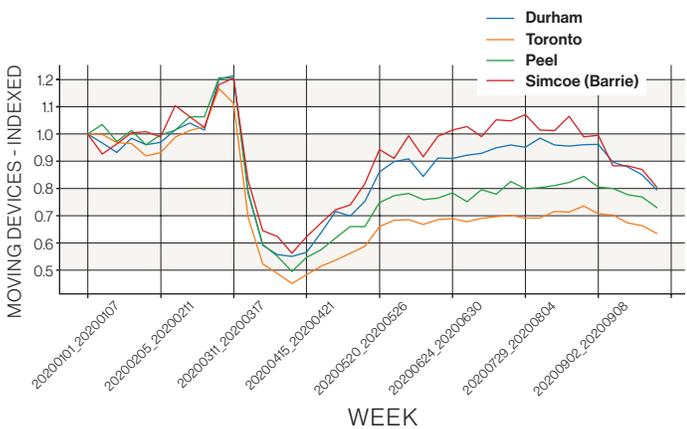
**DAILY PROXIMITY – Jan 01-Oct 06**



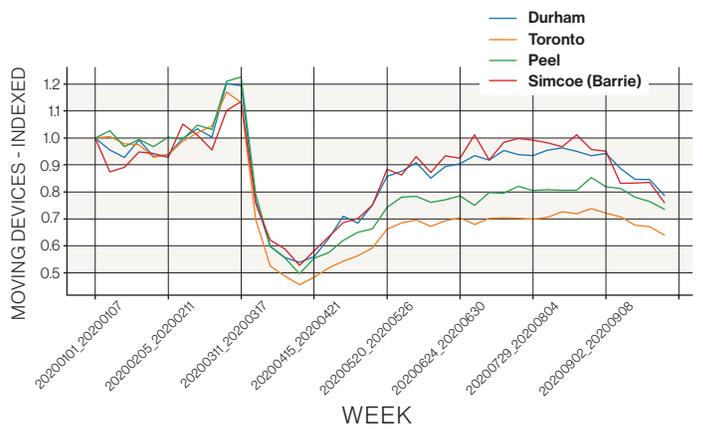
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from York to Neighboring Census Divisions – Jan 01-Oct 06**

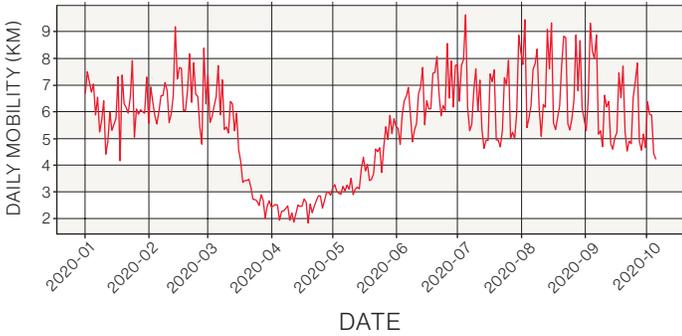


**Weekly Movements from Neighboring Census Divisions to York – Jan 01-Oct 06**

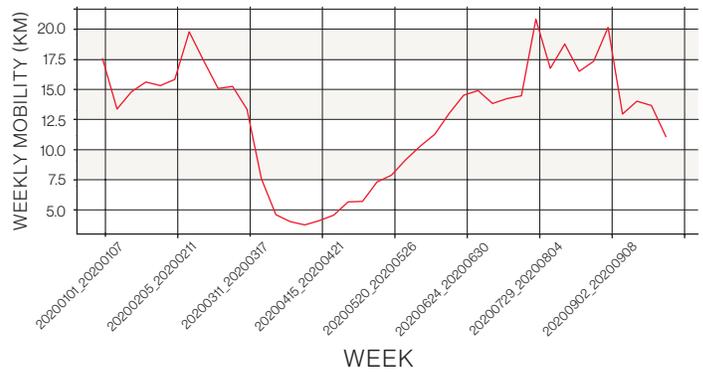


# OTTAWA

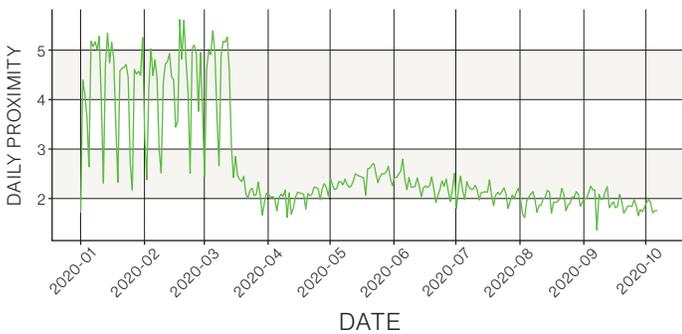
**DAILY MOBILITY – Jan 01-Oct 06**



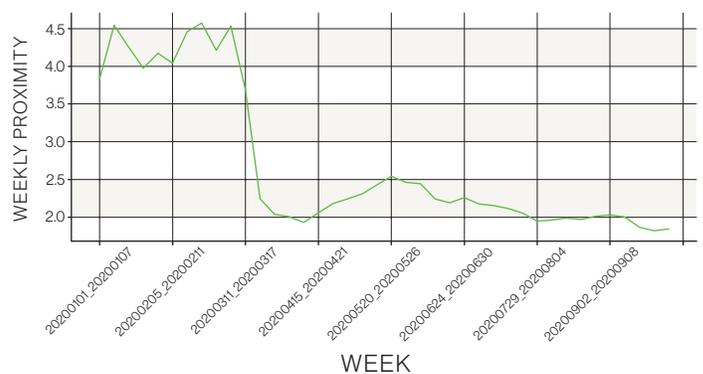
**WEEKLY MOBILITY – Jan 01-Oct 06**



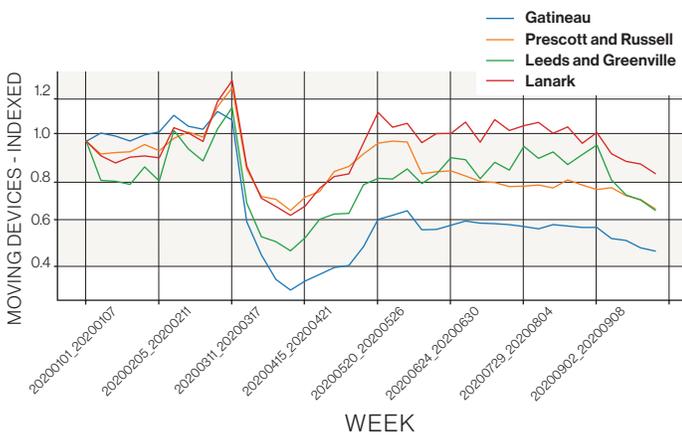
**DAILY PROXIMITY – Jan 01-Oct 06**



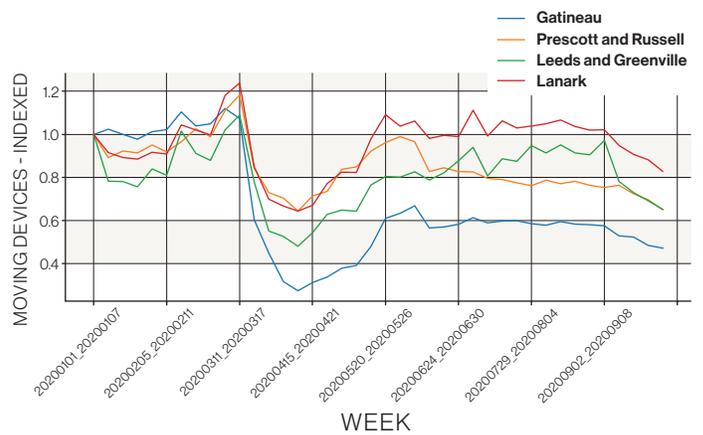
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Ottawa to Neighboring Census Divisions – Jan 01-Oct 06**

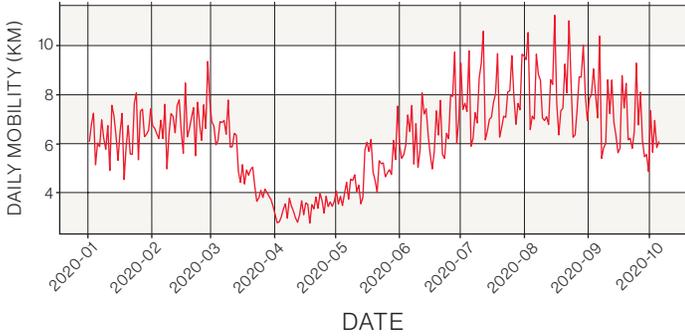


**Weekly Movements from Neighboring Census Divisions to Ottawa – Jan 01-Oct 06**

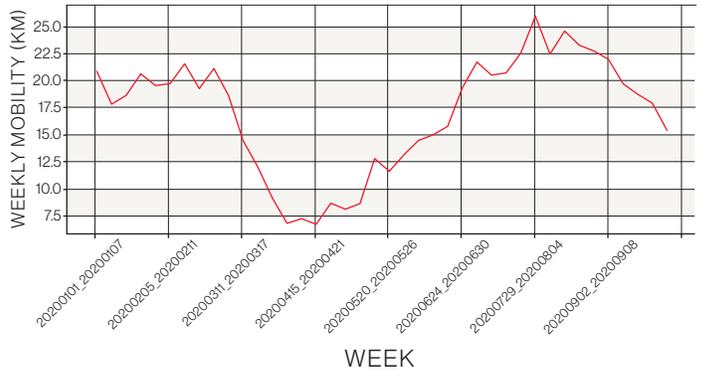


# WINNIPEG

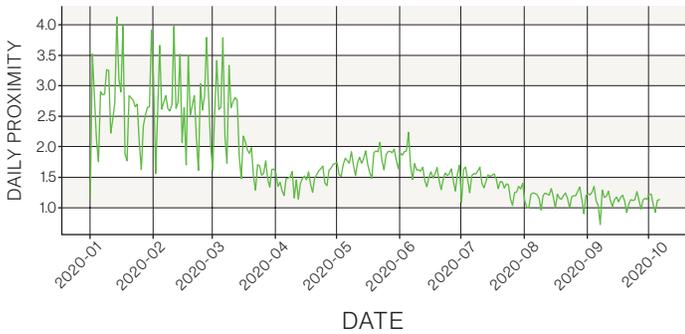
**DAILY MOBILITY – Jan 01-Oct 06**



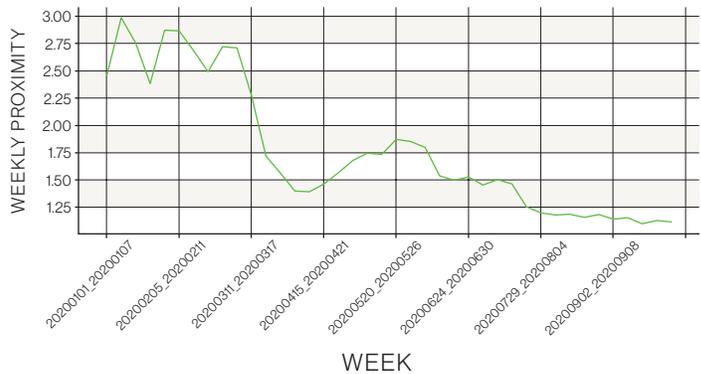
**WEEKLY MOBILITY – Jan 01-Oct 06**



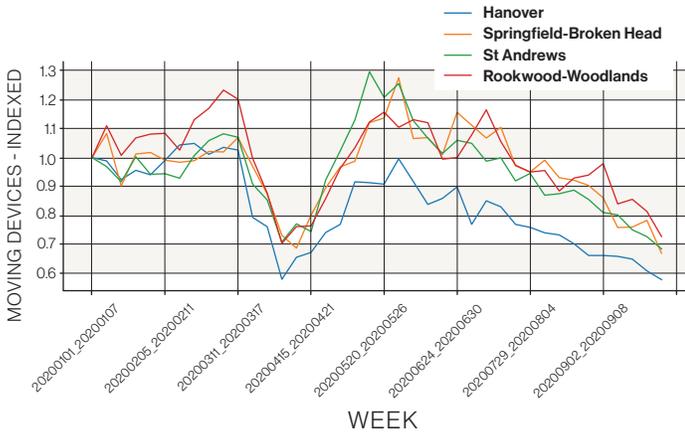
**DAILY PROXIMITY – Jan 01-Oct 06**



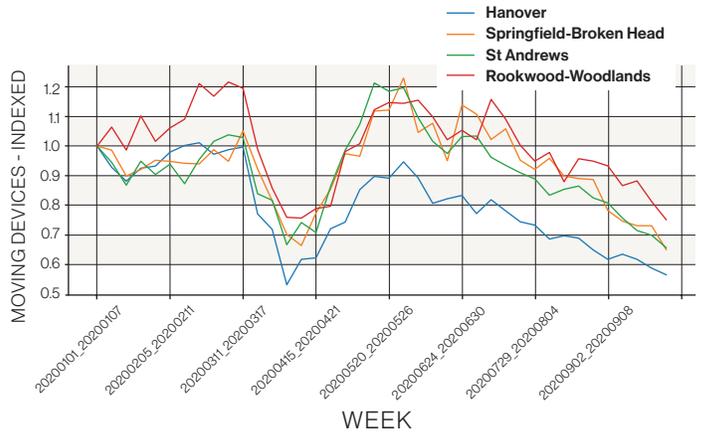
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Winnipeg to Neighboring Census Divisions – Jan 01-Oct 06**

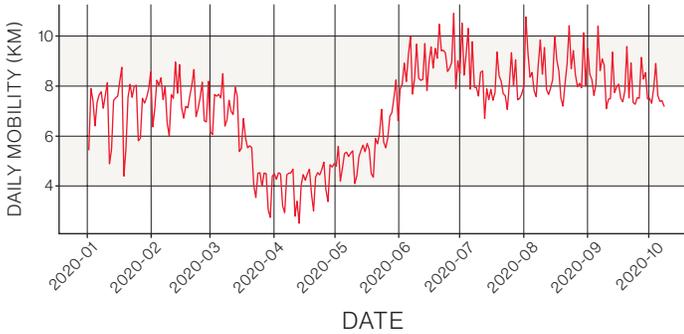


**Weekly Movements from Neighboring Census Divisions to Winnipeg – Jan 01-Oct 06**

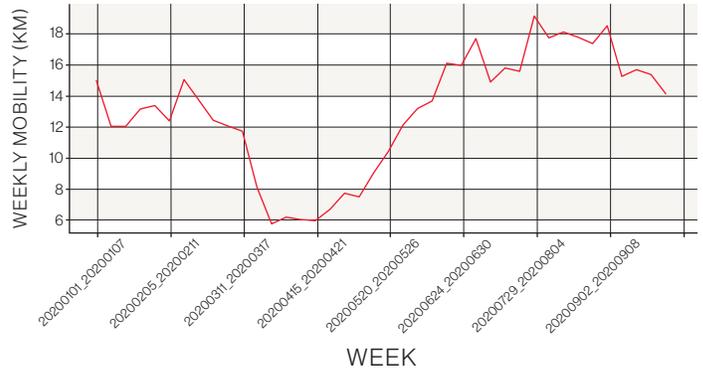


# DURHAM

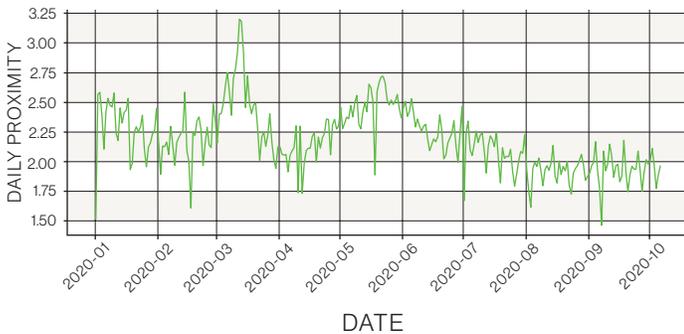
**DAILY MOBILITY – Jan 01-Oct 06**



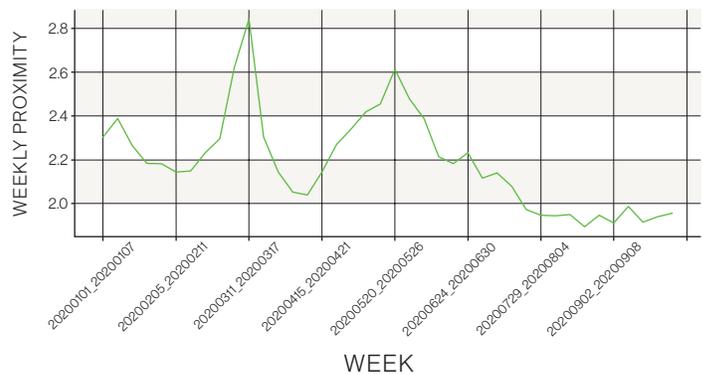
**WEEKLY MOBILITY – Jan 01-Oct 06**



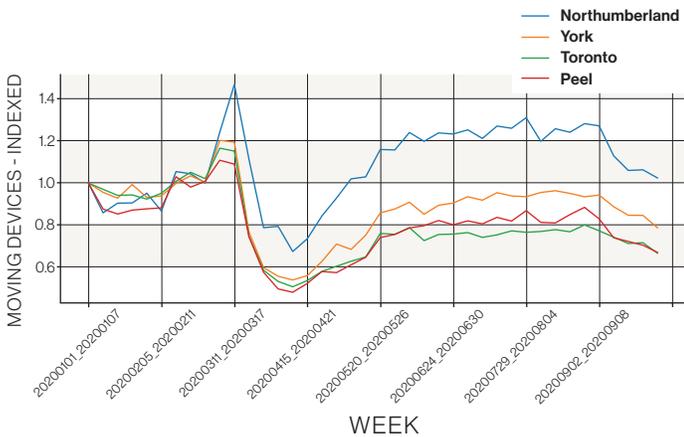
**DAILY PROXIMITY – Jan 01-Oct 06**



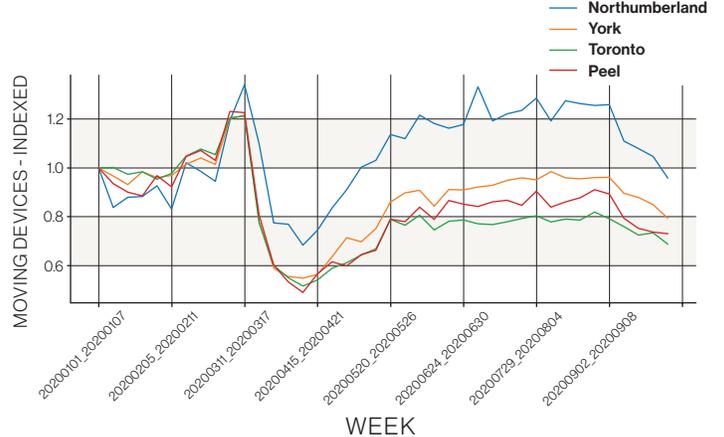
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Durham to Neighboring Census Divisions – Jan 01-Oct 06**

