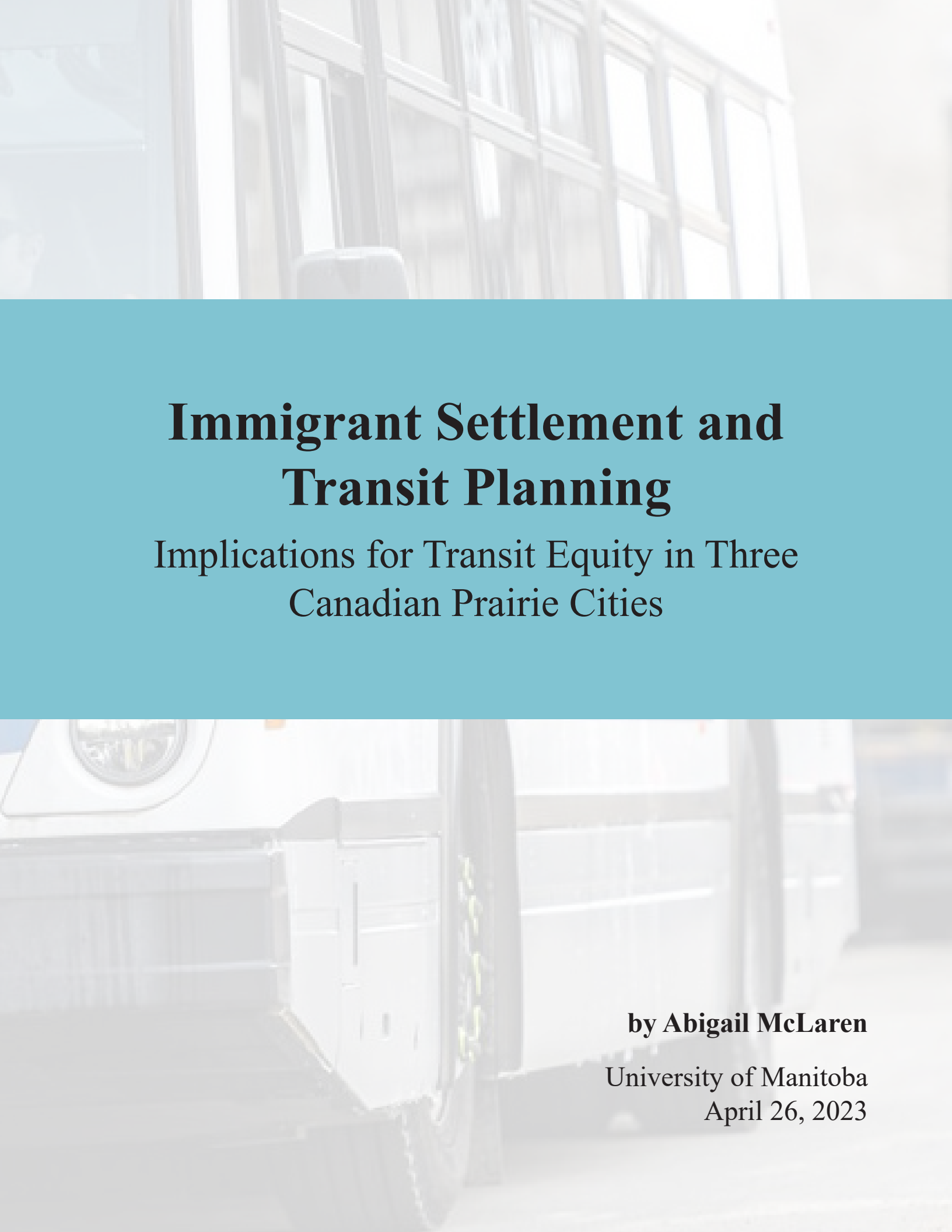

Immigrant Settlement and Transit Planning

Implications for Transit Equity in Three Canadian Prairie Cities

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Executive Summary

Recently, Canada has seen record-high immigration growth, including notable increases in newcomer growth within Manitoba and Saskatchewan. Existing literature indicates that new immigrants may rely on public transit as main mode of transportation, yet mode choices differ based on individual experiences and existing transportation systems at settlement locations. Noting that reduced access to transit may impact daily life for transit-dependent immigrants, this capstone study aims to explore how recent immigrant settlement is considered in transit planning within Winnipeg, Regina, and Saskatoon.

To investigate this issue, this study uses spatial analysis using census and transit network data to compare recent immigrant settlement patterns and transit network changes over 20-year period, and semi-structured interviews with transit agency professionals to learn more about route revision processes. The objective of using combined methods was to see where changes occurred, as well as how and if transit agencies consider such changes during route revision.

This study found that overall, recent immigrant settlement has increased in suburban and greenfield areas, despite transit presence remaining higher in core areas. Each city experienced recent immigrant population growth differently, both spatially and by census year. Transit agencies revise routes based on a variety of factors related to finances, performance data, feedback, and land-use expansion, although all are conducted without formal evaluation criteria and minor instances of public engagement. The findings demonstrate similar trends across the cities, yet each transit agency should take a unique approach to integrating equity goals within transit planning processes and policy adoption.

Without clear goals for equity, transit agencies may fail to include groups which represent a significant proportion of city residents and may contribute to ridership. To address policy implications, agencies should prioritize public engagement, consider connectivity of trip types beyond commuting patterns, and adopt clear and equitable route revision evaluation strategies.

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List of Abbreviations

CT	Census Tract
CTUID	Census Tract Unique Identification
GTFS	General Transit Feed Specification
PDF	Portable Digital File
OCP	Official Community Plan
WTMP	Winnipeg Transit Master Plan
RTMP	Regina Transit Master Plan
CBD	Central Business District

1.0 Introduction

Canada's population growth and demographics increasingly reflect its "ethnocultural diversity" (Zhuang, 2020, p.208). Between 2021 and 2022, international migration accounted for 93.5% of Canada's population growth (Statistics Canada, 2022a), and nearly one-quarter of all Canadians were or had arrived in the country as an immigrant (Statistics Canada, 2022b). Immigration is essential to the social, economic, and cultural fabric of Canada, yet the government recognizes that the annual influx of newcomers may increase strain on existing transportation systems and housing supply (Statistics Canada, 2023).

Studies have found that, over time, immigrant settlement in Canadian cities has shifted from urban cores to suburban developments (Allen et al., 2021; Kataure & Walton-Roberts, 2014; Zhuang, 2020), where the shift could be, in part, a result of gentrification of core areas (Allen & Farber, 2021). Immigrants may experience lower incomes (Barajas et al., 2018; Edmonston and Fong, 2011), where greater housing affordability outside of city centres entice residents. Yet, studies also demonstrate that settlement and transportation need of immigrants are heterogenous among groups based on ethnicity, gender, and socio-economic status (Barajas et al., 2018; Harun, 2021; Tal & Handy, 2010; Smart, 2015); however, areas with lacking quality transit systems, such as smaller cities and suburban areas with low transit presence, may negatively impact population retention and newcomers' quality of life (Bauder & Sharpe, 2002; Lo et al., 2011; Perry & Scott, 2021; Zhuang, 2020). Therefore, future transportation planning processes and policy development to include greater equity objectives for immigrants (Harun, 2021; Manaugh et al., 2015; Zhuang, 2020).