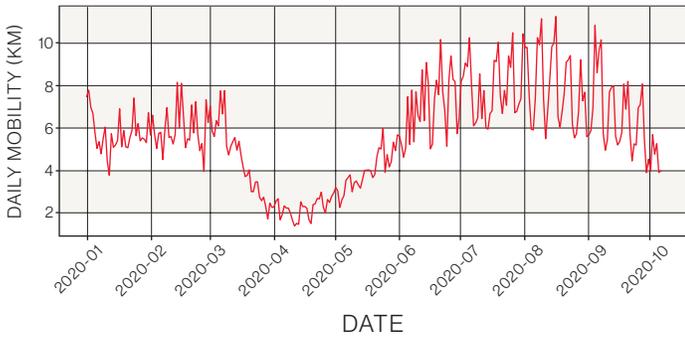


**Weekly Movements from Neighboring Census Divisions to Durham – Jan 01-Oct 06**

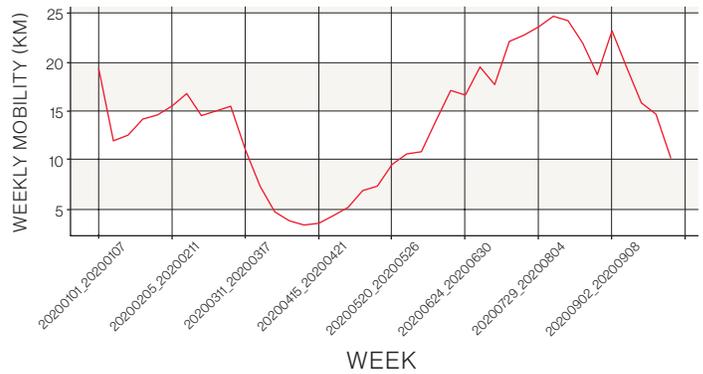


# QUEBEC CITY

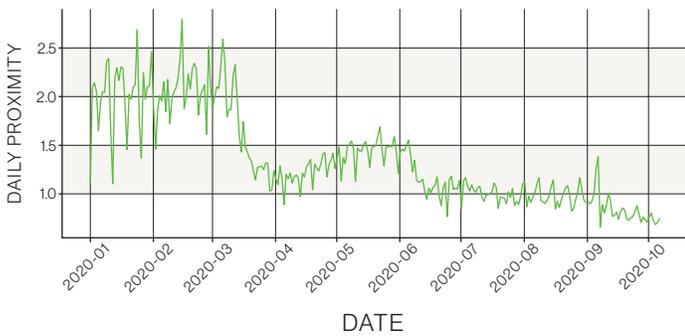
**DAILY MOBILITY – Jan 01-Oct 06**



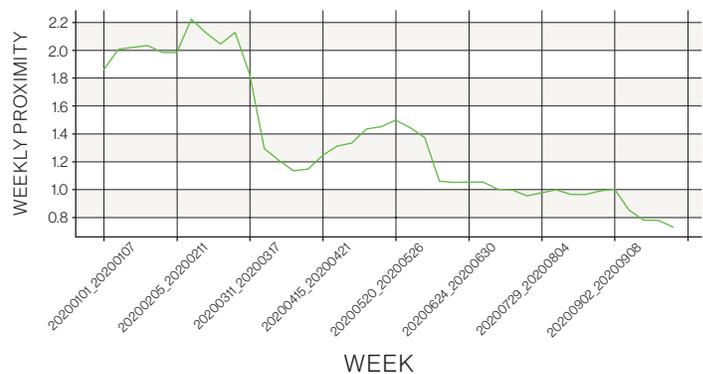
**WEEKLY MOBILITY – Jan 01-Oct 06**



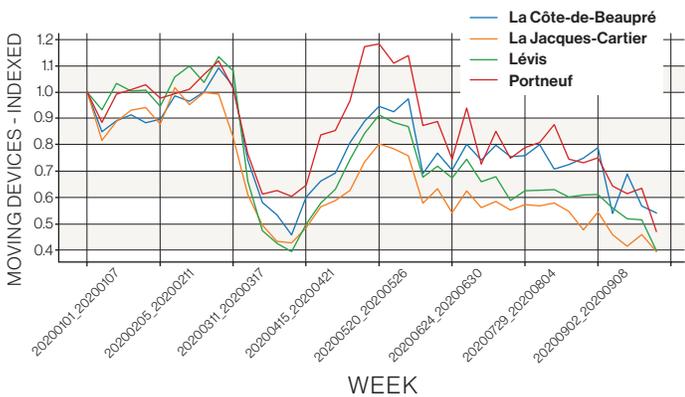
**DAILY PROXIMITY – Jan 01-Oct 06**



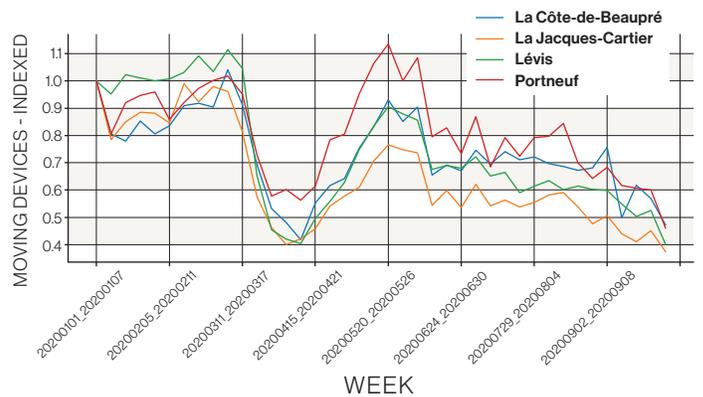
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Quebec City to Neighboring Census Divisions – Jan 01-Oct 06**

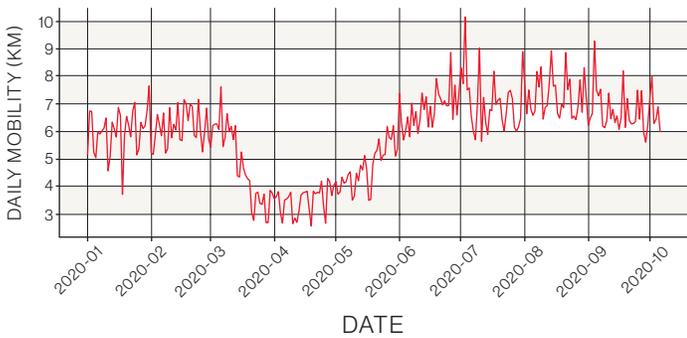


**Weekly Movements from Neighboring Census Divisions to Quebec City – Jan 01-Oct 06**

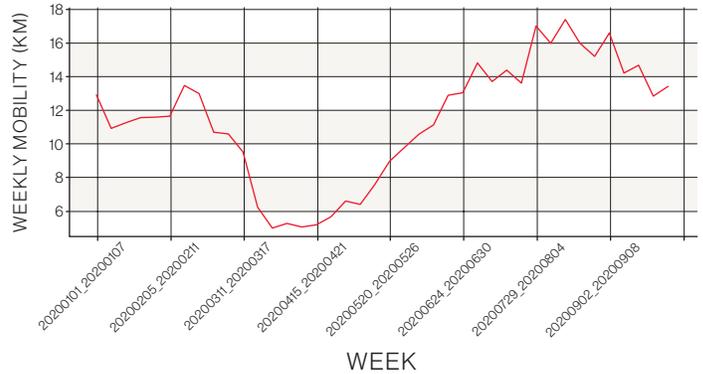


# HAMILTON

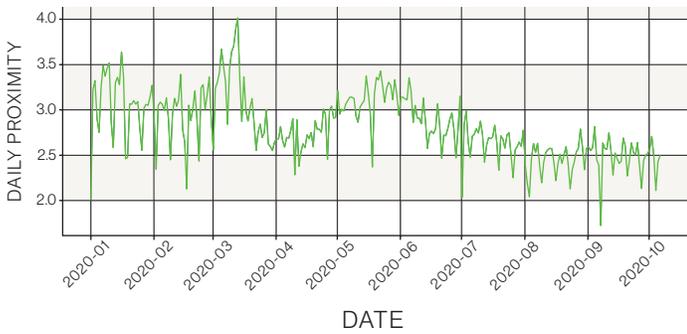
**DAILY MOBILITY – Jan 01-Oct 06**



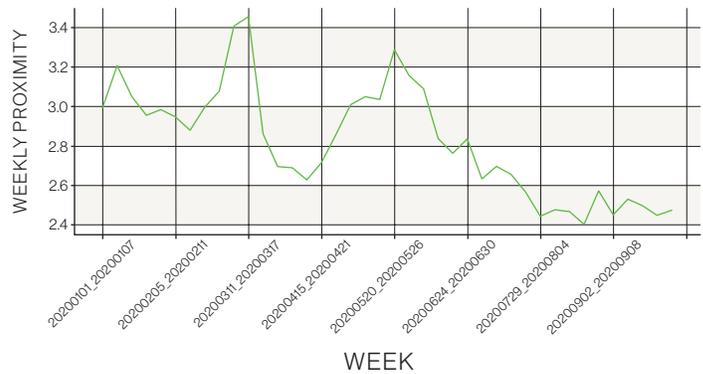
**WEEKLY MOBILITY – Jan 01-Oct 06**



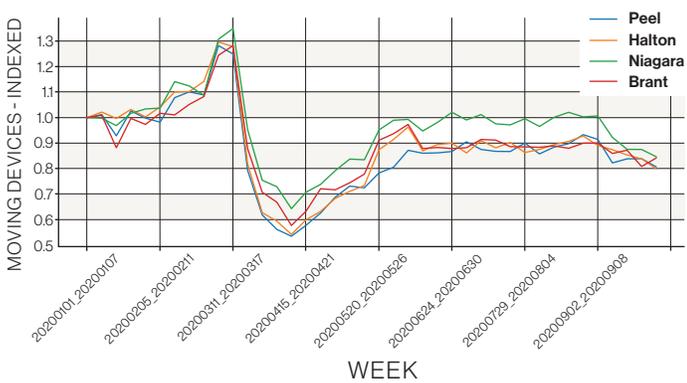
**DAILY PROXIMITY – Jan 01-Oct 06**



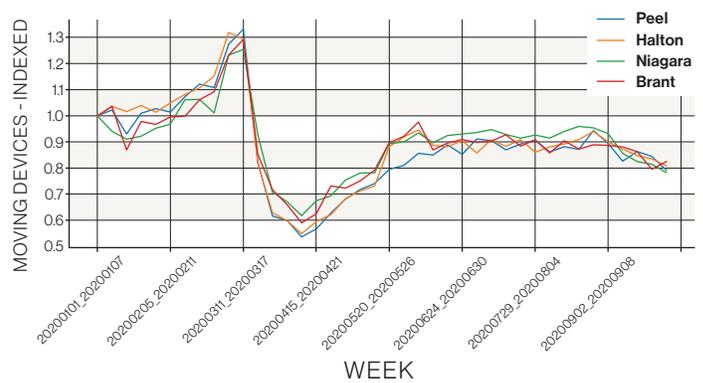
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Hamilton to Neighboring Census Divisions – Jan 01-Oct 06**

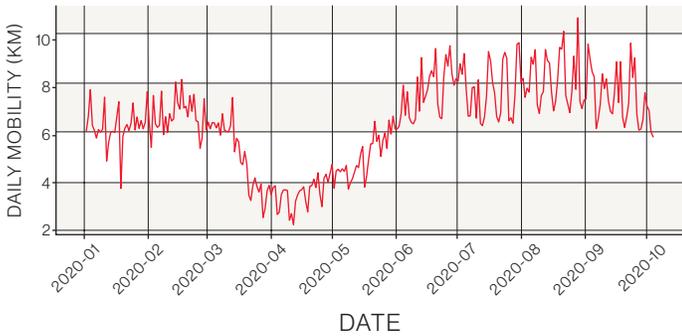


**Weekly Movements from Neighboring Census Divisions to Hamilton – Jan 01-Oct 06**

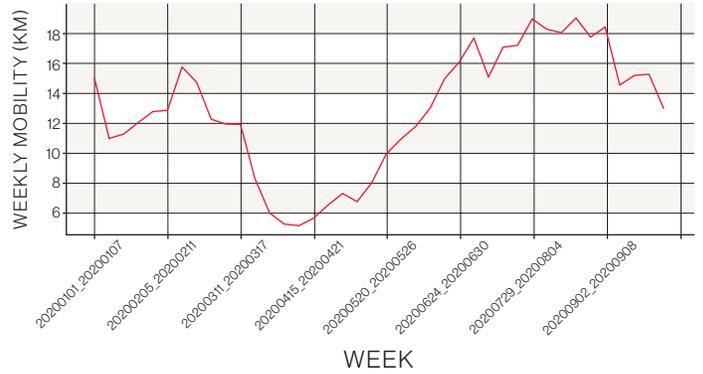


# WATERLOO

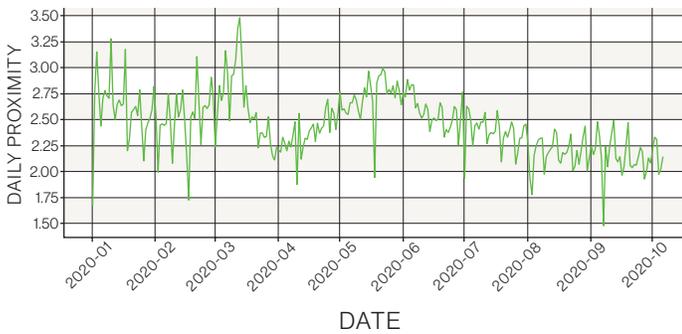
**DAILY MOBILITY – Jan 01-Oct 06**



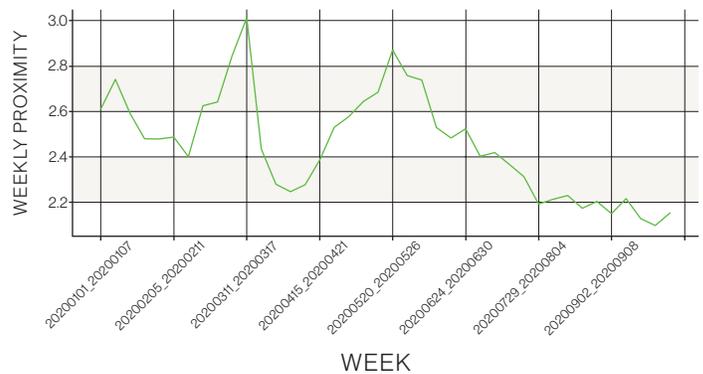
**WEEKLY MOBILITY – Jan 01-Oct 06**



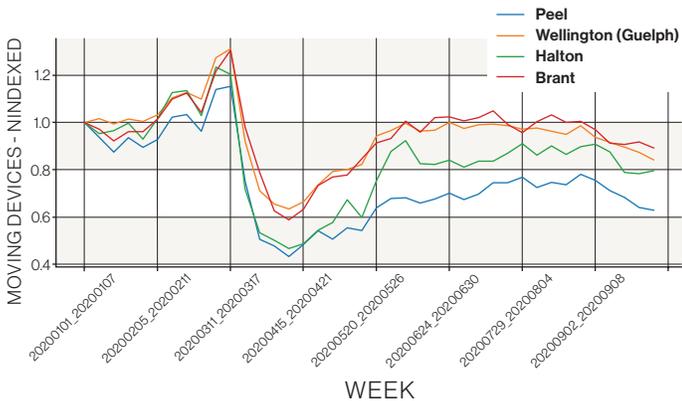
**DAILY PROXIMITY – Jan 01-Oct 06**



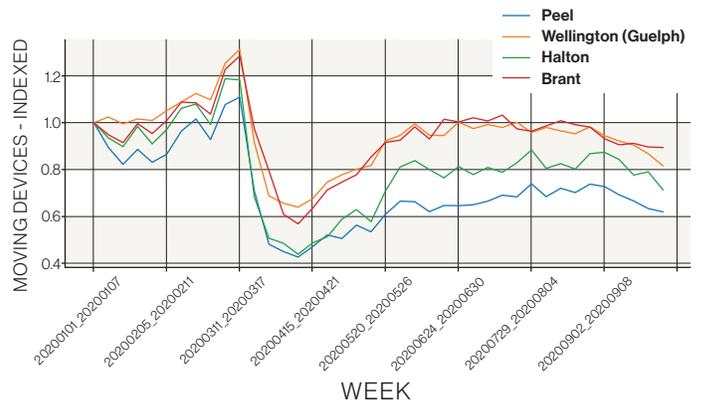
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Waterloo to Neighboring Census Divisions – Jan 01-Oct 06**

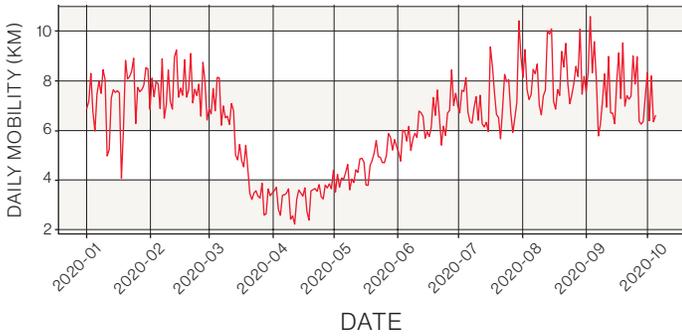


**Weekly Movements from Neighboring Census Divisions to Waterloo – Jan 01-Oct 06**

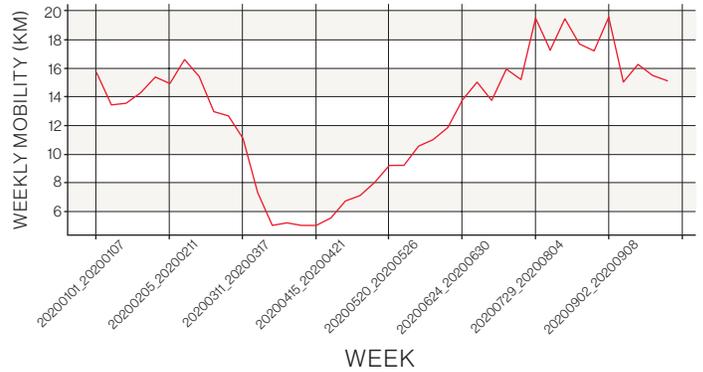


# HALTON

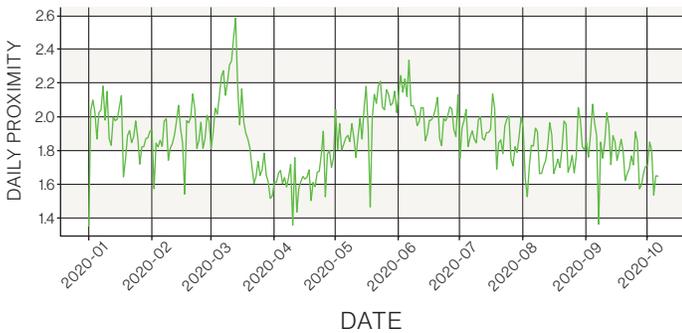
**DAILY MOBILITY – Jan 01-Oct 06**



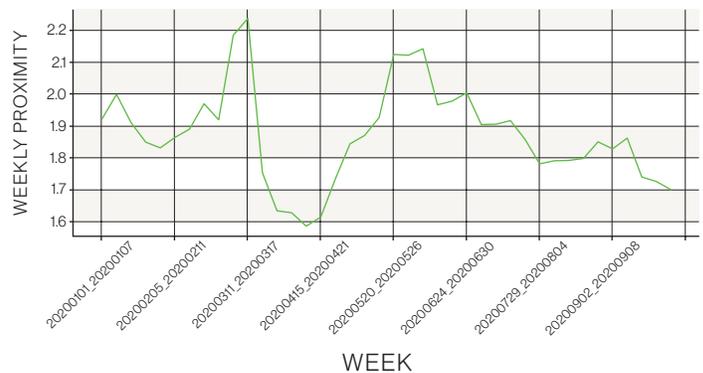
**WEEKLY MOBILITY – Jan 01-Oct 06**



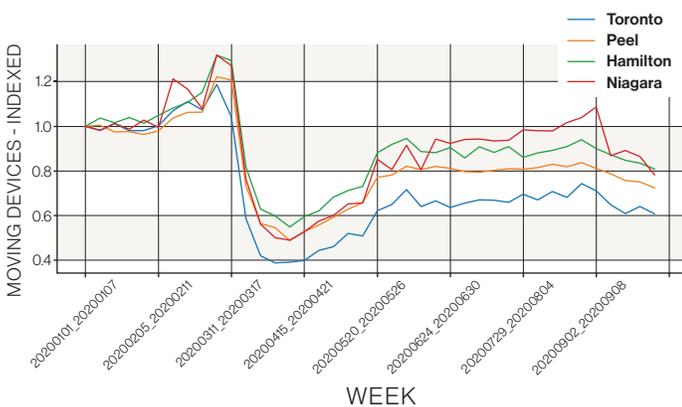
**DAILY PROXIMITY – Jan 01-Oct 06**



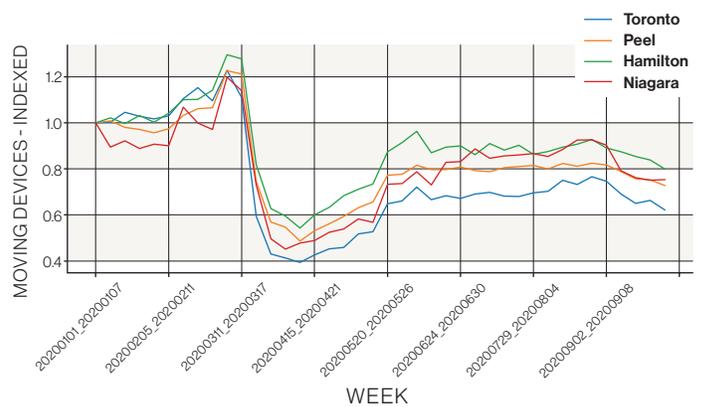
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Halton to Neighboring Census Divisions – Jan 01-Oct 06**

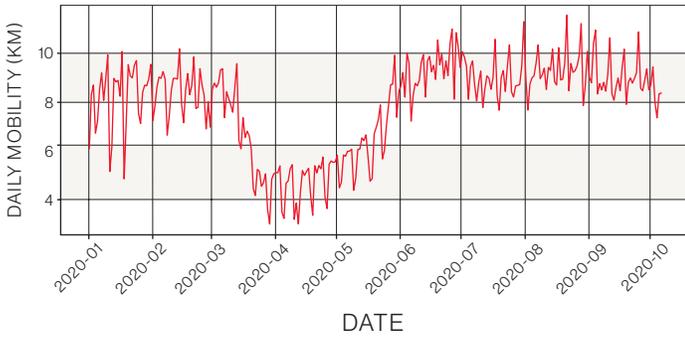


**Weekly Movements from Neighboring Census Divisions to Halton – Jan 01-Oct 06**

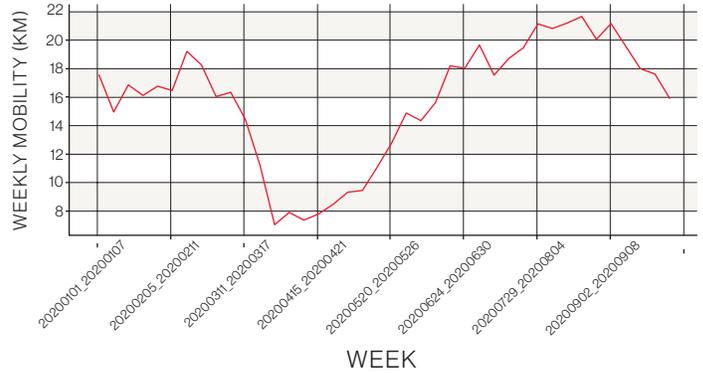


# SIMCOE (BARRIE)

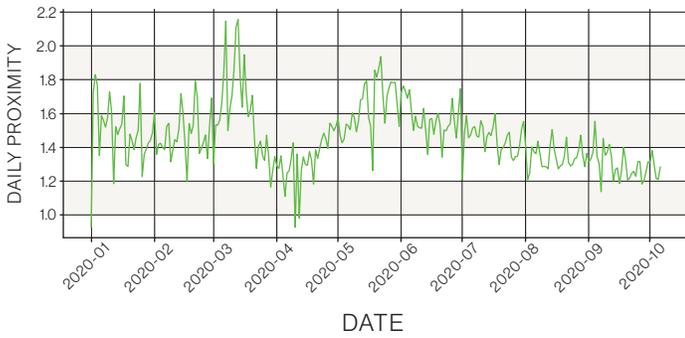
**DAILY MOBILITY – Jan 01-Oct 06**



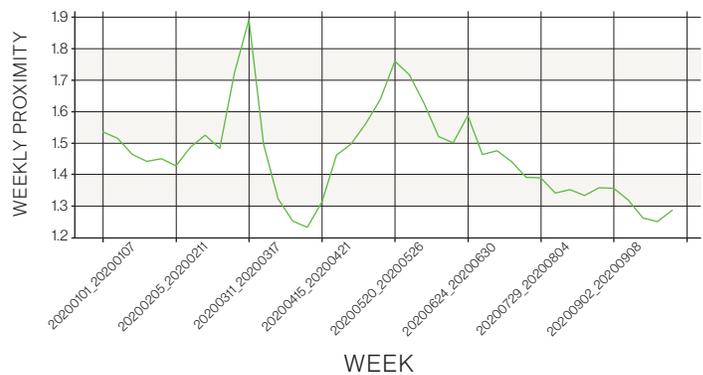
**WEEKLY MOBILITY – Jan 01-Oct 06**



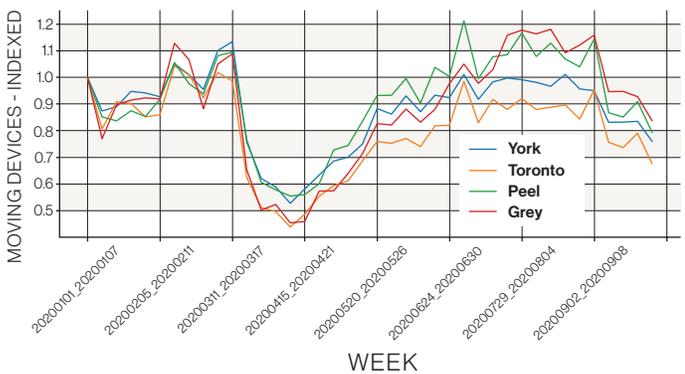
**DAILY PROXIMITY – Jan 01-Oct 06**



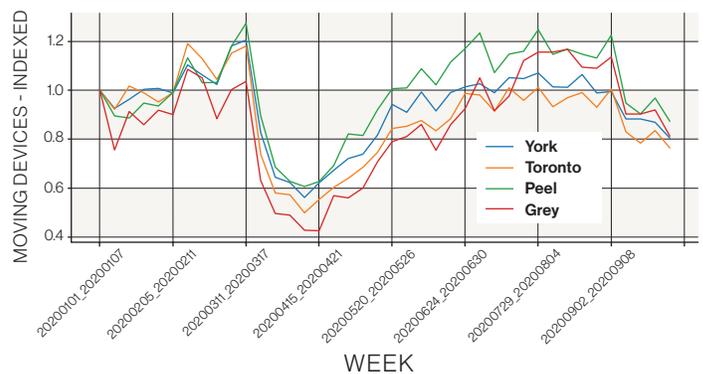
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Simcoe (Barrie) to Neighboring Census Divisions – Jan 01-Oct 06**

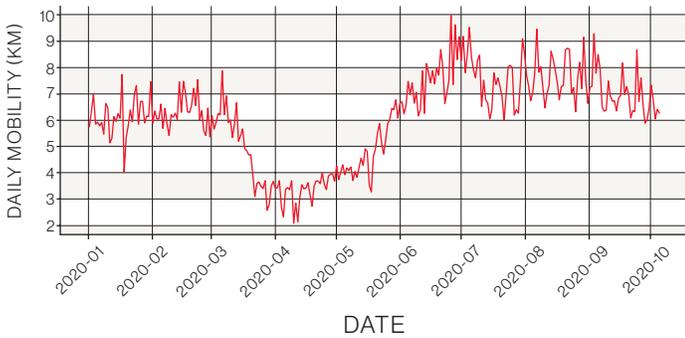


**Weekly Movements from Neighboring Census Divisions to Simcoe (Barrie) – Jan 01-Oct 06**

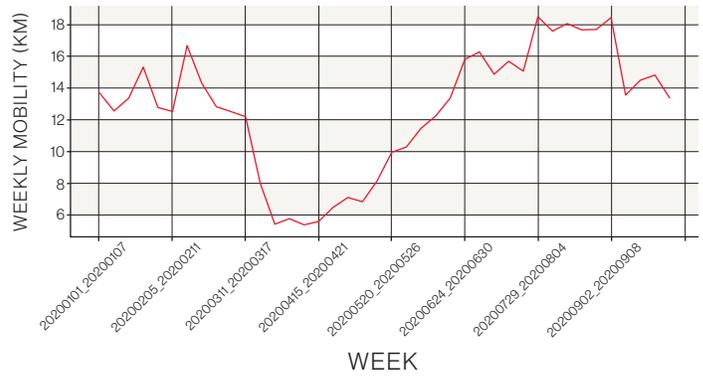


# MIDDLESEX (LONDON)

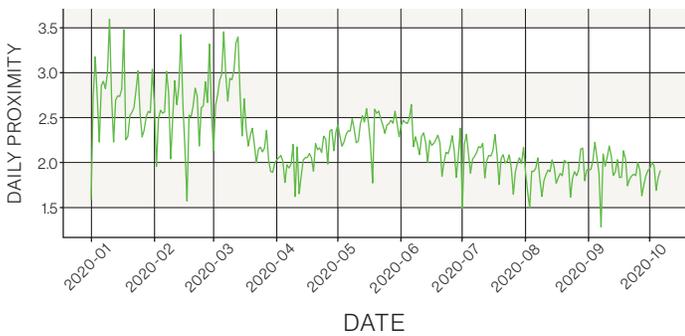
**DAILY MOBILITY – Jan 01-Oct 06**



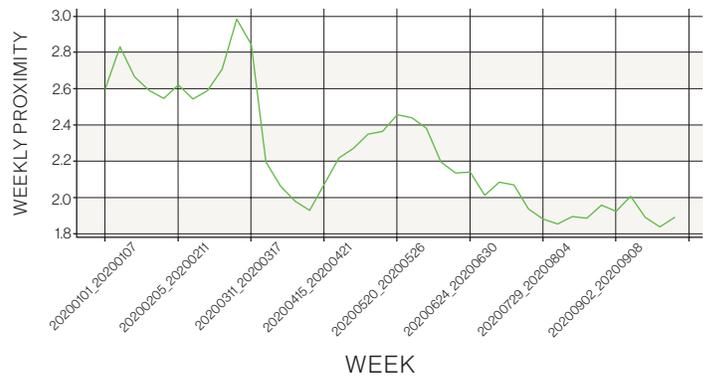
**WEEKLY MOBILITY – Jan 01-Oct 06**



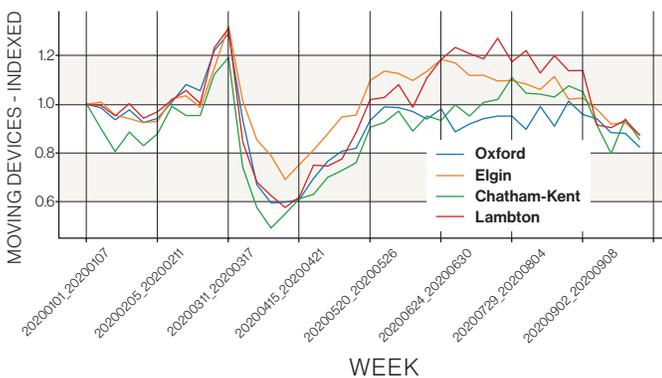
**DAILY PROXIMITY – Jan 01-Oct 06**



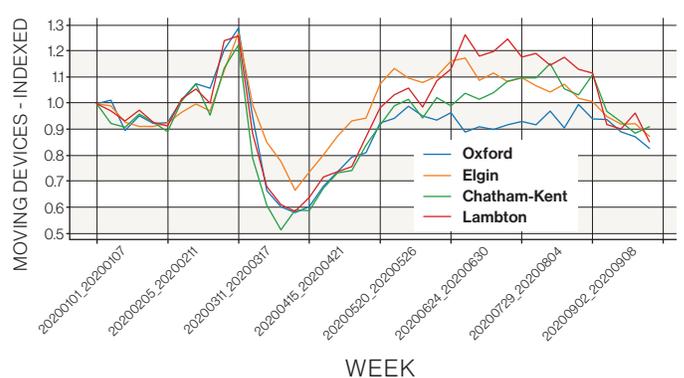
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Middlesex (London) to Neighboring Census Divisions – Jan 01-Oct 06**