There have been previous studies conducted on immigration and transportation in Canada, but most focus on larger cities – namely Toronto, Montreal, and Vancouver – which have historically welcomed the most immigrants in the country (Bonifacio, 2013; Lo et al., 2011; Statistics Canada, 2022b). As of 2021, these three cities continued to see the highest immigration rates in the country; however, their most recent growth numbers reflect gradual declines amidst

record high immigration across Canada (Statistics Canada, 2022b). Despite demonstrating historic population losses due to provincial out-migration (Statistics Canada, 2022a), Manitoba and Saskatchewan welcomed the two highest shares of provincially nominated economic immigrants (Statistics Canada, 2022b). In 2021, the proportion of immigrants representing Winnipeg's population exceeded the national average (Statistics Canada, 2022b) while Regina and Saskatoon, saw that "[n]ew immigrants represented almost one-third of [their] immigrant population[s]" (Statistics Canada, 2022b, p.11).

1.1 Goal of the Research

The goal of this capstone is to contribute to the understanding of transit planning in Canadian prairie cities by analyzing how transit routes have changed over time; produce data on transit route revision processes and criterion used by transit agencies; examine and compare the spatial relationship between transit provision and immigrant settlement areas; and illustrate implications for transit equity advancement.

1.2 Definitions

Key terms throughout the report are defined as follows:

Equity refers to the concept of vertical equity which "considers how transportation systems serve disadvantaged and underserved groups, and address structural injustices" (Litman, 2022, p.44).

Recent immigrants are defined as "a person who obtained landed immigrant or permanent resident status in the five years preceding a given census" (Statistics Canada, 2022b).

Greenfield development refers to undeveloped to residential land use conversion sparked by changing boundaries due to "[l]arge-lot zoning at the urban fringe" (Kane & York, 2017, p.415). Since each city expanded at different points in time; the term as used in this report broadly refers to areas undeveloped prior to the mid-2000s.

1.3 Report Structure

This report will begin by discussing the methods selected for the project and their connection to the research questions and existing literature. The methods section will be followed by the literature review, which explored existing studies on immigrant settlement patterns, immigrants and transportation, and transit equity. The literature review will be followed by a brief discussion about the geographic, demographic, and transit policy contexts of each city included in the study. Next, the findings of the study are presented by method, before moving on to the discussion and analysis section of the findings. The report will end with concluding remarks and recommendations for future research.

All figures are included in Appendix C.

2.0 Methods

The capstone project is guided by the following research questions:

1. Where are immigrants settling in Winnipeg, Regina, and Saskatoon, and what are the impacts of transit routes changes on areas with higher recent immigrant populations in these cities?
2. What changes have been made to transit routes in Winnipeg, Regina, and Saskatoon over time, and what key information do local transit agencies use to determine and design service revisions?
3. What are the policy implications of changing settlement patterns for transit agencies in prairie cities?

I used spatial analysis to address the first question. Upon data visualization, descriptive statistical data of immigration is associated within geographic space and can be spatially analyzed by mapping (used in Allen & Farber, 2021; Allen et al., 2021; Harun, 2021; Heisz & Schellenberg, 2004) and modelling (used in Anderson et al., 2021; Blumenberg & Smart, 2010; Kramer, 2018; Smart, 2015; Tal & Handy, 2010). To address the second question, I conducted interviews with transit agency professionals. Interviews are recognized by researchers as an effective means of collect firsthand accounts of information not captured in formal policy (used in Amar & Teelucksingh, 2015; Bonifacio, 2013; Karner & Levine, 2021; Linovski et al. 2018; Perry & Scott, 2021; Wellman, 2015; Wellman, 2016).

2.1 Spatial Analysis

Based on the project scope and my technical capabilities, I used mapping as a tool for spatial analysis. Through mapping, I was able to visualize where recent immigrants are settling in each city and how settlement patterns changed over time, as well as where transit routes have existed and currently exist in relation to these settlement areas. I used ArcGIS Pro software to create the maps. The mapped datasets include Statistics Canada census data, agency-provided transit

data, and general transit feed specification (GTFS) files from the Open Mobility Data portal on transitfeed.com. For a more accurate comparison of transit routes and settlement patterns across each city, I aimed to map transit data which closely aligned with the census years 2001 and 2021.

2.1.1 Data Sets

To visualize recent immigrant settlement in each city, I used Statistics Canada census population data and census tract (CT) profiles on immigration capturing a 20-period. I used the data repository <Odesi> to find and download CT profile datasets from 2001, 2006, 2011, and 2016. I chose to use <Odesi> rather than Statistics Canada's website, since the library carried the data in smaller, more accessible formats such as .ivt[1] and .xls[2] files. For each city and each census year, I calculated the percentage of the recent immigrant population per CT by taking the total CT population and dividing it by the total number of recent immigrants within that CT.

Since not all datasets from the 2021 census have been published on <Odesi>, I also used the Census Data Viewer tool from the Statistics Canada website to find and export .xls tables containing the required data. Since one of the web application's capabilities was to represent and download the information as rates, I did not need to manually calculate the rate of recent immigrant populations per CT.

Boundary files delineating CT and census subdivisions[3] also came from Statistics Canada. To visually represent the census data, I created a spatial join between the Excel data and cartographic boundary file based on the CT unique identification or "CTUID". Other relevant data, such as road networks, was downloaded from authoritative government sources.

To visualize transit route networks, I used datasets shared by transit agencies from each city. Each transit agency shared their data in a file format available to them; Winnipeg Transit shared shapefiles (.shp)[4] from 2003 to 2022, Regina Transit shared a combination of .shp and PDFs from

1 File format compatible with Beyond 20/20.
2 File format compatible with Microsoft Excel.
3 Used in this study to represent the boundary of each city.
4 File format compatible with geographic information systems (GIS) programs.

various years between 2002 to 2021, Saskatoon Transit shared PDFs from various years from 2002 to 2021 (see Table 1.).

Table 1. Available Route Data from Each Transit Agency

	Data Corresponding with Census Years 2001, 2006, 2011, 2016, 2021? (Y/N)	If no, which one is missing?	Are all in mappable formats? (i.e. .shp)? (Y/N)	If no, could they be digitized? (Y/N)
Winnipeg Transit	Y	-	Y	-
Regina Transit	N	2006	N	Y
Saskatoon Transit	Y	-	N	Y

Based on the scope of the project, I decided to map transit data comparing two points in time – approximately 2001 and 2021. To convert the early transit data from Regina and Saskatoon into a mappable format, I digitized both of their 2002 routes from PDFs into polyline features in ArcGIS Pro. I downloaded 2021 GTFS data from Open Mobility Data at transitfeed.com to supplement any remaining data gaps, and from there, converted the GTFS text files to shapes in ArcGIS Pro.

2.1.2 Identifying Sample Areas

I identified sample areas within each city to narrow down which transit routes would be considered in the spatial analysis. The sample areas included six CTs from each city which witnessed the highest rates of recent immigrants over a 20-year period. Of the six sample areas per city, I identified three as CTs which demonstrate the highest average rate of recent immigrants over time, and three CTs demonstrating the greatest increase of recent immigrant population shares between 2001 and 2021. I calculated the percentage increase over time by taking the difference between the population rate from 2021 and 2001.

2.2 Interviews

I used semi-structured interviews to identify the key information local transit agencies use to determine and design route revisions. My goal was to interview transit agency staff from Winnipeg Transit, Regina Transit, and Saskatoon Transit, who had been involved in transit route design and revisions. Staff who did not have knowledge of the transit revision processes were ineligible to participate in the interviews.

I aimed to recruit six participants, and two from each city: Winnipeg, Regina, and Saskatoon. I scanned the directories of each city to identify prospective participants based on their job title and their contact information. If I was unable to find their contact information online, I phoned the transit agencies' main line to inquire about the email addresses of employees deemed appropriate candidates for the interview. From there, I developed and used an email script to contact prospective participants. I designed the interviews to be semi-structured, by including ten (10) structured discussion questions which focused on criteria used by transit professionals in making route or network revisions (see Appendix A). Most of the interviews conducted took place via a licensed version of Zoom and lasted 30 minutes each. One interview was conducted via phone and lasted for 15 minutes, where I took handwritten notes.