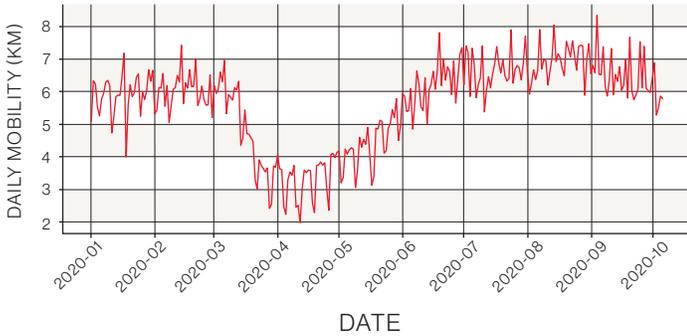


**Weekly Movements from Neighboring Census Divisions to Middlesex (London) – Jan 01-Oct 06**

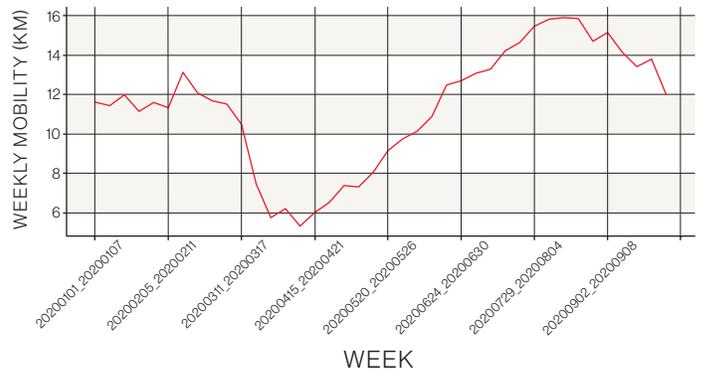


# NIAGARA

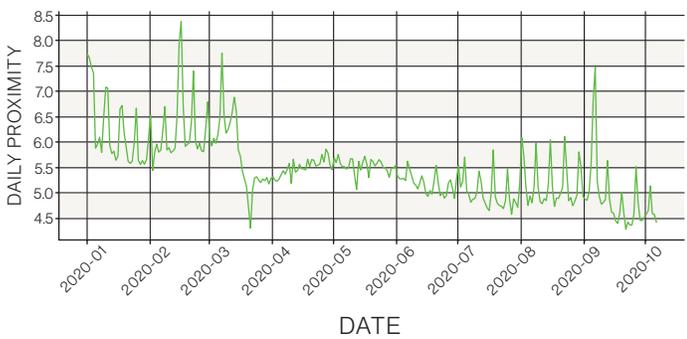
**DAILY MOBILITY – Jan 01-Oct 06**



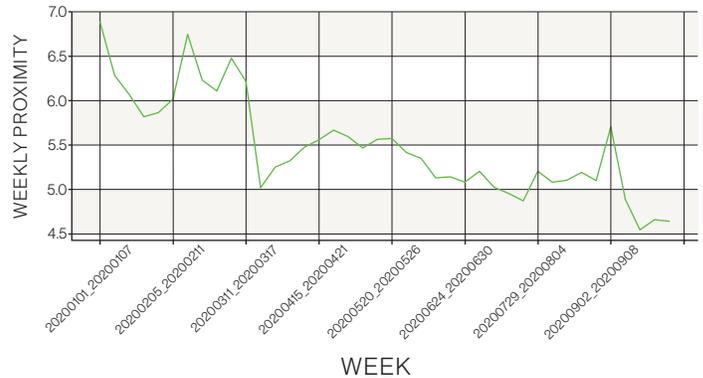
**WEEKLY MOBILITY – Jan 01-Oct 06**



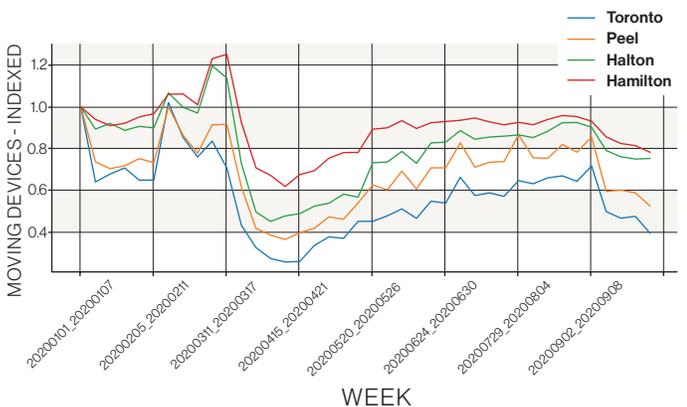
**DAILY PROXIMITY – Jan 01-Oct 06**



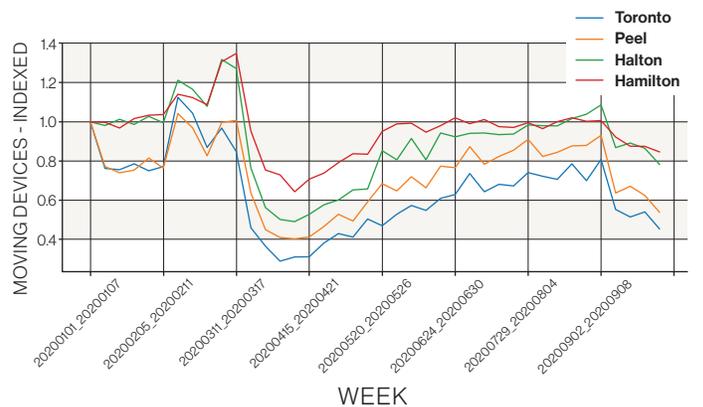
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Niagara to Neighboring Census Divisions – Jan 01-Oct 06**

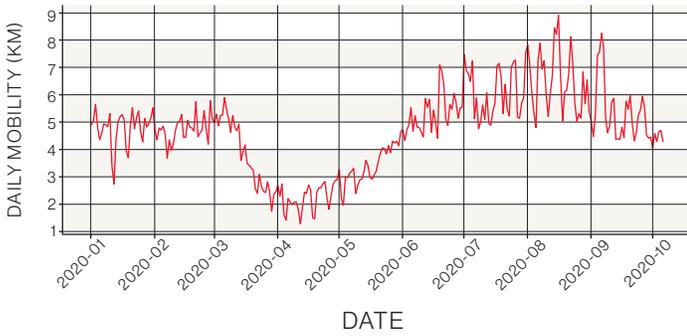


**Weekly Movements from Neighboring Census Divisions to Niagara – Jan 01-Oct 06**

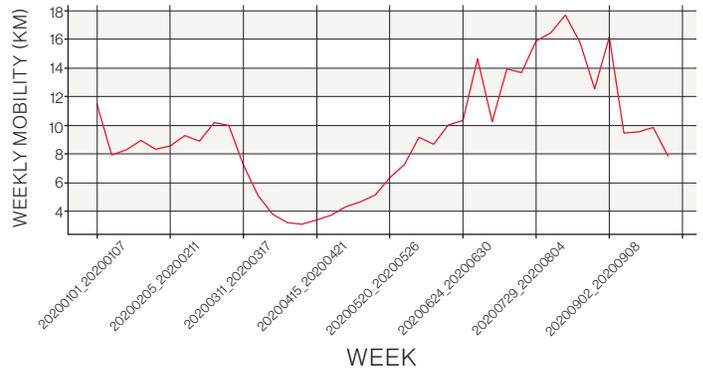


# LAVAL

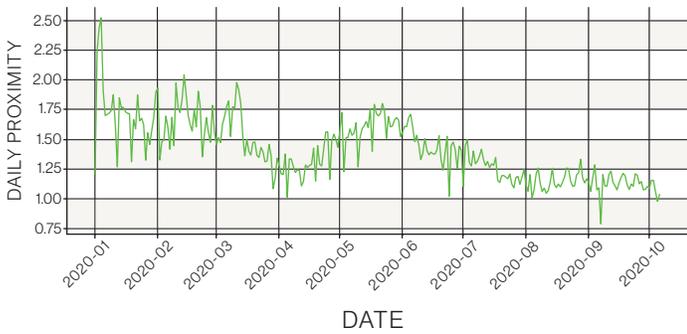
**DAILY MOBILITY – Jan 01-Oct 06**



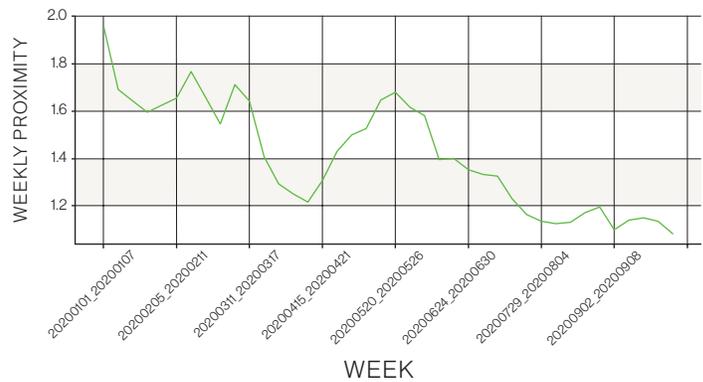
**WEEKLY MOBILITY – Jan 01-Oct 06**



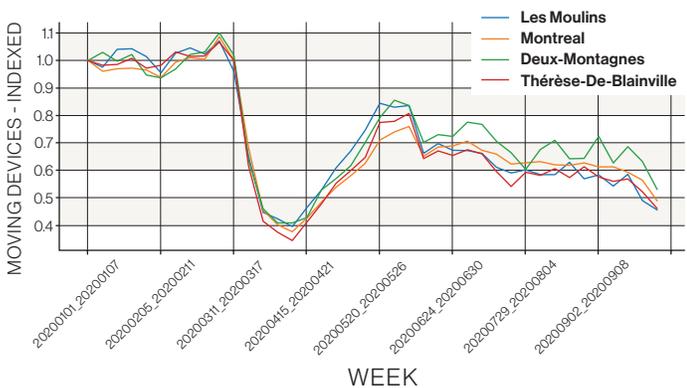
**DAILY PROXIMITY – Jan 01-Oct 06**



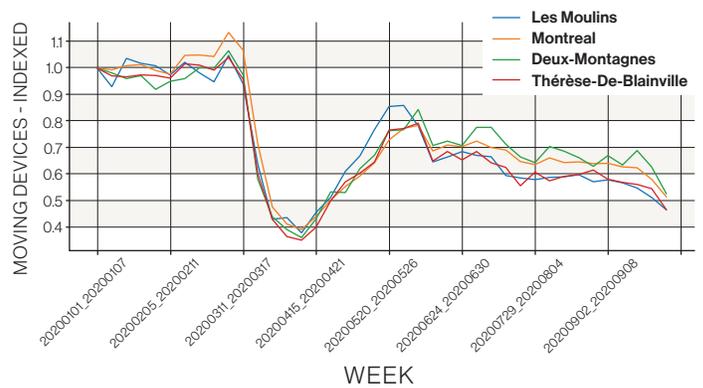
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Laval to Neighboring Census Divisions – Jan 01-Oct 06**

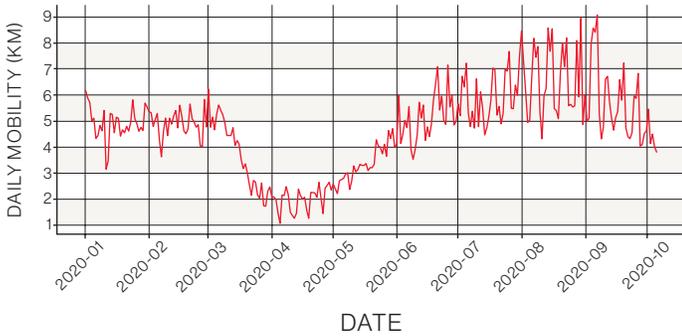


**Weekly Movements from Neighboring Census Divisions to Laval – Jan 01-Oct 06**

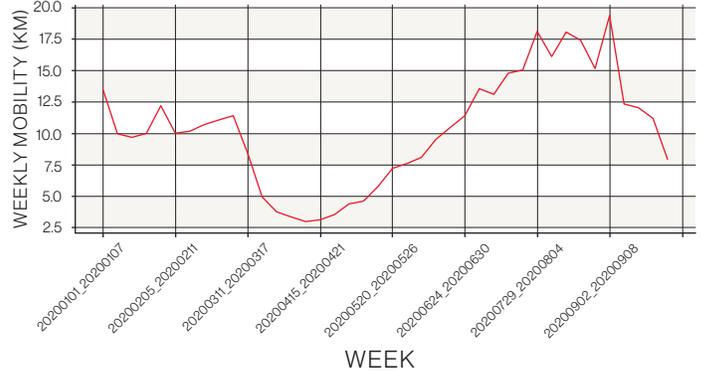


# LONGUEUIL

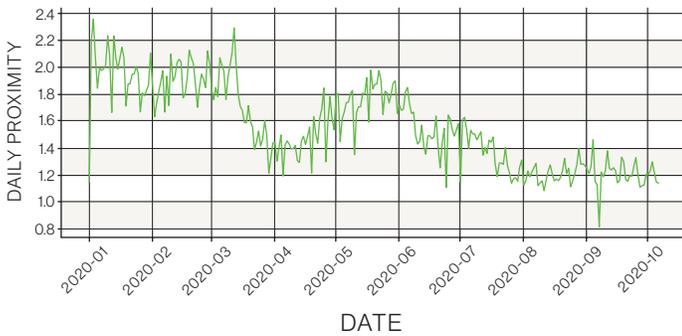
**DAILY MOBILITY – Jan 01-Oct 06**



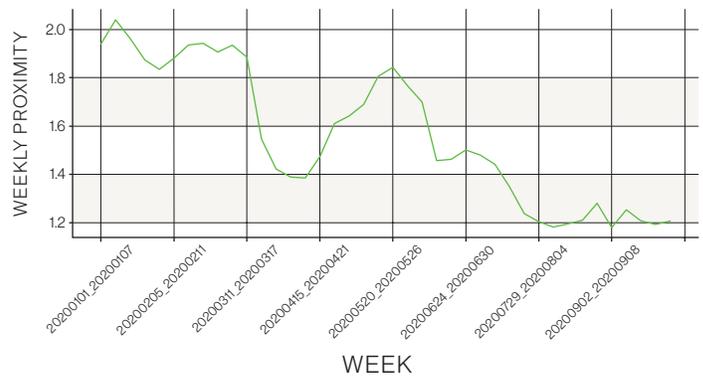
**WEEKLY MOBILITY – Jan 01-Oct 06**



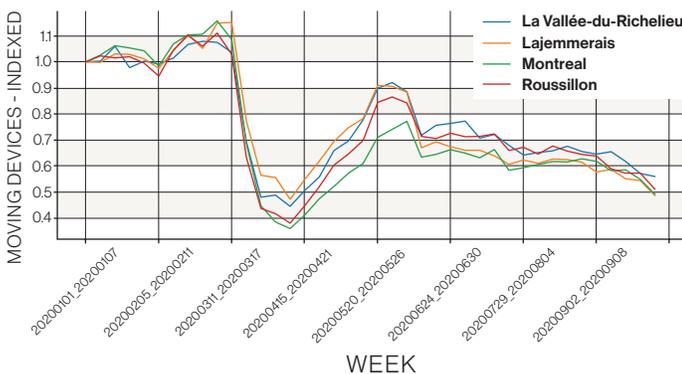
**DAILY PROXIMITY – Jan 01-Oct 06**



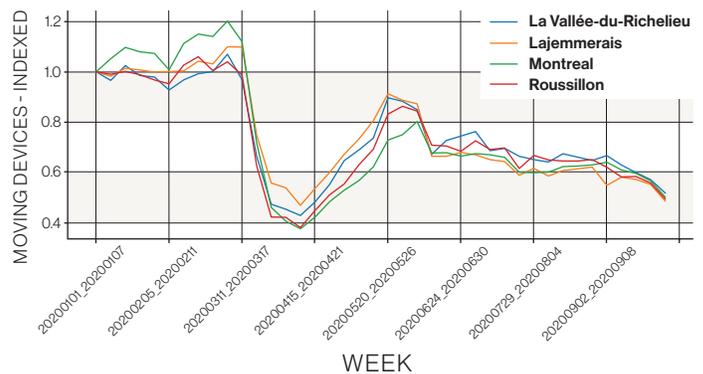
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Longueuil to Neighboring Census Divisions – Jan 01-Oct 06**