I was able to interview five participants in total: one planner, two engineers, and two transit managers. One prospective participant declined since they were new to the position and did not feel comfortable answering the interview questions.

2.3 Limitations

This study includes limitations in the methods and data, in part due to the capstone project scope and timeline.

My knowledge about immigrant settlement and mode choice is drawn from the literature review, since my methods did not include interviews with recently immigrated persons or representatives from immigrant settlement organizations. Although the findings from literature are rich, relevant,

and reputable, most of the studies were conducted in other geographic contexts. As such, my knowledge about immigrant settlement processes and lived experienced specific to Winnipeg, Regina, and Saskatoon is limited.

My spatial analysis was limited to CT boundaries, which are subject to change per census year. CT changes do not happen often but may occur because of new development (Statistics Canada, 2018). In 2021, all three cities saw recent immigrant settlement occur in newly formed CTs. I chose not to compare the new CTs with re-aggregated CTs from preceding years, so I could identify where such CTs emerged over time. Additionally, in my transit analysis I only considered routes which intersected with a sample area CT's boundary. In some cases, transit routes may have only been touching the border of a CT and did not adequately service the entire area.

I considered routes identified by the same route number in 2001 and 2021 as unchanged across the 20-year period. If the routes between the two years shared the same identifying route number, I did not analyze and compare the differences in their origin and destination nor the accessibility to bus stops and destinations.

One limitation of downloading census data from <Odesi> is that the CT population data and CT profile data, for all years except 2006, had to be downloaded as two separate .xls files. In these cases, I manually combined the data into one table, which may have resulted in errors.

Another limitation of the census data is that some CT profile data is repressed due to low population counts or for other confidentiality matters. Low population numbers may also have skewed the visual representation of the data.

I also had difficulty in retrieving transit data. Winnipeg Transit was the only agency able to provide transit route data in a conveniently mappable format from 2003 and onward. Saskatoon Transit was unable to access and share .shp due to data agreements with a third-party company, and Regina Transit did not have any .shp prior to 2018. Errors may have been introduced to the transit route data in cases where I digitized the data myself.

3.0 Literature Review

This literature review begins by discussing immigrant settlement patterns over time, and some common factors that influence settlement choice. From there, the literature review focuses on the complexities of travel behaviour and mode choice among immigrants, as well as the transportation barriers experienced by immigrants. The literature review will continue with a section of transportation and equity, followed by gaps in literature, and conclude with implications for future research.

3.1 Immigrant Settlement Patterns: Urban to Suburban Shift

According to census data interpretations across several studies, immigrants are more likely to reside in neighbourhoods with members from their same ethnic group or among other racialized groups (Anderson et al., 2021; Edmonston & Fong, 2011; Tal & Handy, 2010). Scholarship has also found that immigrants with higher socio-economic status may relocate away from ethnic groups as income rises (Harun, 2021; Zhuang, 2020). Additionally, some scholars agree spatial mismatch, a theory noting disparity between a racialized group's access to suburban employment (Kain, 1968), continues to exist between residential selection and access to key destinations (Harun, 2021; Lo et al., 2011). However, others suggest that no spatial theory can resolve the complexities of immigrant settlement amidst current housing market and transportation disparities (Amar & Teelucksingh, 2015; Kataure & Walton-Roberts, 2014; Kramer, 2018).

Beyond theory, settlement patterns reflect the diversity of immigrant groups and their various cultural and socio-economic backgrounds (Amar & Teelucksingh, 2015; Harun, 2021; Kataure & Walton-Roberts, 2014; Tal & Handy, 2010). These patterns are shaped by "the economic opportunities and developments […] present in different periods" (Edmonston & Fong, 2011, p.10) such as the labour market and immigration policies encountered by each cohort (Bauder & Sharpe, 2002; Bonifacio, 2013). As a result of these complexities, chosen settlement locations can be both voluntary and involuntary (Anderson et al., 2021; Chatman & Klein, 2013).

3.1.1 Housing Affordability

Housing affordability is a primary factor in immigrant settlement (Allen et al., 2021; Amar & Teelucksingh, 2015; Zhuang, 2021). Large cities which typically attract immigrants, such as Toronto, Montreal, and Vancouver, experience high rental housing costs (Kramer, 2018; Li & Teixeira, 2014) and increasing housing prices near areas with good access to transit, such as downtown and pre-war neighbourhoods (Allen & Farber, 2021). During the mid-20th century, most immigrants were settling within inner-city centres (Amar & Teelucksingh, 2015; Lo et al., 2011), characterized at the time by affordable housing (Li & Teixeira, 2014), key social services, and public transit access (Tal & Handy, 2010). More recently, immigrant settlement patterns have shifted away from the urban core, and towards suburban areas (Allen et al., 2021; Harun, 2021; Zhuang, 2020), although some scholars suggest this shift "began as early as the 1900s" (Kataure & Walton-Roberts, 2014).

3.1.2 Existing Cultural Community

Apart from housing affordability, settlement patterns are also influenced by the concentration of cultural community. Enclaves are areas of immigrant settlement at the neighbourhood-scale, often emergent in low-density suburbs (Harun, 2021; Kataure & Walton-Roberts, 2014) characterized by a greater amount of rental apartment stock (Allen et al., 2021; Bauder and Sharpe, 2002) and developed social networks (Bonifacio, 2013). Although the term formerly described a homogeneous clustering of ethnic groups, recent enclaves are found to be highly diverse, multicultural, and mixed-income communities (Edmonston & Fong, 2011; Harun, 2021; Kataure & Walton-Roberts, 2014; Zhuang, 2020).

Immigrants may seek to settle in enclaves because of their rich social capital, including ties to family, culture, religion, or country (Allen et al., 2021; Bonifacio, 2013; Chatman & Klein, 2013; Kataure & Walton-Roberts, 2014; Harun, 2021; Smart, 2015; Zhuang, 2021), comparatively affordable housing (Bauder and Sharpe, 2002), or proximity to culturally significant commercial and service hubs (Allen et al., 2021; Chatman, 2014; Smart, 2015), ethnic food stores (Amar

& Teelucksingh, 2015) or shopping centres (Bonifacio, 2013; Harun, 2021; Zhuang, 2020). As businesses expand and attract prospective residents, the surrounding built form gradually reflects the vitality of enclaves (Kataure & Walton-Roberts, 2014; Zhuang, 2020).

3.1.3 Proximity to Transit: Still Applicable?

Settling in areas with greater social networks such as enclaves is an arguably greater draw for immigrants compared to housing prices and differing access to transit (Allen et al., 2021; Chatman & Klein, 2013; Harun, 2021). Individuals residing in enclaves may also find local employment and shopping opportunities which greatly reduce commute costs (Chatman, 2014).

For individuals who must commute, the relationship between transportation and housing markets have become increasingly complex in North America as "households must choose between affordable transportation or affordable housing" (Kramer, 2018, p.8). Evidence from a U.S. survey found transportation to be the second highest household cost next to housing (Lucas, 2004; Wellman, 2015). Recent studies in Canada and the US have found that areas with expensive housing demonstrate the highest levels of transit accessibility, where immigrants among other socially disadvantaged groups reside in suburban areas with poorer transit accessibility overall (Allen et al., 2021; Amar & Teelucksingh, 2015; Kramer, 2018). These studies also suggests that immigrant populations may suffer displacement due to "transit-induced gentrification" (Harun, 2021, p.96) following transit-oriented development projects (Allen et al., 2021; Amar & Teelucksingh, 2015).

3.2 Transportation and Immigrants

Existing literature demonstrates that immigrants' transportation decision-making is intrinsically linked to "socio-economic circumstances, spatial settlement patterns, and cultural background" (Harun, 2021, p.21; Smart, 2015) and impacted by existing built form, opportunities available at a given location, and existing transportation systems (Chatman & Klein, 2013; Lo et. al, 2011; Tal & Handy, 2010; Zhuang, 2020). Scholars further describe immigrant travel behaviour and

mode selection in the Prairies and smaller urban centres across Canada varies person to person based on livelihoods and lifestyle (Bonifacio, 2013; Perry & Scott, 2021).

3.2.1 Travel Behaviour

Immigrant travel behaviour differs across intersectionality of race, gender, and income. Travel behaviour and mode selection among immigrants differs from non-immigrants (Smart, 2015; Tal & Handy, 2010), and is heterogenous across groups and genders (Chatman, 2014; Chatman & Klein, 2013; Garrett & Taylor, 1999; Harun, 2021; Heisz & Schellenberg, 2004). For instance, two studies found that East Asian immigrants were more likely to own and utilize cars, compared to South Asian populations who predominantly utilized public transit (Harun, 2021; Heisz & Schellenberg, 2004). Furthermore, studies show that immigrant women are less likely to drive and more likely to use public transit or carpooling compared to immigrant men and non-immigrant women (Blumenberg & Smart, 2010; Heisz & Schellenberg, 2004; Lucas, 2004; Tal & Handy, 2010).

Transport poverty occurs when travel costs are unevenly distributed across households, and combined disadvantage results in lengthy daily commutes (Allen & Farber, 2021). Since affordable housing and enclaves are more likely to be found in suburban areas, “economic independence (e.g. finding and retaining employment), health, and well-being” (Allen & Farber, 2021, p.1833) becomes increasingly challenging without a car. Immigrants experiencing low-income and limited vehicle access are more likely to have trouble in making chain trips, or multiple consecutive trips, when using alternative transportation methods (Amar & Teelucksingh, 2015; Barajas et al., 2018), indicating transport poverty.

3.2.2 Mode Choice

Studies indicate that immigrants frequently use transit or carpooling as a primary mode for all trip types (Amar & Teelucksingh, 2015; Blumenberg & Smart, 2010; Chatman, 2014; Chatman & Klein, 2013; Harun, 2021; Linovski et al., 2021; Smart, 2015; Tal & Handy, 2010).

Recent immigrants are found to be more likely to commute via public transit compared to non-immigrants even while living in suburban areas with poor levels of access (Allen et al., 2021; Barajas et al., 2018; Chatman & Klein, 2013; Heisz & Schellenberg, 2004). Conversely, data from the National Household Travel Survey in the U.S. found that public transit is twelve times less likely to be utilized by recent immigrants for trips compared to carpooling (Blumenberg & Smart, 2010), especially by immigrants residing in enclaves or relying on social supports for ridesharing (Chatman & Klein, 2013; Smart 2015).

Immigrants may be less likely to have access to, or frequently utilize, a household car compared to non-immigrant households (Amar & Teelucksingh, 2015; Barajas et al., 2018; Chatman & Klein, 2013; Lucas, 2004); however, driving remains the preferred method if the option is available (Barajas et al., 2018; Tal & Handy, 2010). Several studies have also observed that increases in income and number of years spent in a host country positively correlated with private auto use – the longer an immigrant has resided within a host country, their transit use diminishes (Chatman & Klein, 2013; Heisz & Schellenberg, 2004; Smart, 2015; Tal & Handy, 2010).

3.2.3 Transportation Barriers

As Lucas (2004) put: “non-car ownership is usually not a choice but rather based upon affordability and/or an inability to drive” (p.23), which is often the case for new immigrants (Amar & Teelucksingh, 2015; Harun, 2021). Approximately one-third of recent immigrants are considered low-income (Edmonston & Fong, 2011; Tal & Handy, 2010), making cost a main factor in mode selection and reduced access to destinations (Barajas et al., 2018; Linovski et al., 2021). For example, the cost of car ownership and use influences high transit dependency among immigrants (Tal & Handy, 2010; Smart, 2015), and walking might be used to avoid unaffordable transit fares (Amar & Teelucksingh, 2015). Studies have also found that bicycles are not financially accessible to all low-income immigrants (Barajas et al., 2018).

Transportation barriers such as poor-quality transit service in areas with immigrant populations can impact daily life by reducing access to participation in the labour force, educational attainment, social networks, or health (Bonifacio, 2013; Blumenberg & Smart, 2010; Edmonston & Fong, 2011; Linovski et al., 2021; Lucas, 2004; Perry & Scott, 2021). Active transportation, such as walking, is often utilized to supplement poor transit service (Amar & Teelucksingh, 2015).

Other recurring transportation barriers include lack of a driver's license and language barriers. Scholars note that lack of previous driving experience (Chatman & Klein, 2013; Smart, 2015), time, opportunity, and finances (Amar & Teelucksingh, 2015) may inhibit driver's license attainment among immigrants. Language barriers can affect ridership by limiting access to transit system information (Linovski et al., 2021; Lucas, 2004), and also affect immigrants' attainment of a driver's licence during written tests (Perry & Scott, 2021).

3.3 Transportation Planning and Equity

Transportation planning is historically focused on economic advancement (Lucas, 2004), mobility efficiencies (Manaugh et al., 2015), and accessibility for the status quo within funding constraints (Hall & Banister, 1995). Transportation networks are "designed to 'fit' a predetermined land-use plan" (Bruton, 1985, p.57), perpetuating built form inequities which disproportionately impact disadvantaged groups (Lucas, 2004; Manaugh et al., 2015). Additionally, travel demand is largely determined by population size, age, sex, labour force participants, and socio-economic status (Bruton, 1985), yet not race or ethnicity. As a result, most policies do not address the differentiations between immigrants and non-immigrants travel behaviour (Harun, 2021), where some scholars believe the lack of distinction further marginalizes such groups in transit decision-making (Garrett & Taylor, 1999).

Most scholars agree that transit agencies have a duty to integrate equity in transportation planning policy and processes (Karner & Levine, 2021; Linovski et al., 2018; Manaugh et al., 2015; Zhuang, 2020). Scholars find that cost-benefit analyses are the most common

transportation evaluation tool used prior to undertaking a project (Bruton, 1985; Lucas, 2004), whereas equity analyses are conducted following implementation (Karner & Levine, 2021). Scholars identify several ways which practitioners can incorporate equity at a project outset, including "multi-criteria decision making" based on intersectionality and various trip types (Manaugh et al., 2015, p.173), evaluating decisions by multiple equity definitions (Litman, 2022), collaborative engagement strategies (Karner & Levine, 2021; Litman, 2022), or other public participation opportunities that involve immigrants and other marginalized groups in land use and transportation planning processes (Zhuang, 2020).

Yet research has found that equity is not always included in transit decision-making. Some scholars note that transit planners attempting to promote equitable systems in U.S. contexts are often limited by government policies and funding streams misaligned with "demographic shifts in urban transit use" (Garrett & Taylor, 1999, p.9) or policymakers themselves (Wellman, 2016). In a study on Bus Rapid Transit (BRT) systems in Canada, Linovski et al. (2018) found that equity was left out of the design and planning process. Other studies have shown that equity may be left out of the transit planning since it is often difficult to define, measure, and analyze (Litman, 2022; Wellman, 2015).