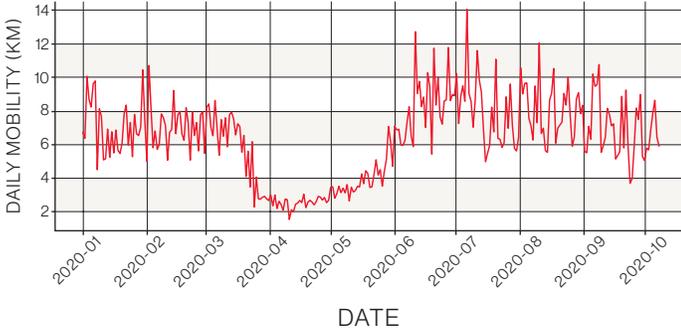


**Weekly Movements from Neighboring Census Divisions to Longueuil – Jan 01-Oct 06**

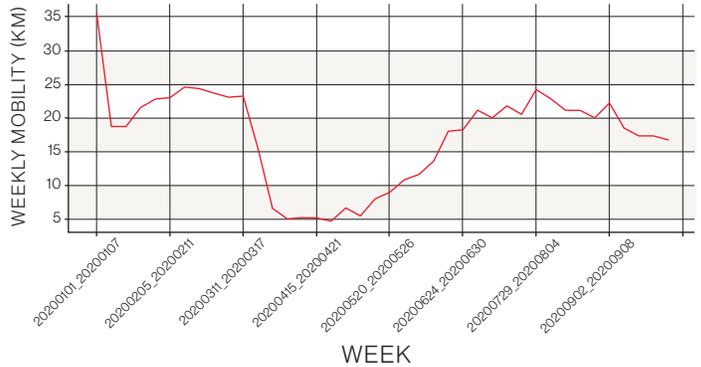


# HALIFAX

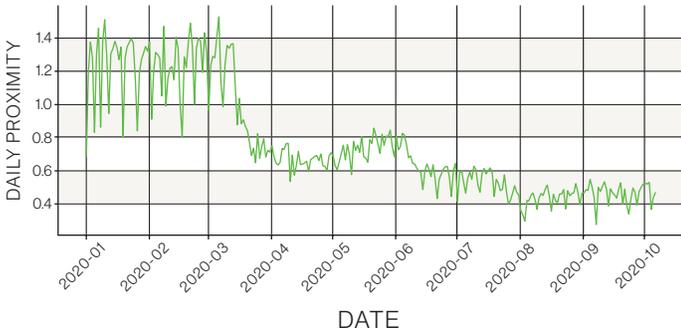
**DAILY MOBILITY – Jan 01-Oct 06**



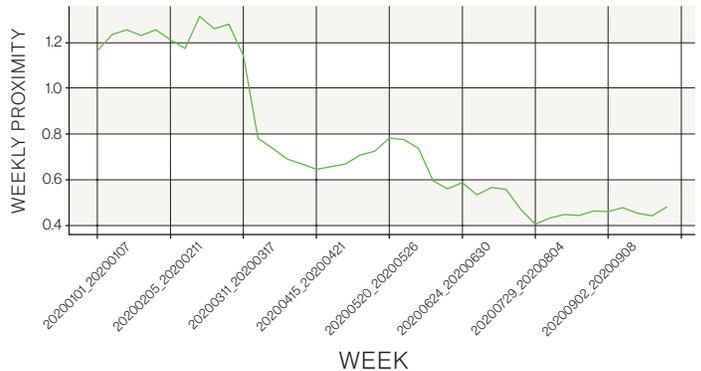
**WEEKLY MOBILITY – Jan 01-Oct 06**



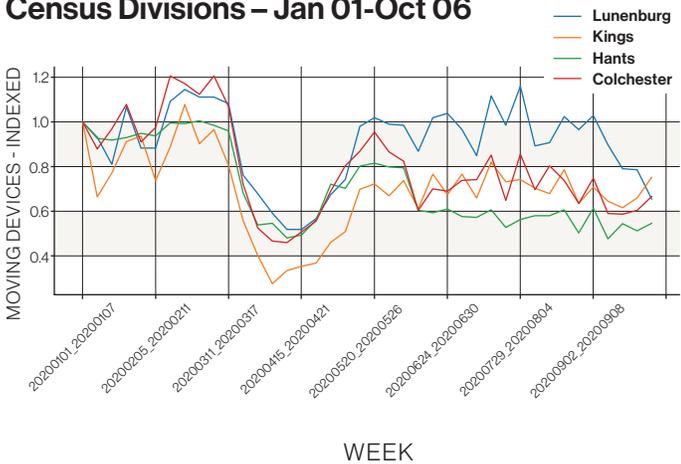
**DAILY PROXIMITY – Jan 01-Oct 06**



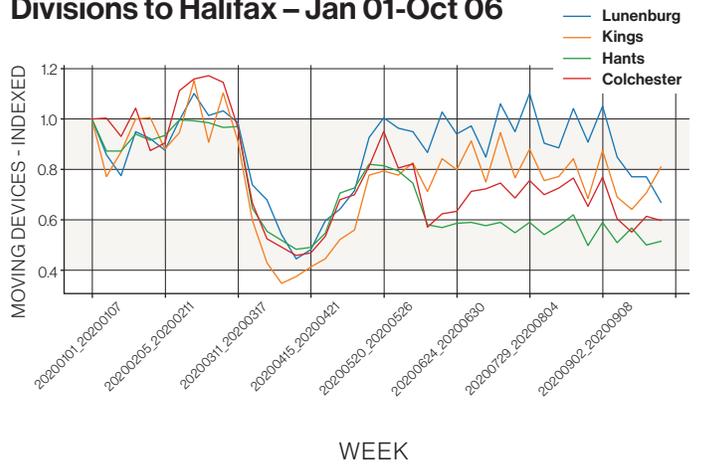
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Halifax to Neighboring Census Divisions – Jan 01-Oct 06**

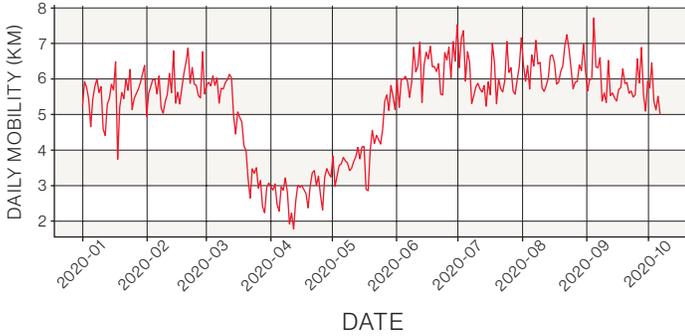


**Weekly Movements from Neighboring Census Divisions to Halifax – Jan 01-Oct 06**

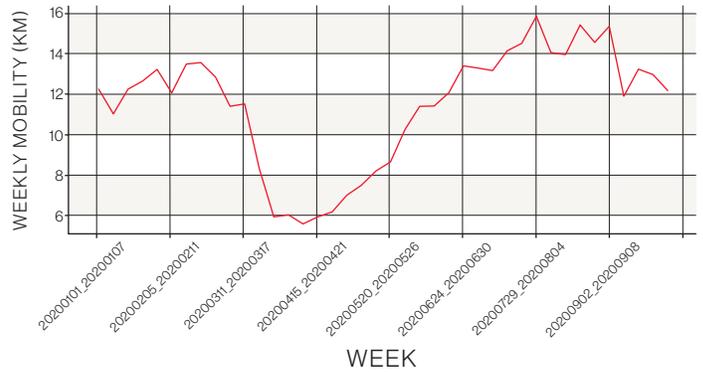


# ESSEX (WINDSOR)

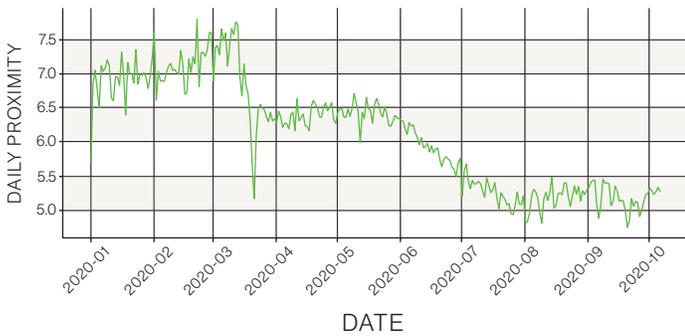
**DAILY MOBILITY – Jan 01-Oct 06**



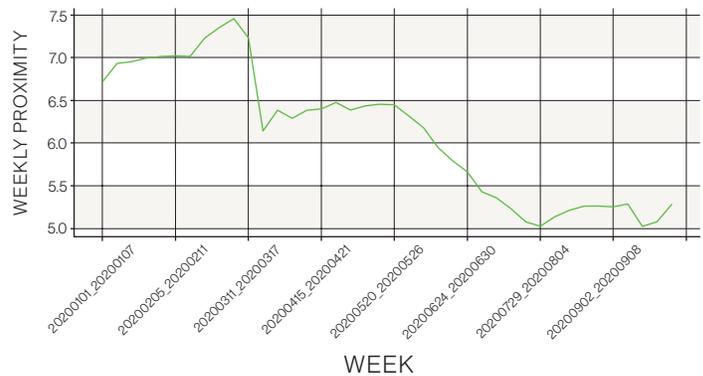
**WEEKLY MOBILITY – Jan 01-Oct 06**



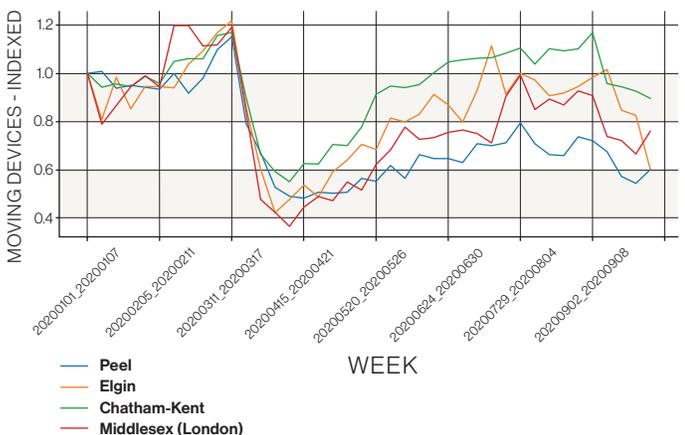
**DAILY PROXIMITY – Jan 01-Oct 06**



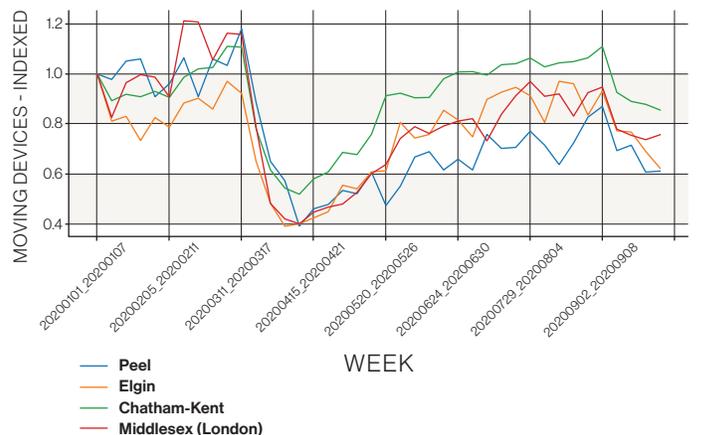
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Essex (Windsor) to Neighboring Census Divisions – Jan 01-Oct 06**

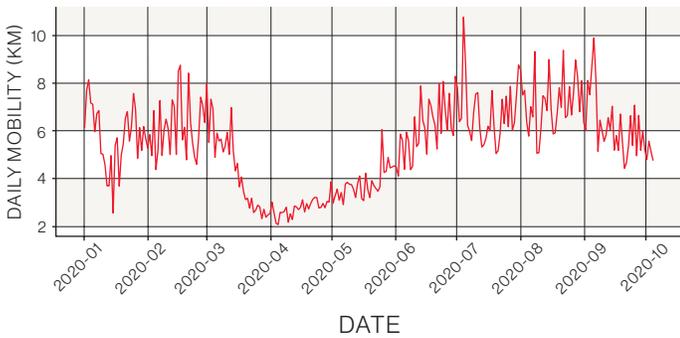


**Weekly Movements from Neighboring Census Divisions to Essex (Windsor) – Jan 01-Oct 06**

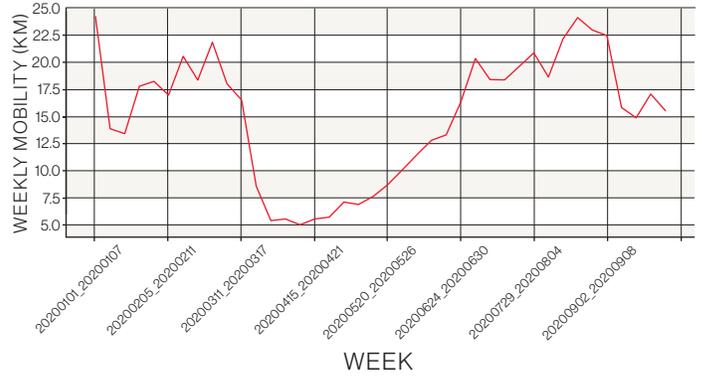


# CAPITAL (VICTORIA)

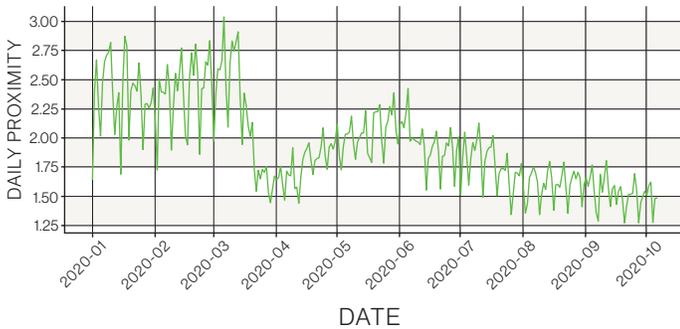
**DAILY MOBILITY – Jan 01-Oct 06**



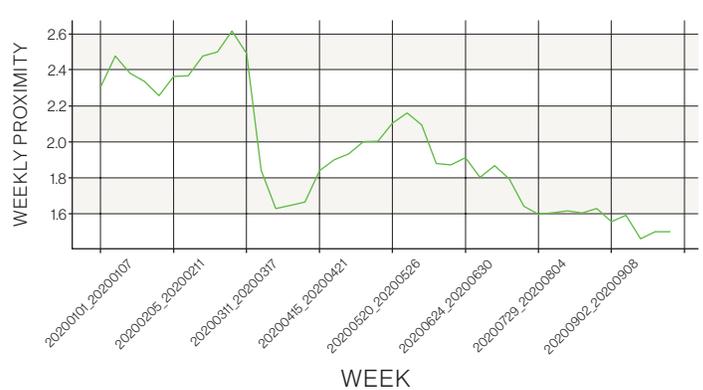
**WEEKLY MOBILITY – Jan 01-Oct 06**



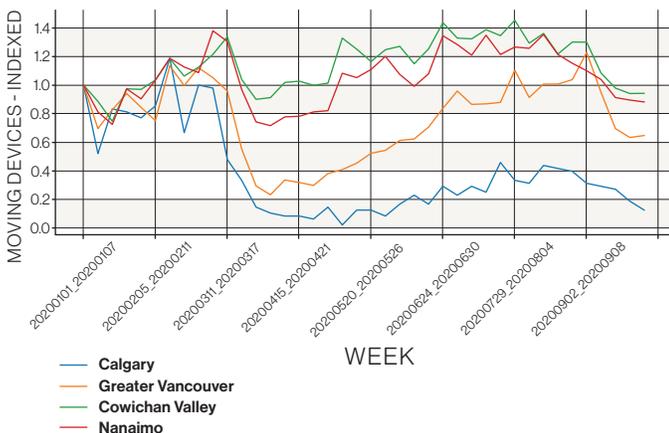
**DAILY PROXIMITY – Jan 01-Oct 06**



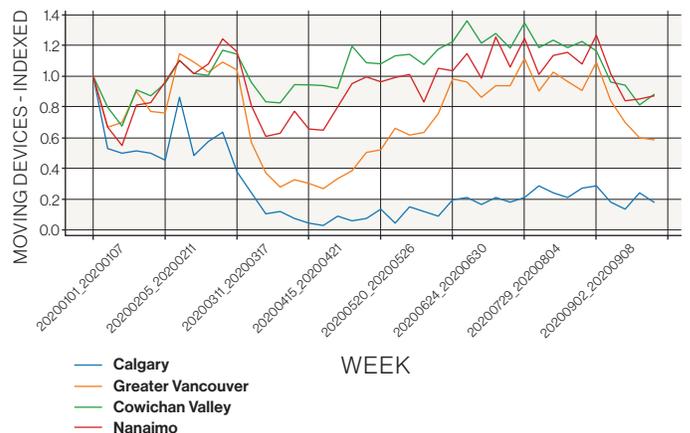
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Capital (Victoria) to Neighboring Census Divisions – Jan 01-Oct 06**