3.4 Gaps in Literature

Although the literature review demonstrates the depth of existing research on transportation and immigrant settlement to date, little is known about these topics within a Canadian prairie context. Twelve studies reviewed focused on immigrant settlement and transportation provisions within the Toronto, Montreal, and Vancouver context, three of which included Calgary or Edmonton (see Anderson et al., 2021; Kramer, 2018; Manaugh et al., 2015). Winnipeg was mentioned as an emerging gateway for immigration in two studies (Bonifacio, 2013; Lo et al., 2011), yet other central prairie urban centres were not referenced. Out of the sources reviewed, few scholars addressed transportation experiences of the Canadian immigrants in smaller, suburban cities (Bonifacio, 2013; Perry & Scott, 2021), describing access between rural and urban areas as

"[requiring] more personal driving than in areas with regular public transportation services" (Bonifacio, 2013, p.73). Other understudied topics related to central Canadian experiences, such as winter's affect on immigrant travel behaviour, briefly arose in two interview-based studies (Amar & Teelucksingh, 2015; Bonifacio, 2013).

Another gap in literature exists regarding how evidence-based travel behaviour data is used in transportation planning practice at the local level in Canada. Linovski et al. (2021) found that while there is much literature regarding lived experiences of equity-deserving groups, less exists on transit providers and equitable policy goals in transportation. Much of the literature reviewed found that equity in transportation planning is more widely discussed and supported by legislation in UK and U.S. contexts (Blumenberg & Smart, 2010; Manaugh et al., 2015; Tal & Handy, 2010; Smart, 2015). Although there are studies that discuss the systemic political barriers transit agencies face in promoting equity goals (see Garrett & Taylor, 1999; Wellman, 2015; Wellman, 2016), few studies talked about such issues within a Canadian context (Linovski et al., 2018; Zhuang, 2020).

3.5 Implications for Future Research

As Canada continues to welcome newcomers from across the globe, it is critical that cities and transit agencies coordinate planning efforts to support immigrant settlement. Not only will this assist in making the transition to Canada smoother for of new residents, but also enhance their quality of life. Although most Canadian literature surrounding immigration settlement, transportation, and social participation focuses on the "big three" (Bonifacio, 2013, p.71) – Toronto, Montreal, and Vancouver – there is emerging need for studies to consider these challenges in Prairie provinces, smaller cities, and suburban areas with poor transit quality systems (Bauder & Sharpe, 2002; Lo et al., 2011; Perry & Scott, 2021; Zhuang, 2020).

The literature demonstrates that learning more about an individual and their unique lived experiences as an immigrant, through interviews or focus groups, may help address settlement and transportation issues within the "changing demographic landscape" (Amar and Teelucksingh,

2015, p.45). Additionally, most of the reviewed literature examined the periods between 1986 and 2016, illustrating a clear change in transportation trends globally. Literature based in U.S. contexts demonstrates that immigrants are consistently choosing automobility after living in a host country for five to fifteen years, indicating that travel and trip needs of recent immigrants are not successfully met through transit service.

In Canadian contexts, studies show that equity is infrequently discussed in relation to transportation. When equity was defined, it was in relation to "accessibility, mobility, and spatial coverage" instead of equity-deserving groups such as transit-dependent populations (Linovski et al., 2018, p.80). Since immigrant settlement is found to have shifted towards suburban areas, and recent immigrants are more likely to be considered transit dependent, Canadian transit agencies should aim to meaningfully involve immigrants in transportation planning, policies, and processes.

4.0 Context

Winnipeg, Regina, and Saskatoon are situated within Canada's central prairie region. Winnipeg, Manitoba, Canada (49.8954° N, 97.1385° W), is the furthest south compared to the other two cities. Regina (50.4452° N, 104.6189° W) and Saskatoon (52.1579° N, 106.6702° W) are both located in Saskatchewan, Canada, where Saskatoon is the furthest north of all three cities. Due to their locations within Canada, all cities experience four seasons with cold average temperatures that nearly double by summer[5] (see Table 2.)

Table 2. Key Daily Average Temperatures and Winter Precipitation Levels, Adapted from Environment Canada

	Daily Average Temperature, January (˚C)	Daily Average Temperature, June (˚C)	Average Snowfall, January (cm)	Average Snow Depth, January (cm)
Winnipeg	-16.4	17.0	23.7	16
Regina	-14.7	16.2	19.4	16
Saskatoon	-15.5	15.8	17.5	14

Key indicators related to land and population highlight the differences and similarities between each city[6] (see Table 3.). According to land area and total population, Winnipeg is the largest of all three cities and Regina is the smallest. Despite having a population over three times higher than Regina, Winnipeg's population density is only greater by approximately 400 persons per square kilometre. Of all three cities, Saskatoon has the lowest population density. Immigrants comprised about one-fifth of both Regina and Saskatoon's populations, whereas immigrants in Winnipeg contribute to over one-quarter of its population. The median age of each city is young compared to the national median age of 41.7 years (Statistics Canada, 2022a). In 2021, Saskatoon saw the largest population growth rate out of all three cities.

5 Weather data retrieved from: Environment Canada

6 Key indicators retrieved from: Statistics Canada. 2023. (table). Census Profile. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released February 8, 2023. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed March 11, 2023).

Table 3. Key Indicators per City, Sourced from Statistics Canada 2021

	Winnipeg	Regina	Saskatoon
Land Area (km²)	461.8	178.8	226.6
Population Density (per km²)	1,623.3	1,266.2	1,174.7
Total Population	749,607	226,404	266,141
Total Immigrant Population*	201,040	45,210	53,210
Median Age	38.8	37.6	36.8
City Growth, between 2016 and 2021	6.3%	5.3%	7.7%

* Total immigrant population values are drawn from a 25% response rate.

None of the cities have significant geographic boundaries preventing outward growth. The development of both Winnipeg and Saskatoon is shaped by and straddle the rivers running through each city - the Assiniboine River and Red River, and South Saskatchewan River, respectively. All three cities also developed along streetcar networks (City of Saskatoon, 2020; Dillon Consulting, 2022; Winnipeg Transit, 2021), as did their transit systems which currently disperse radially from their Central Business Districts (CBD). According to the 2021 Census of Population, 27,710[7] of commuting Winnipegers reported that their main mode was by transit, whereas only 3,145[8] of Regina commuters and 3,660[9] commuting Saskatoonians named public transit as their main transportation.

4.1 Relevant Transit Policies

Transit agencies within each city rely on different policies to guide transit planning (see Table 4.). In Winnipeg and Regina, transit planning is guided by recently adopted master plans. In the absence of a transit master plan document, Saskatoon Transit relies on the city's Official Community Plan (OCP) and Saskatoon Transit Services Standards. Prior to 2022, Regina Transit

7 Number was drawn from a sample size of 296,775 of working age respondents in Winnipeg.
8 Number was drawn from a sample size of 87,130 working age respondents in Regina.
9 Number was drawn from a sample size of 108,790 working age respondents in Saskatoon.

did not have transit-specific policy, and Winnipeg Transit used the master plan update as an opportunity to redesign the entire transit network from scratch.

Table 4. Policies Referred to by Transit Agencies

	Year Policy was Written or Amended	Type of Policy	Mention of Equity? (Y/N)	If so, is it equity in relation to new Canadians? (Y/N)
Winnipeg	2021	Master Plan	Y	N
Regina	2022	Master Plan	Y	Y
Saskatoon	2020	Official Community Plan	N	N
	2021	Service Standards	Y	N

The Winnipeg Transit Master Plan (WTMP) was written in response to growing city development and population needs and adopted as a 25-year visioning document for transit in the city (Winnipeg Transit, 2021). The overarching strategy of the WTMP is to improve service for "all people, regardless of age and ability, […] in the most sustainable, cost-effective, and reliable manner" (Winnipeg Transit, 2021, p.12). Within the policy, the term 'equity' is mentioned once and interpreted as being "accessible by every demographic" (Winnipeg Transit, 2021, p.21). The main goals and objectives of the plan include increasing the efficiency, ridership, land use coordination, multi-mobility, and affordability, as well as improving paratransit service.

The Regina Transit Master Plan (RTMP), prepared by Dillon Consulting, is the first transit-specific master plan created for the City of Regina (Dillon Consulting, 2022, p.4). Like the WTMP, the RTMP is also intended to guide transit planning over the next 25 years. Equity is named as the second of three strategic priorities of the policy, where equity is interpreted as "treating everyone fairly by acknowledging their unique situation and addressing systemic barriers" (Dillon Consulting, 2022, p.11). The policy outlines how equity might look across different user groups and defines one of the equity goals as to "encourage transit use by

newcomers" where the objective is to increase accessibility to recent immigrants and "eliminate language barriers" (Dillon Consulting, 2022, p.15). To enhance customer experience, the RTMP focuses on coordinating feedback with organizations to evaluate service areas and provision. For example, information provided by community organizations would be included in determining if an area should be serviced through fixed or on-demand service models, and information from settlement organizations would inform how route information could be made more accessible for those whom English is not their first language (Dillon Consulting, 2022).

Transit goals and objectives for the City of Saskatoon are outlined in Section H of the Saskatoon OCP. As defined in this section, the goal of transit is to provide "[an] accessible, efficient […] transportation option for residents and visitors, helping to alleviate congestion […] [and] coordinating land use and development patterns" (City of Saskatoon, 2020, p.100). The main transit objectives within this policy are to create networks and offer service that complement land use development and support economic growth. Although Section H does not make distinctions between targeted transit user groups, it does specify that transit aims to "operate and maintain accessible and efficient transit system that provides individuals with the opportunity to use the system with ease and dignity" (City of Saskatoon, 2020, p.102).

Saskatoon's Transit Service Standards is an additional policy tool based on concepts outlined in the OCP. The standards guideline aims to address service provision in a way that "establish[es] and maintain[s] a transit service that recognizes customer needs, equity and ensures the effective use of available resources" (Saskatoon Transit, 2021, p.2) by defining types of service, minimum bus stop distances per land use area, and projected targets for ridership and service times. The suitability of an area's transit infrastructure and population densities largely determine these ridership and service targets.

5.0 Findings

The spatial analysis findings of recent immigrant settlement patterns at each census year from 2001 to 2021 demonstrates growth experienced by Winnipeg, Regina, and Saskatoon, and how these patterns have changed over time. Through identifying sample areas, I was able to further analyze the census data per CT and presence of transit over time and compare those findings across each city. Lastly, the findings from the interviews with transit professionals demonstrate information and processes considered, or unconsidered, during route revision.

5.1 Settlement Patterns by Census Year

Across Regina and Saskatoon, the share of recent immigrants per CT does not exceed 20% within any given year. Out of the three cities, Winnipeg welcomed the most immigrants over the 20-year period, where recent immigrants represented shares of more than 20% per CT from 2011 onward. Winnipeg experienced the highest recent immigrant growth in 2011, whereas Regina and Saskatoon experienced this increase during the subsequent census year.

Out of all three cities in 2001, Saskatoon demonstrated among the highest proportion of recent immigrants – exceeding 17% of the total population – in a northwest CT on the fringe of the city (see Figure 1.).

Recent immigrants did not exceed 12% of the total population in any Winnipeg CT (see Figure 2.); in Regina, this value did not exceed 5% (see Figure 3.). Both Winnipeg and Regina saw the highest recent immigrant settlement rates at their downtown cores. In Winnipeg, three CTs in the south quadrant of the city demonstrated an immigrant population rate of between 5% and 10%. In 2001, each city appears to be missing large amounts of data from areas within its respective boundary. Missing data is likely a result of negligible rates of recent immigrants or due to undeveloped land at the time.

In Winnipeg's inner city and central core CTs, the rate of recent immigrants nearly doubled by 2006 (see Figure 4.). Conversely, Saskatoon saw the lowest representation of recent immigrants

in this year compared to every other census year within the 20-year period, where no CT exceeded a rate of 10% (see Figure 5.). In Regina, an inner-city CT had recent immigrants represent over 10% of its total population, 3.5% up from the previous cohort (see Figure 6.).

In 2011, Winnipeg saw highest proportion of recent immigration over the 20-year period. For instance, recent immigrants in the city's suburban CTs represented over 21% and 30% of the total population, approximately 27% in mature neighbourhoods, and nearly 26% in two separate suburban and core CTs, and 24% in three different suburban CTs in the north-west quadrant (see Figure 7.). In Regina, the central core CT with the highest rate of recent immigrants in the cohort prior continued to demonstrate the highest proportion of immigrants within the city; however, suburban areas began to see more recent immigrants (see Figure 8.). In contrast to 2006, Saskatoon saw about three times as much recent immigrant representation in suburban CTs to the north, east, and west quadrants of the city (see Figure 9.).

In 2016, both Regina and Saskatoon experienced their greatest representation of recent immigrants over the 20-year period. Regina saw the highest proportion of recent immigrants in suburban and greenfield CTs and no CTs with an immigrant population share of less than 1% (see Figure 10.). In Saskatoon recent immigrant settlement further extended into suburban and greenfield CTs (see Figure 11.). In this year, Winnipeg saw sustained growth across the whole city, where only three CTs experienced a negligible number of recent immigrants (see Figure ¬12.).

By 2021, recent immigrant population rates in Winnipeg remained high in central core CTs and suburban CTs in the south quadrant, yet decreased representation elsewhere (see Figure 13.). In Regina, the population rate of recent immigrants decreased at the city centre but increased in suburban and greenfield CTs to the west, southwest, and southeast quadrants of the city (see Figure 14.). Similarly, Saskatoon saw continued representation in central suburban and greenfield CTs (see Figure 15.).

5.2 Settlement in Sample Areas

Over the past 20 years, Winnipeg has seen the greatest proportion of recent immigrant settlement within CTs at the city centre, in suburban neighbourhoods proximal to the University of Manitoba, and in greenfield developments (see Figure 16.). Recent immigrants to Regina are settling in greenfield CTs and suburban areas near the University of Regina and industry (see Figure 17.). Similarly, Saskatoon has experienced its highest proportions of recent immigrant settlement in emerging greenfield CTs at the east and west outskirts of the city and in suburban CTs along major corridors (see Figure 18.). The unique CTUID of each sample area is included in a table in Appendix B.

The sample areas of neither Regina nor Saskatoon demonstrated recent immigrant settlement in the downtown core, whereas Winnipeg saw the largest representation of recent immigrants at three core CTs (see Table 5.). In Regina, sample areas were split evenly between greenfield and suburban CTs. Of all three cities, Saskatoon saw the greatest share of recent immigrant in suburban settlement at four CTs, where the other two sample areas were in greenfield areas.

The highest average recent immigrant population rate over the 20-year period and across all three cities is demonstrated within Winnipeg's sample area C. Aside from demonstrating an above average proportion of recent immigrants in 2001, this core CT experienced a 18.5% growth increase between 2001 and 2011, but dropped by 12.5% in 2021, reducing the overall increase in recent immigrant population between 2001 and 2021. Greenfield CTs in Regina and Winnipeg demonstrate the next highest average population rates of recent immigrants, closely followed by a greenfield CT Saskatoon (refer to Table 5.).

Sample area A in Winnipeg represents a core CT with the greatest increase in recent immigrant rates; its growth rate is nearly 5% higher than any other CT's population across all three cities. Seven of the 18 CTs across three cities saw between a 12 to 13% change over the 20-year period.

In 2001, both Winnipeg and Saskatoon had CTs with recent immigrant population rates of 10%

and greater, and by 2021, all sample areas across each city demonstrated a recent immigrant population rate of 10% or higher. Overall, Winnipeg demonstrates the greatest proportion of recent immigrants within the sample areas, followed by Saskatoon, and lastly Regina.