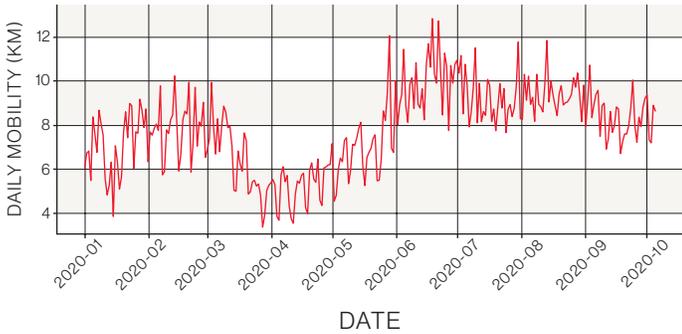


**Weekly Movements from Neighboring Census Divisions to Capital (Victoria) – Jan 01-Oct 06**

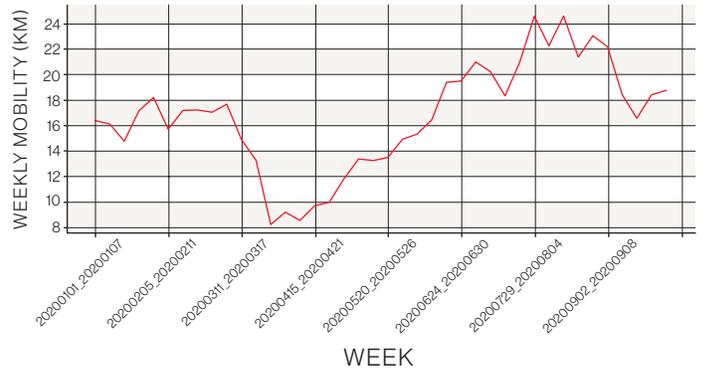


# FRASER VALLEY

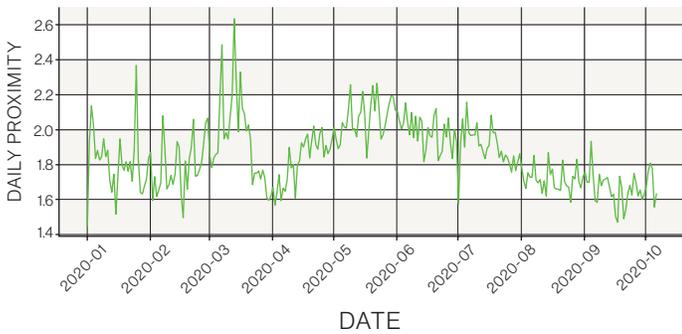
**DAILY MOBILITY – Jan 01-Oct 06**



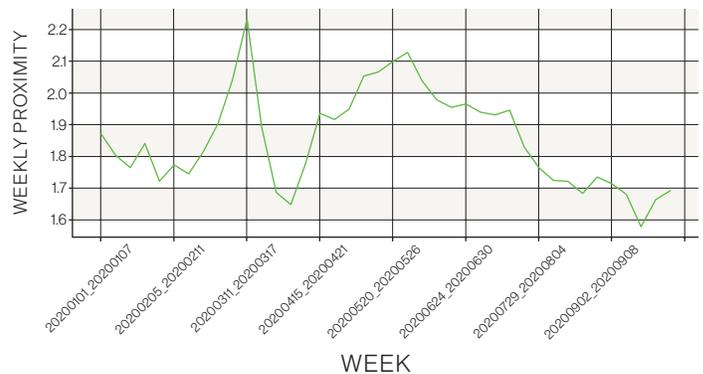
**WEEKLY MOBILITY – Jan 01-Oct 06**



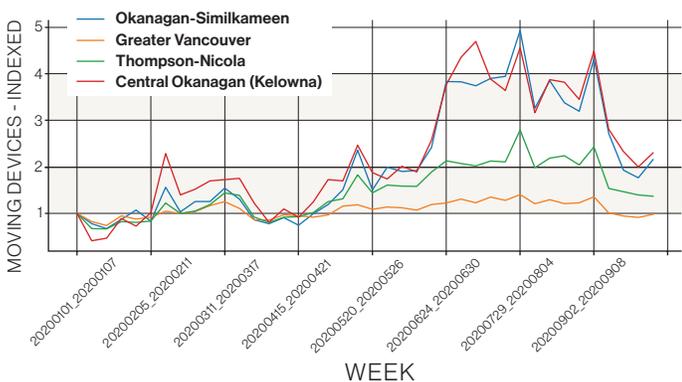
**DAILY PROXIMITY – Jan 01-Oct 06**



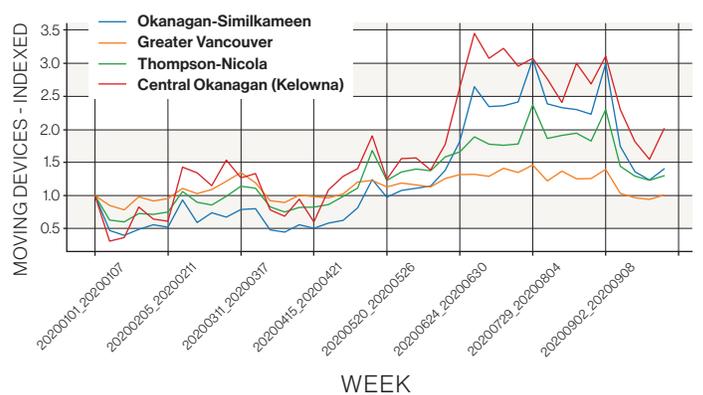
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Fraser Valley to Neighboring Census Divisions – Jan 01-Oct 06**

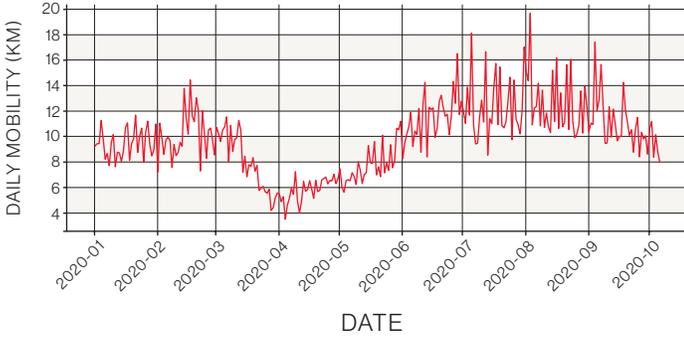


**Weekly Movements from Neighboring Census Divisions to Fraser Valley – Jan 01-Oct 06**

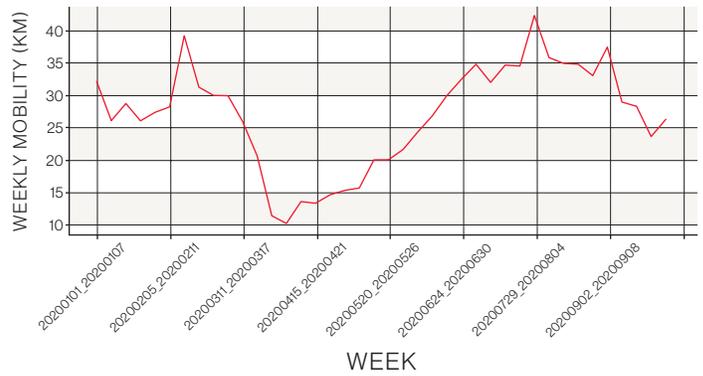


# SASKATOON

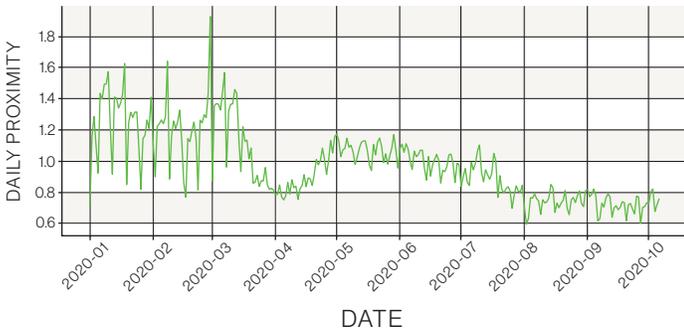
**DAILY MOBILITY – Jan 01-Oct 06**



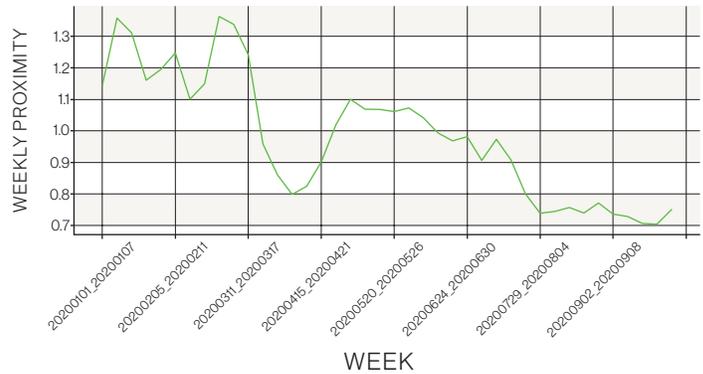
**WEEKLY MOBILITY – Jan 01-Oct 06**



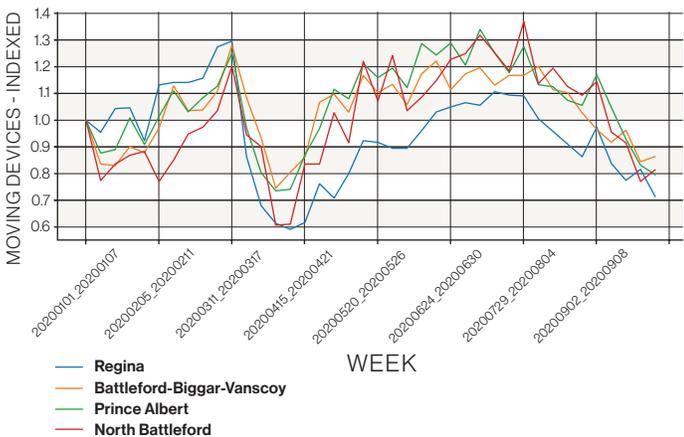
**DAILY PROXIMITY – Jan 01-Oct 06**



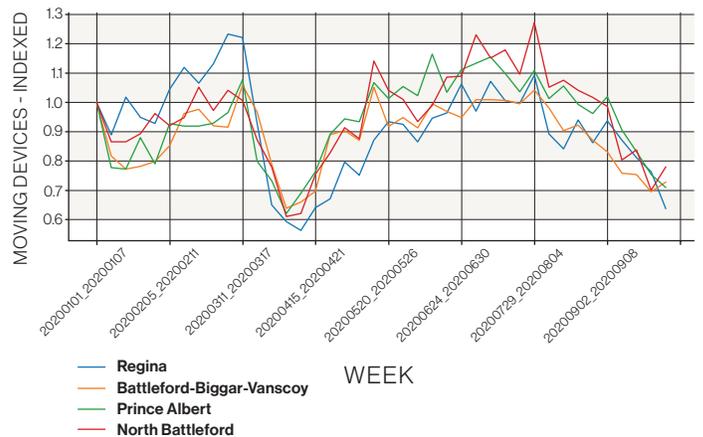
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Saskatoon to Neighboring Census Divisions – Jan 01-Oct 06**

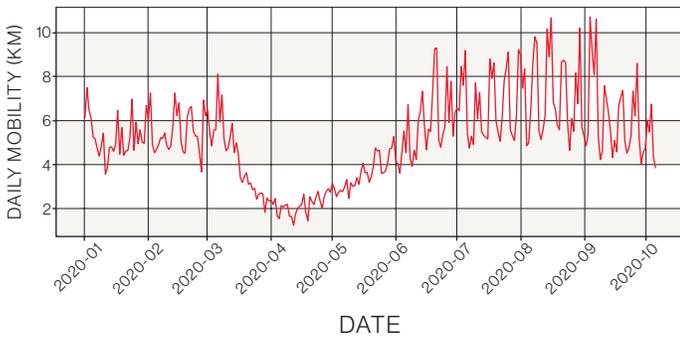


**Weekly Movements from Neighboring Census Divisions to Saskatoon – Jan 01-Oct 06**

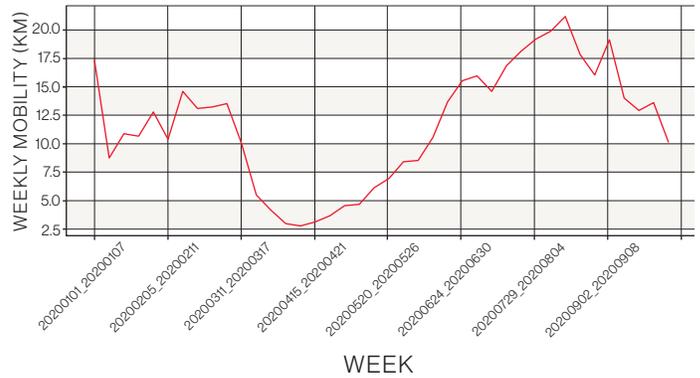


# GATINEAU

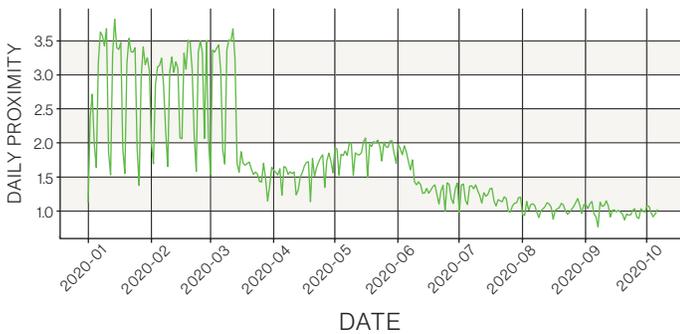
**DAILY MOBILITY – Jan 01-Oct 06**



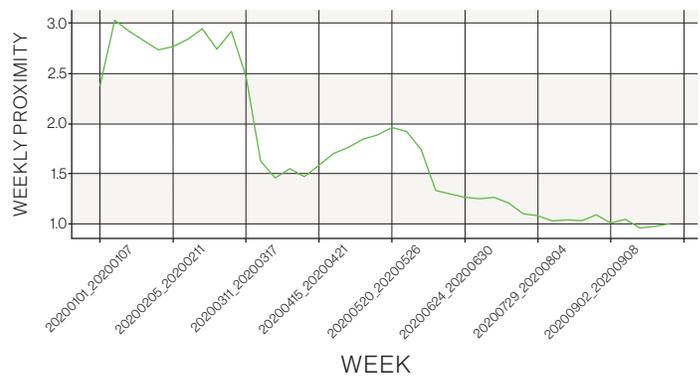
**WEEKLY MOBILITY – Jan 01-Oct 06**



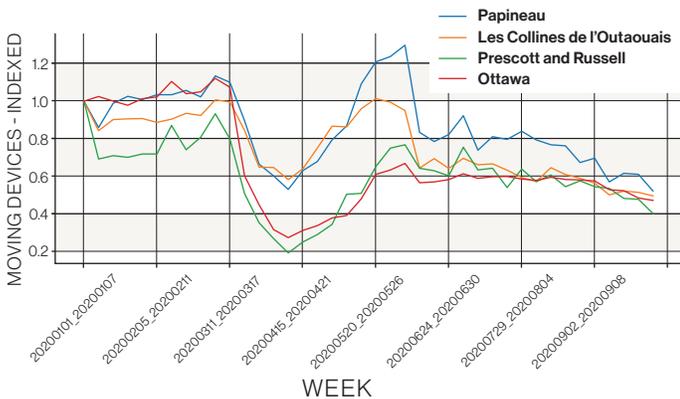
**DAILY PROXIMITY – Jan 01-Oct 06**



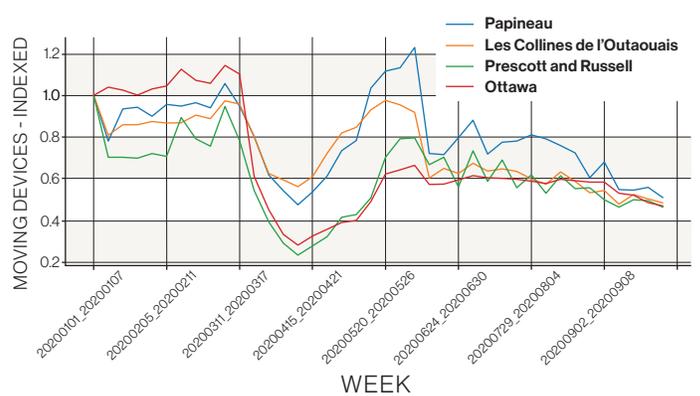
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Gatineau to Neighboring Census Divisions – Jan 01-Oct 06**