Table 5. Rate of Recent Immigrant Population within Sample Areas

Census Classification	City		Recent Immigrants by Census Tract (% of total population)						
			2001	2006	2011	2016	2021	Average	Change
Core CTs	Winnipeg	A	2.8	6.6	n/a	20.0	20.4	12.5	+17.6%
		B	10.0	18.9	21.1	19.4	21.0	18.0	+11.3%
		C	11.7	19.6	30.2	20.1	17.5	19.8	+5.8%
Suburban CTs	Winnipeg	D	3.1	6.4	11.1	15.1	15.6	10.3	+12.5%
		E	3.8	8.4	12.8	16.9	16.2	11.6	+12.4%
	Regina	A	1.7	2.7	9.3	11.9	13.7	7.9	+12.0%
		B	0.4	0.4	1.4	9.0	12.4	4.7	+12.0%
		C	1.4	1.2	8.3	15.6	11.6	7.6	+10.2%
	Saskatoon	A	3.1	2.7	7.7	14.8	15.8	8.8	+12.7%
		B	0.8	0.8	7.9	12.3	10.5	6.4	+9.7%
		C	4.2	2.8	5.2	10.5	12.7	7.1	+8.5%
		D	11.0	6.9	15.7	12.0	15.7	12.7	+4.7%
Greenfield CTs	Winnipeg	F	n/a	n/a	n/a	n/a	17.1	17.1	n/a
	Regina	D	n/a	n/a	n/a	n/a	17.4	17.4	n/a
		E	n/a	n/a	n/a	n/a	12.8	12.8	n/a
		F	n/a	n/a	n/a	n/a	12.6	12.6	n/a
	Saskatoon	E	n/a	n/a	n/a	17.0	15.2	16.1	-1.3%
		F	n/a	n/a	n/a	n/a	14.6	14.6	n/a

5.3 Presence of Transit in Sample Areas

In this study, Winnipeg is the transit outlier with 80 total routes in 2003 (see Figure 19.). In 2002, Saskatoon serviced 22 routes (see Figure 20.) and Regina had only ten (see Figure 21.). By 2021, Winnipeg had 87 routes (see Figure 22.), Saskatoon had 36 routes (see Figure 23.), and Regina more than doubled to 21 routes (see Figure 24.). In all three cities, the changes to the routes over time were not major (refer to Table 6.). New routes added within the 20-year period fleshed out sparsely serviced areas within existing neighbourhoods, increased connections for thru service, and extended routes to cover greenfield developments. For example, Winnipeg's Southwest Transitway was constructed by 2019, and added a direct physical connection between downtown and south suburban areas via dedicated infrastructure for the city's bus rapid transit (BRT) system (City of Winnipeg, n.d.).

Over the 20-year period, most sample areas within each city did not see a significant increase in the number of servicing routes. Out of all three cities, a suburban CT in Saskatoon experienced the most notable increase in number of routes, and a core CT in Winnipeg saw the most notable decrease in routes. In 2021, almost all greenfield CTs across the three cities were serviced by a minimum of one route. For instance, sample area F in Winnipeg is serviced by three routes, all three of which were added between 2003 and 2021. All greenfield CTs in Regina were serviced by two or more routes, making the number of routes comparable to other suburban CTs. Saskatoon saw the least amount of servicing in new greenfield CTs, with one in sample area E and none in sample area F.

The change in number of routes between the first year[10] and 2021 is not analogous to the change in routes servicing a CT. For instance, the number of routes that serviced a core CT in Winnipeg increased by two from 2003 to 2021; however, 33 of the 37 routes in 2021 shared the same name as 2003 routes. Similarly, in some cases the number of routes intersecting a CTs did not change over time, such as sample areas D and E Winnipeg and sample A in Regina. Yet, according to

10 The first year of study refers to either 2002 or 2003, depending on the city.

the route names between the two years, none of the routes remain the same. Out of the three cities, suburban CTs in Saskatoon saw the greatest difference in routes between 2002 and 2021, whereas most CTs in Winnipeg, particularly in core areas, have remained unchanged from 2003. According to 2021 data, the number of unique routes shared by two or more sample areas per city are as follows: 51 of 87 routes in Winnipeg; five of 21 routes in Regina; and 15 of 36 total routes in Saskatoon.

Table 6. Routes per Sample Area

Census Classification	City		# of routes in first year	# of routes in 2021	Change in # of routes between first and last year	2021 routes named the same as first year routes
Core CTs	Winnipeg	A	43	45	+2	73.3%
		B	30	31	+1	83.9%
		C	44	37	-7	89.2%
Suburban CTs	Winnipeg	D	4	4	0	0%
		E	8	8	0	87.5%
	Regina	A	5	5	0	40%
		B	2	3	+1	66.7%
		C	2	4	+2	50%
	Saskatoon	A	10	6	-4	33.3%
		B	10	6	-4	50%
		C	8	11	+3	0%
		D	8	15	+7	6.7%
Greenfield CTs	Winnipeg	F	0	3	+3	0%
	Regina	D	0	4	+4	0%
		E	0	2	+2	0%
		F	0	4	+4	0%
	Saskatoon	E	0	1	+1	0%
		F	0	0	0	0%

5.4 Route Revision Processes: Insight from Transit Professionals

Interviews with transit professionals demonstrated that there is no clear framework for evaluating transit routes. Each city's agency considers a combination of feedback, performance data analysis, financial viability, scheduling, and conformance with existing policy guidelines as criteria in route revision. The common responses regarding triggers for a transit route revision included changes to urban form through land use, budget, operational deficiencies, customer demand, and direction from superiors. Overall, participants' responses suggested the main objectives of route revisions focus on providing equally efficient service to the most people.

5.4.1 Occurrence of Route Revisions

Overall, there is a lack of consensus amongst participants about how often transit routes are revised. Two respondents from the same city agreed there is no set time for revision, where one participant specified the revisions happen on an as-needed basis based on unsolicited feedback.[11] Participants agreed that route revisions do not always accompany fixed schedule changes,[12] but any route revisions that must occur would be implemented during June to allow riders to adjust to the changes prior to wintertime. The processes for route revision in this way are closely tied with scheduling evaluation and needs and separate from transit master plan revisions. However, as three respondents noted, few mid to large-scale changes occur apart from changes made during transit master planning processes.

5.4.2 Funding Constraints

All participants agreed that the financial feasibility of a route was a main factor in making revisions, where budgeting and funding were the most heavily weighted criteria. Respondents across all three cities agreed that routes may be altered based on budget constraints, or as new capital funding is made available. For example, one respondent from Winnipeg Transit noted that

11 See Section 5.4.5 Stakeholder Input for more information.

12 Winnipeg Transit and Saskatoon Transit have set schedule and revision changes which occur four times a year in September, December, April, and June to align with customer demand flux of university students.

they were able to redraw the entire route network from scratch since the WTMP was funded by joint initiative between municipal and federal levels of government.

Almost all respondents point out cost-benefit analysis as being part of route evaluation. Four out of five respondents defined ridership as a main factor in cost-benefit analysis, followed by funding availability (noted by three respondents), and time efficiency savings because of route design improvements (noted by one respondent). The sentiment of financial constraints experienced by each city's agency was aptly captured by a quote from Engineer 1: "If we need to add another bus per hour on a certain route – and we don't necessarily have the buses or the funds to do so – where can we pull from somewhere else? It becomes a matter of shuffling resources around."