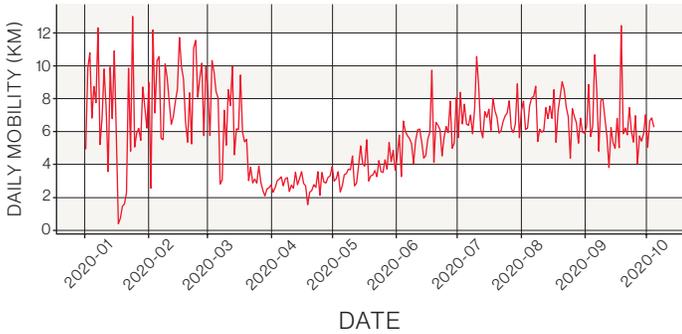


**Weekly Movements from Neighboring Census Divisions to Gatineau – Jan 01-Oct 06**

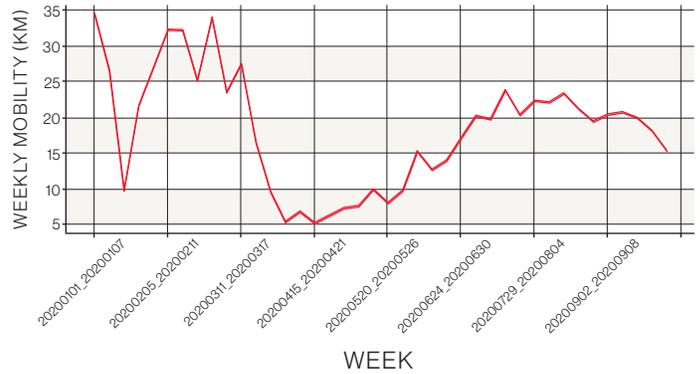


# AVALON PENINSULA (ST. JOHN'S)

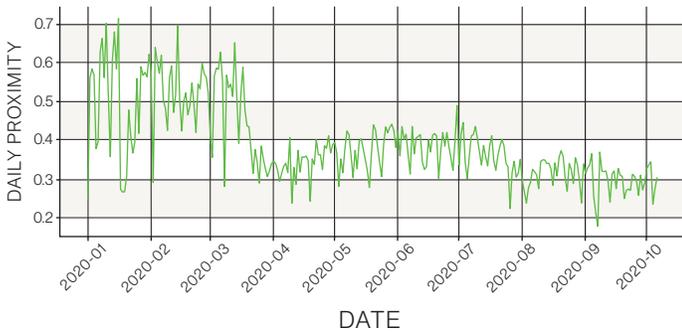
**DAILY MOBILITY – Jan 01-Oct 06**



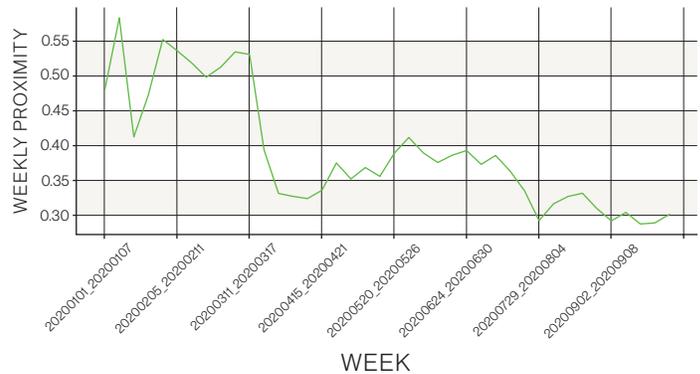
**WEEKLY MOBILITY – Jan 01-Oct 06**



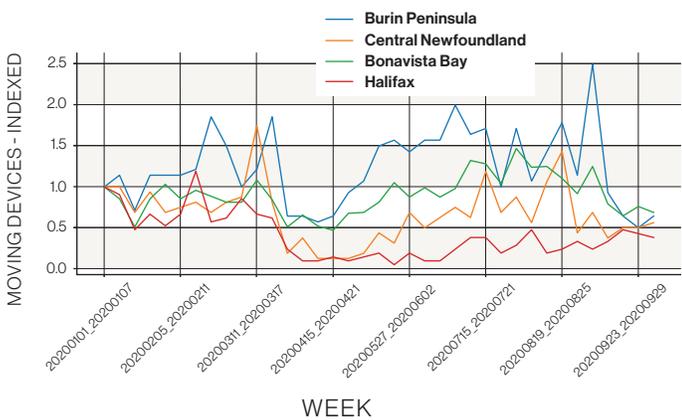
**DAILY PROXIMITY – Jan 01-Oct 06**



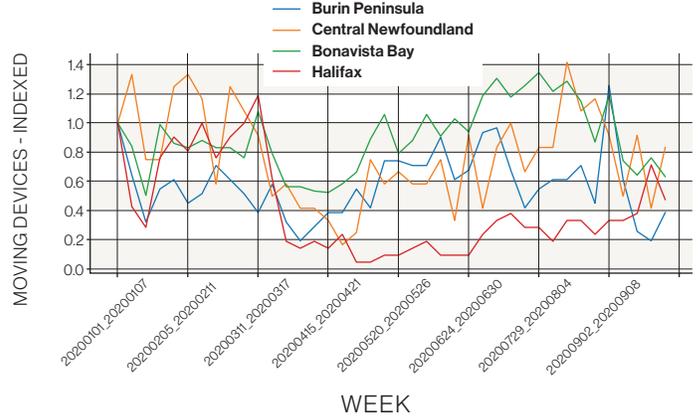
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Avalon Peninsula (St. John's) to Neighboring Census Divisions – Jan 01-Oct 06**

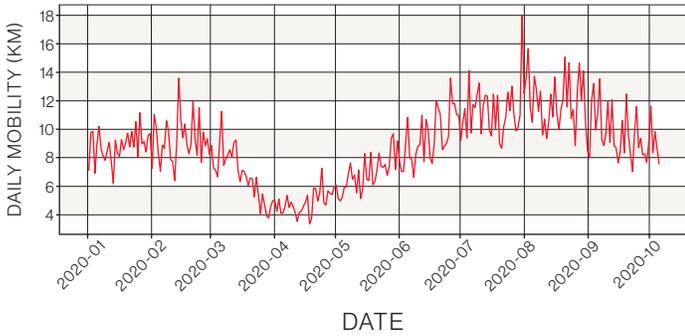


**Weekly Movements from Neighboring Census Divisions to Avalon Peninsula (St. John's) – Jan 01-Oct 06**

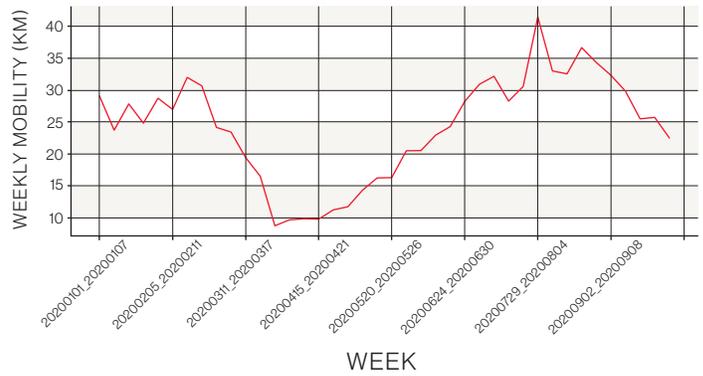


# REGINA

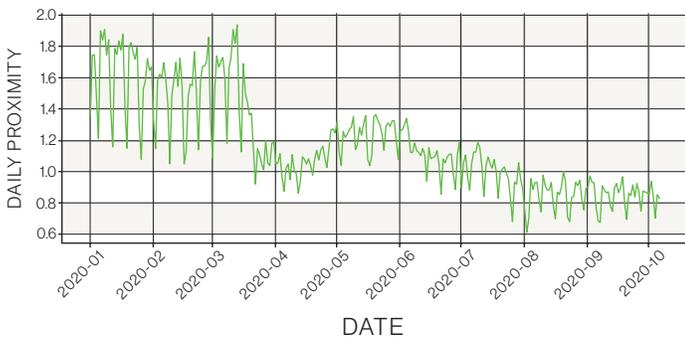
**DAILY MOBILITY – Jan 01-Oct 06**



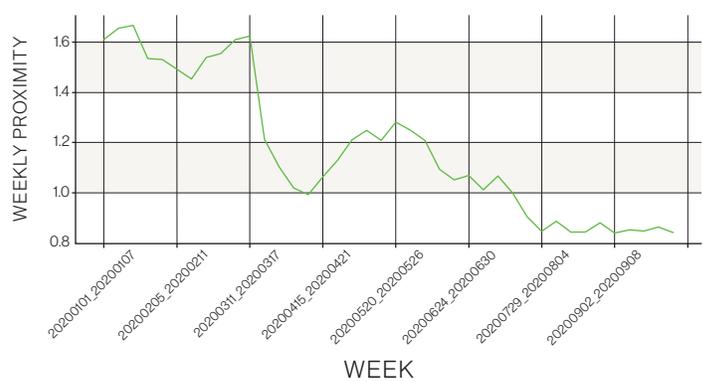
**WEEKLY MOBILITY – Jan 01-Oct 06**



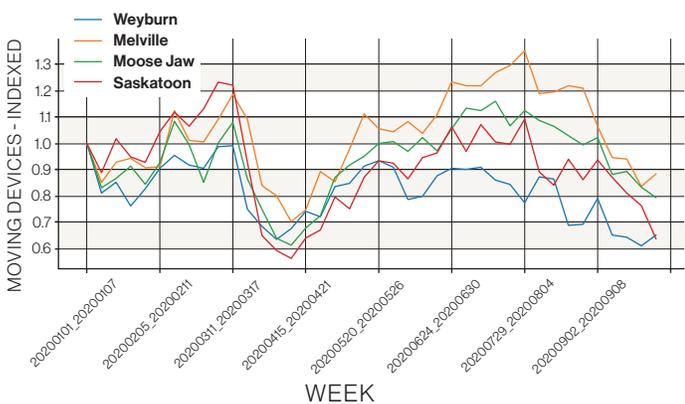
**DAILY PROXIMITY – Jan 01-Oct 06**



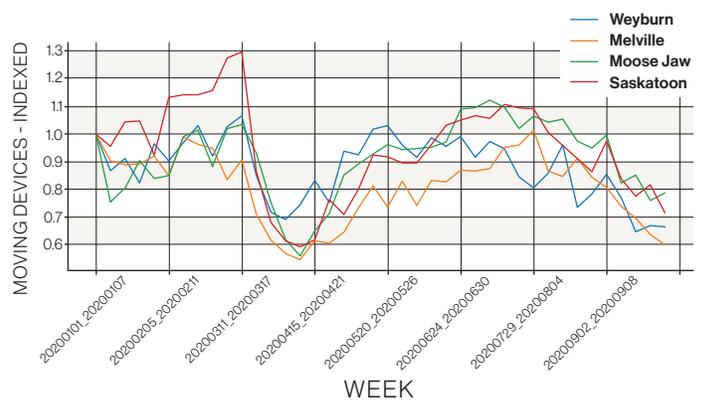
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Regina to Neighboring Census Divisions – Jan 01-Oct 06**

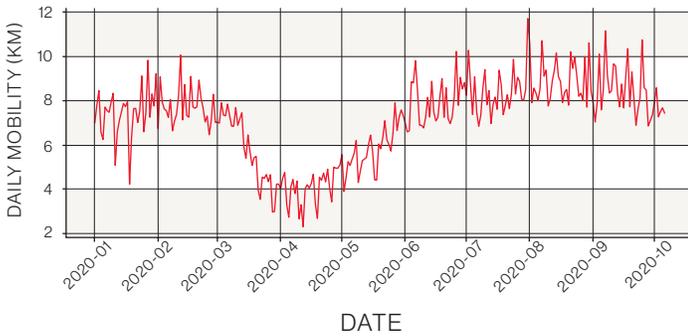


**Weekly Movements from Neighboring Census Divisions to Regina – Jan 01-Oct 06**

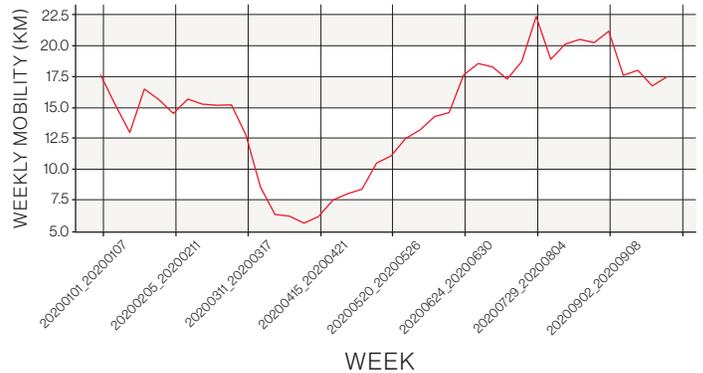


# WELLINGTON (GUELPH)

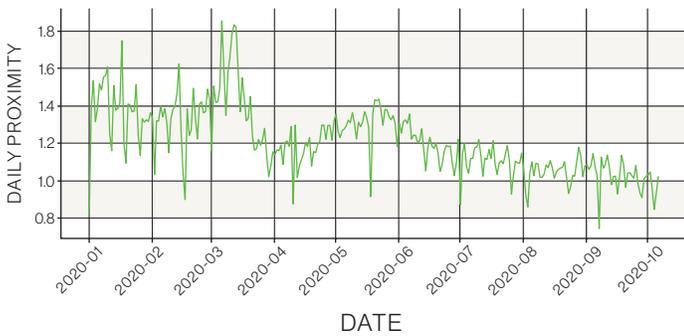
**DAILY MOBILITY – Jan 01-Oct 06**



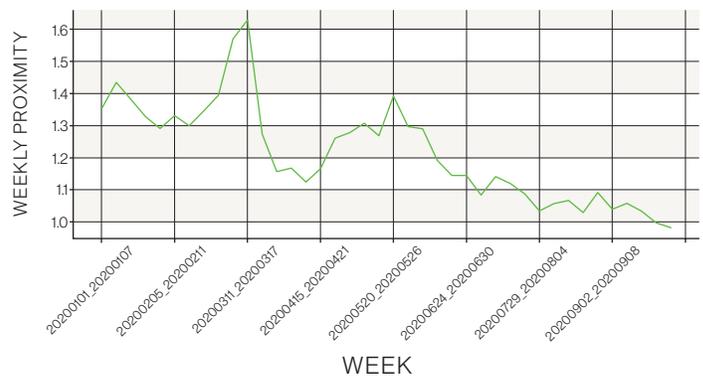
**WEEKLY MOBILITY – Jan 01-Oct 06**



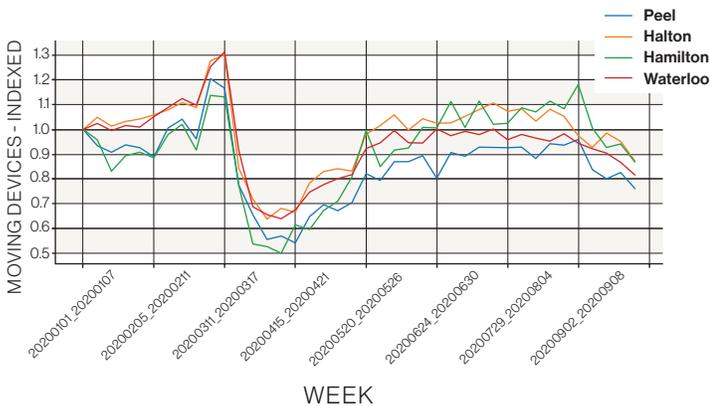
**DAILY PROXIMITY – Jan 01-Oct 06**



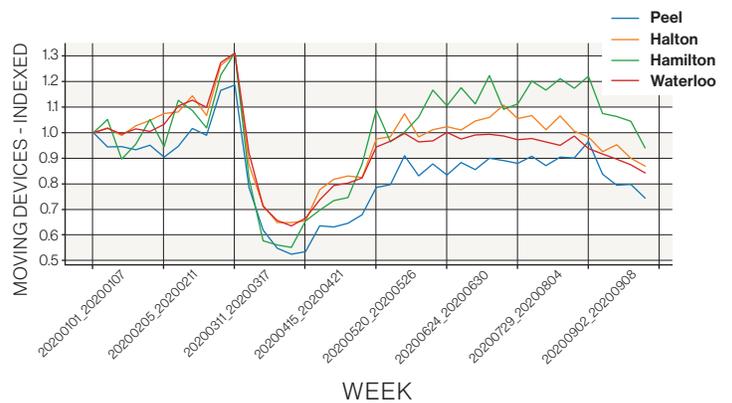
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Wellington (Guelph) to Neighboring Census Divisions – Jan 01-Oct 06**

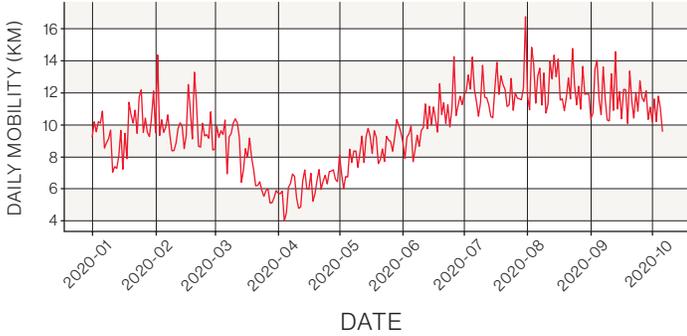


**Weekly Movements from Neighboring Census Divisions to Wellington (Guelph) – Jan 01-Oct 06**

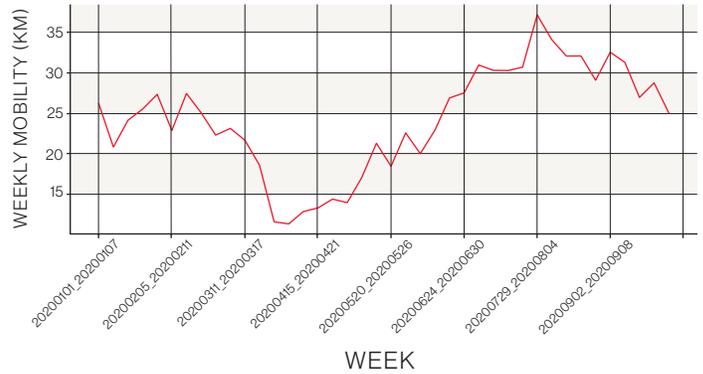


# RED DEER

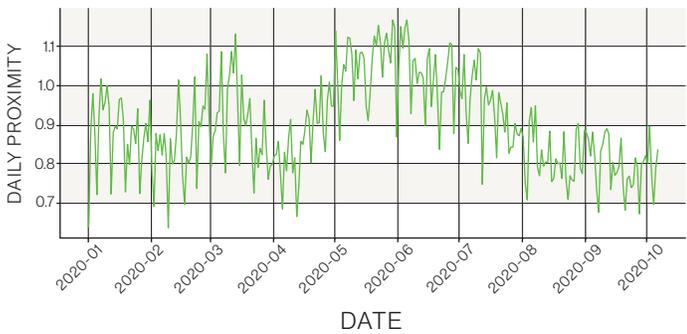
**DAILY MOBILITY – Jan 01-Oct 06**



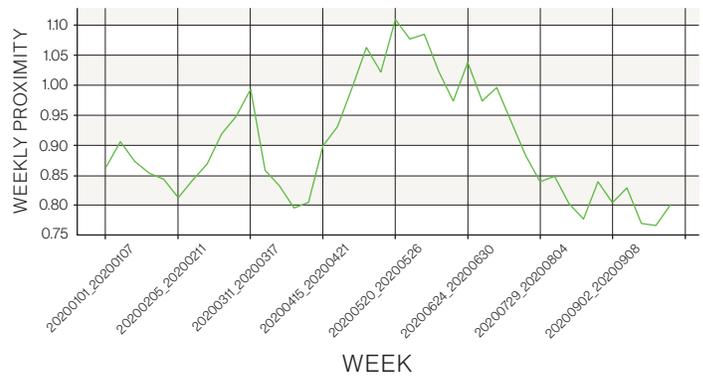
**WEEKLY MOBILITY – Jan 01-Oct 06**



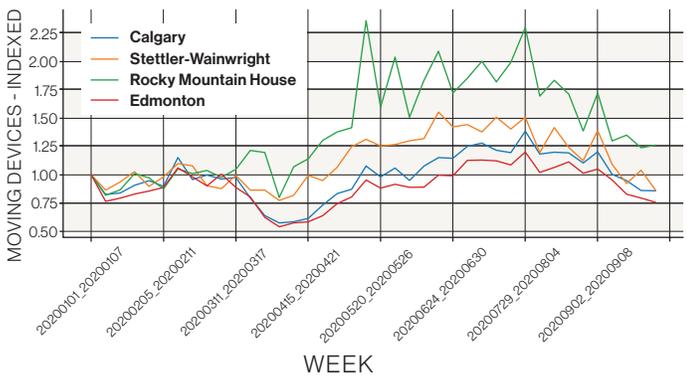
**DAILY PROXIMITY – Jan 01-Oct 06**



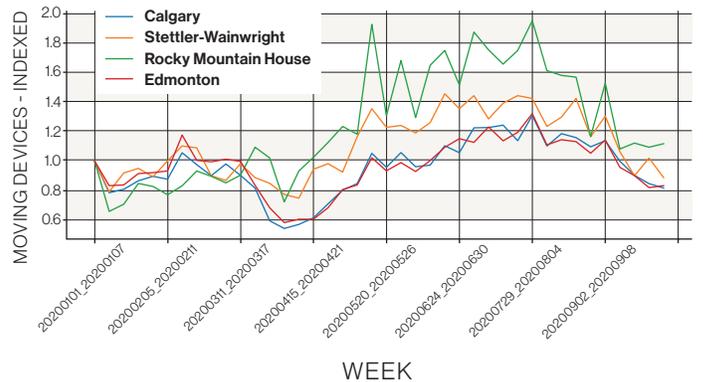
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Red Deer to Neighboring Census Divisions – Jan 01-Oct 06**

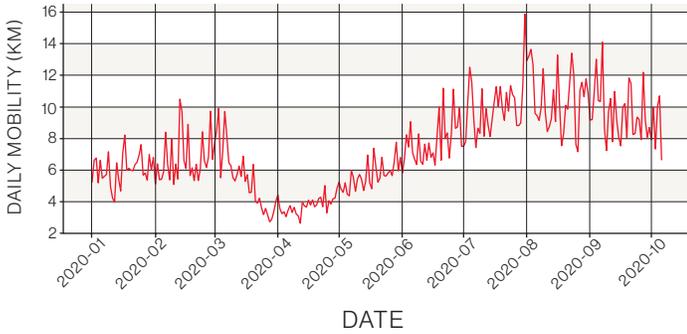


**Weekly Movements from Neighboring Census Divisions to Red Deer – Jan 01-Oct 06**

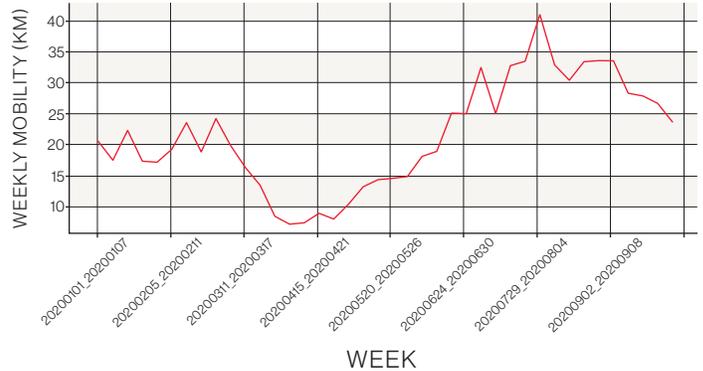


# CENTRAL OKANAGAN (KELOWNA)

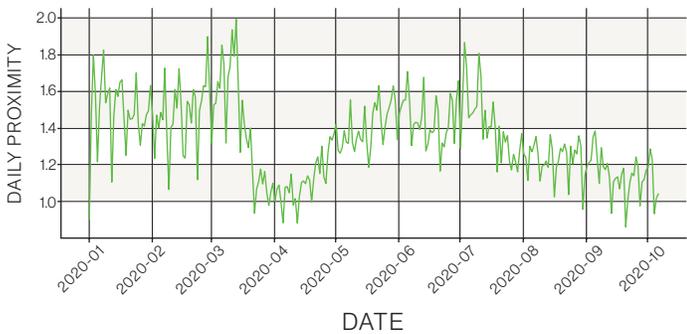
**DAILY MOBILITY – Jan 01-Oct 06**



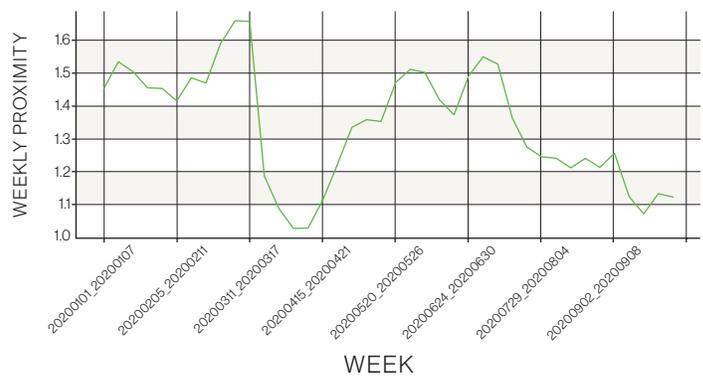
**WEEKLY MOBILITY – Jan 01-Oct 06**



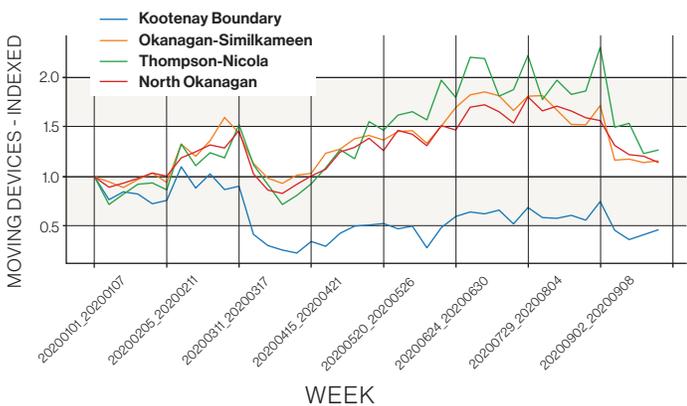
**DAILY PROXIMITY – Jan 01-Oct 06**



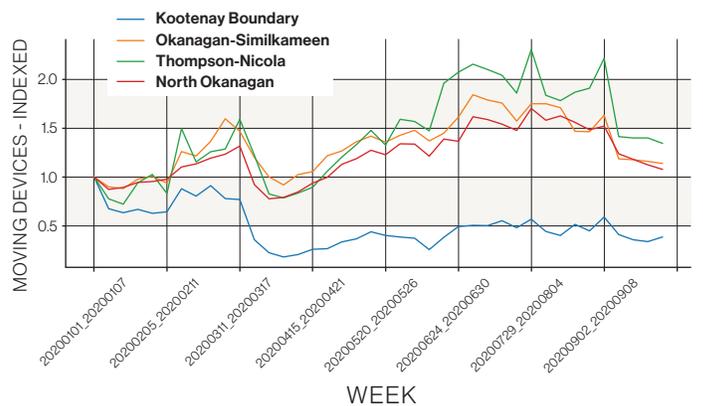
**WEEKLY PROXIMITY – Jan 01-Oct 06**



**Weekly Movements from Central Okanagan (Kelowna) to Neighboring Census Divisions – Jan 01-Oct 06**



**Weekly Movements from Neighboring Census Divisions to Central Okanagan (Kelowna) – Jan 01-Oct 06**

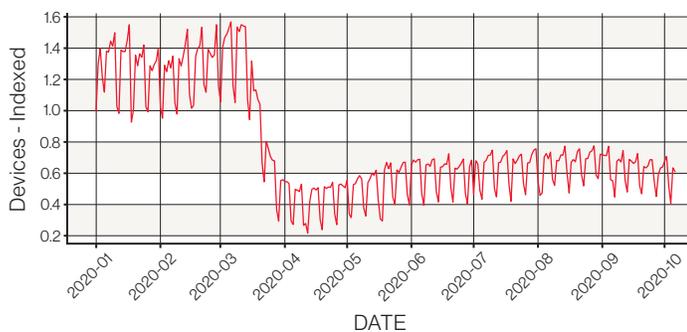


# 6. Analysis of Activity at Canadian Airports

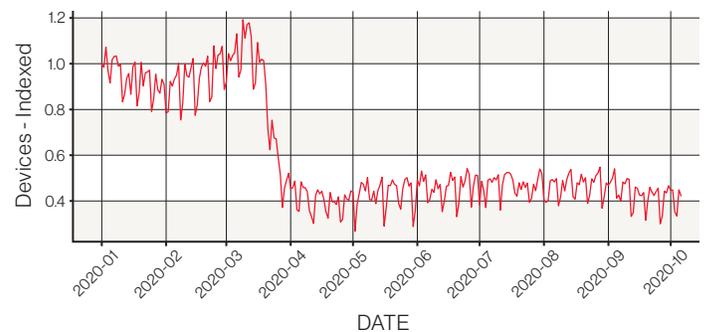
The charts below represent changes by day in the number of unique devices with locations within 3 kilometers of the center of an airport for 1-1/2 hours or more. This analysis provides information on overall activity at airports arising from arrival and departure of passengers, staff, and service personnel such as taxi drivers. The results are indexed by an

anchor on the amount of traffic through each airport on January 1, 2020. The seven international airports represented are associated with Toronto, Vancouver, Montreal, Calgary, Ottawa, Edmonton and Winnipeg. Overall, the results show a dramatic and persistent drop in the amount of activity in Canada's major airports.

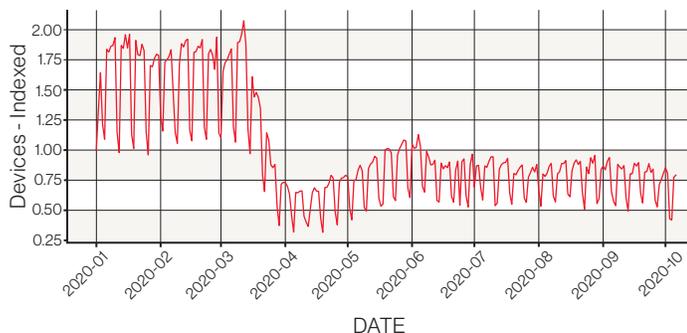
**Devices Passing Daily through TORONTO International Airport January 01 – October 06**



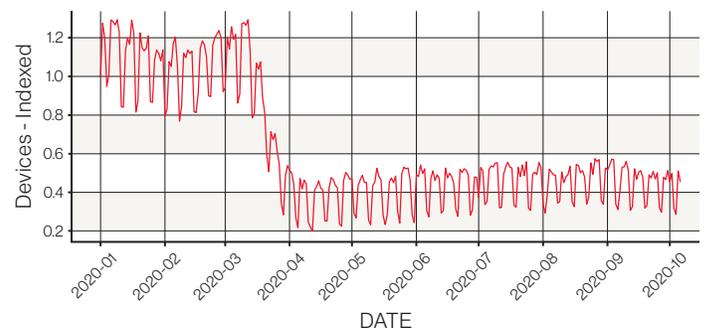
**Devices Passing Daily through VANCOUVER International Airport January 01 – October 06**



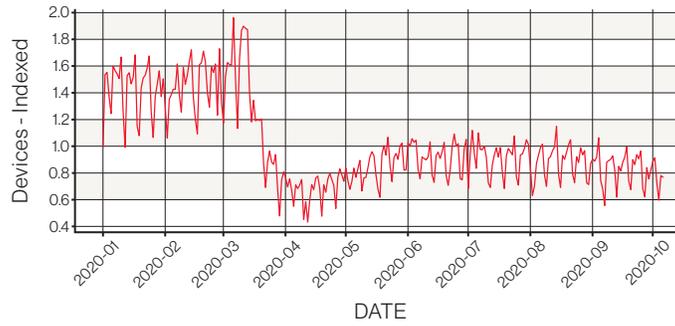
**Devices Passing Daily through MONTREAL International Airport January 01 – October 06**



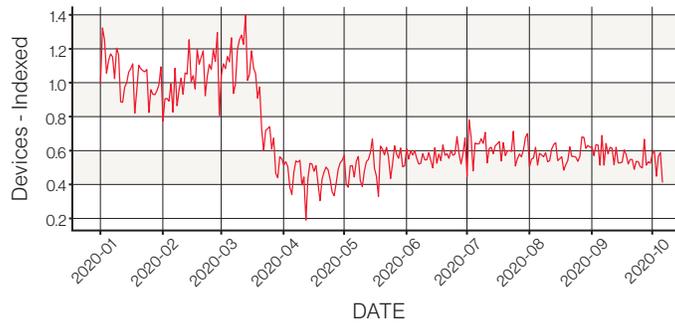
**Devices Passing Daily through CALGARY International Airport January 01 – October 06**



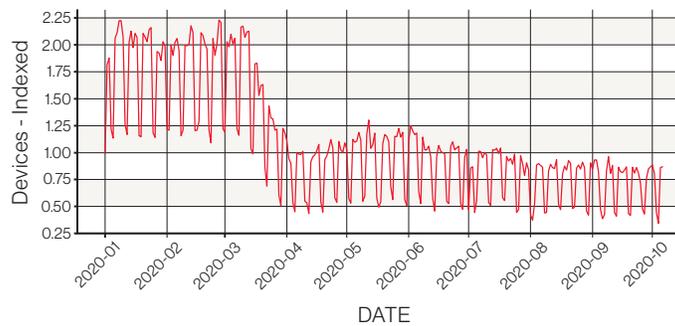
### Devices Passing Daily through OTTAWA International Airport January 01 – October 06



### Devices Passing Daily through EDMONTON International Airport January 01 – October 06



### Devices Passing Daily through WINNIPEG International Airport January 01 – October 06



# 7. Discussion and Conclusion

**In this report**, we present data on the mobility and proximity of Canadians during the COVID-19 pandemic. The results indicate that, while Canadian mobility has largely recovered to pre-restriction levels in many areas, the movements are not driven by air travel. Canadians appear to be traveling primarily locally within and between co-located cities. This movement is not accompanied by a return to pre-pandemic levels of proximity between individuals. On average, the number of people that an individual encountered on a typical day during the Canadian summer and autumn of 2020 is comparable to the number encountered on a Canadian winter weekend prior to the implementation of pandemic restrictions.

Social interaction is at the heart of Canadian life and culture. The analysis raises significant questions for future research, such as whether and how changes in mobility and proximity have affected the experiences, opportunities, and relationships of Canadians. Specific questions also arise regarding the relationships between mobility, proximity, and infection abatement. Further research is needed to understand how shifts on mobility and proximity have been distributed across privileged and vulnerable populations within Canada, and on the consequences for health, economic, educational, and other social outcomes. We need to know much more about how these changes have affected economic and educational opportunity. For example, much

more information is needed on whether the distribution of proximity is skewed in ways that make low-income essential workers more likely than others to be exposed to infection. The consequences of changes in mobility may be significant for the structure of the downtown core areas of cities. Much more knowledge is needed on the consequences of changes in mobility patterns for air and ground travel, and the potential environmental impact.

These and other questions are raised but not answered by the analyses presented in this report. What we do know is that Canadians responded to the pandemic by radically changing behavior, and by gradually shifting that behavior after March, 2020, in ways that continue to limit proximity. While overall levels of mobility have increased since March, the nature of mobility has changed significantly, with much less air travel, and more ground travel within census divisions. While local travel between census divisions increased after the March decline, the amount of travel has not returned to pre-pandemic levels in many areas.

While much is yet to be known about the causes and consequences of these changes, what is already clear is that Canadians have demonstrated a profound capacity for collective behavioral change, and an equally remarkable capacity to maintain social distance while restoring mobility within local areas.