5.4.3 Data Analysis

All respondents agreed that transit routes are initially evaluated based on data analyses of ridership, capacity, and scheduling performance data, and only one respondent mentioned their agency considers neighbourhood analysis of land use, zoning, population targets, and political environment. Noted solely by Planner 1, but applicable to all agencies based on their description of route evaluations, is that there is no formalized process for determining how or when route revisions should occur.

According to all respondents, ridership counts are the second-highest weighted criteria in route revision. Respondents from two different cities said their ridership indicators are collected by buses' fare boxes. At least one respondent from each city relies on passenger loading counts to evaluate capacity, where one agency relies on ridership targets laid out in policies and strategies to evaluate capacity.

The term 'capacity' and 'customer demand' were often used interchangeably by respondents – where customer demand was assessed based on pass-ups or ridership counts. If the customer demand is low, the agencies will either reduce the number of stops (Saskatoon Transit), reroute lines (Winnipeg Transit), or reduce hours of service (Regina Transit).

One respondent specified that routes were evaluated based on GPS data of buses' logged position and schedule adherence. Three respondents, two of which are engineers, noted that route revisions were paired with schedule evaluation. For instance, if buses on a route were late or demonstrated inconsistent headway often, and as a result deviated from the schedule too greatly, then agencies would consider route revision.

Conformance with Existing Policies

Respondents from all agencies agreed that route revisions must support and conform to existing policies, such as transit master plans in the cases of Winnipeg Transit and Regina Transit. Respondents from Saskatoon Transit and Regina Transit noted their consideration of service standards documents, while participants from Saskatoon Transit also mentioned the OCP as a document they consider when making revisions. Despite the OCP's inclusion of policy objectives and strategies for transit and land use, most reference to the document focused on infrastructure design and maintaining travel through the downtown core.

5.4.4 Stakeholder Input

Feedback was noted by all five participants as the number one criterion in route revision and route evaluation; however, there was no clear answer regarding how or when this feedback is solicited. For example, one respondent mentioned they might refer to feedback from social media posts, whereas another participant mentioned they solicit feedback through neighbourhood associations and committees during summer months. All respondents felt feedback from the public was most important, followed by feedback from nearby impacted businesses, and bus operators. In addition to these groups, agencies may consider input from other city departments. Three respondents shared that route revision may be trigger by direction from municipal superiors, such as the Director of Transit, City Manager, or city council (noted by two respondents from different cities).

Two participants from different cities said customers' safety concerns may also trigger revisions to bus stop placement and routes. One of these participants mentioned they would look to

enhance the Crime Prevention Through Environmental Design (CPTED) principles from first generation to second generation principles before deciding to change stops or routes, and the other participant said they would make judgement calls about where to located bus stops along the route if they decided an area was too unsafe. Both responses did not mention specific methods for how they determined if an area was unsafe.

Public Engagement

Participants made it clear that public engagement is not a requirement of the transit revision processes and therefore not always used – although all agreed that public engagement is important. Winnipeg Transit is responsible for conducting their own public engagement, whereas Regina Transit and Saskatoon Transit do not have available staff or resources to conduct their own public engagement. Instead, these agencies collaborate with other city departments or dedicated engagement teams to lead their public engagement processes.

All respondents agreed that public engagement is mandatory for all large-scale route revisions, such as transit master planning or bus rapid transit projects. Two respondents from different cities noted that they only use public engagement if there is an obvious impact on a stakeholder group, such as a business or school. Saskatoon Transit and their external engagement team have developed a "productivity committee" that helps communicate transit changes to affected neighbourhoods. Another participant added that long-standing or highly used routes will require public engagement.

Respondents from each city said if the size or scale of the route change is small, public engagement is not used. One participant also noted that engagement is not used prior to implementation of brand-new routes, and instead is later evaluated based on performance data. Respondents from a city that recently adopted a transit master plan said they had not used public engagement at that scale prior to undergoing the process, and generally would not conduct such in-depth engagement due to lack of budget.

Participants from transit agencies that conducted public engagement during the pandemic reported that turn-out for online engagement sessions was more successful than traditional in-person formats. However, respondents from both cities also acknowledged the barriers to participation may be created by facilitating online engagement, such as no access to computer or the Internet.

Only one agency described their approach to public consultation in instances where engagement is not possible. This agency noted that they post printed notices on bus stops to advise customers about upcoming changes; the notices include contact information, where affected persons are encouraged to reach out and voice their concerns. A participant noted:

> [How we inform customers about] our changes to transit routes exist in combination – one is engagement, and the other is information. The two are vastly different. I don't like giving our customers the illusion that we are engaging with them when we make changes [without public engagement]. But at times, due to operational and business [requirements], we do make changes and then inform customers.

5.4.5 Improved Efficiency

All respondents agreed that long-term efficiency improvements are a primary motivation of route revision. Four out of five respondents said their agency's main goal is to address headway and frequency issues, where one participant noted that reducing the complexity of a route design was an effective means of doing so. Participants from each agency agreed that revising routes from a hub-and-spoke model to a primary-feeder network was an appropriate means of improving efficiency; however, in all cases, these revisions exist only in plan. Respondents from Winnipeg Transit and Saskatoon Transit noted poor connections to transfers and overcrowding or pass-ups as key operational issues addressed in recent master planning.

Participants from each city also have made immediate route revisions in the interest of operational efficiency. Participants from Saskatoon Transit shared that they had recently removed

bus stops as a means of improving the immediate efficiency on the routes, but it was unclear if public engagement was used prior to these revisions.

Respondents from Winnipeg Transit and Regina Transit also noted that if an area is without service, they will address the issue by extending existing routes or adding new routes to cover the area, yet in most cases, agency resources only allowed for the former. However, these agencies are hoping to pilot on-demand service to extend coverage to new or existing neighbourhoods in a more cost-efficient manner. One respondent said that the goal of efficiency improvements is to "work for greatest number of people while serving the most destinations", through focusing on equal service provision. Respondents from Winnipeg Transit and Regina Transit also noted their agency's aim is to meet the needs of underserved neighbourhoods, but neither specified how such areas are defined.

5.4.6 Land Use & Development Patterns

Three respondents from two cities, said that the primary reason for creating new routes is to ensure they are "keeping up with city growth". All respondents agreed that external changes related to land use and infrastructure often influence route revisions. Three respondents noted changes to land use development patterns, where participants from Winnipeg and Regina specified greenfield development as a main cause for route revisions. In the context of greenfield development, the respondents were referring to adding new lines as a route revision. Both respondents from Winnipeg Transit noted changing travel patterns as a factor in route revision, where both participants linked changed commuting to the suburbanization of employment and reduced travel downtown as a result. Additionally, respondents from two different cities specified road construction over summer months as a reason for route revision.

6.0 Discussion & Analysis

The discussion and analysis focus on three main themes from the findings: settlement choice, agencies' responses to city growth, and equity as it relates to transit route revision processes. In all three cities, recent immigrant settlement has differed across the years, where finding suggest that choice may vary based on household needs. Responding to city growth was a key response from transit agencies, but it was unclear if changing demographics and population growth was accounted for in the definition. Lastly, agencies preferred the concept of equality over equity when discussing route revision and transit service.

6.1 Settlement Choice

When looking at census data over a 20-year period, there were sample areas within each city that stood out as experiencing consistent immigrant population growth over time. For instance, two core CTs in Winnipeg and one suburban CT in Saskatoon reflected shares of recent immigrant populations exceeding 10%, whereas most other CTs from all cities at that time demonstrated population rates of 4% or less. Data in other sample areas also revealed that immigration may ebb and flow per year, where most variation occurred in suburban CTs. As demonstrated by the literature review, settlement choice for new immigrants can be complex. Sometime settlement is voluntary or involuntary (Anderson et al., 2021; Chatman & Klein, 2013), dependent on the year and political climate (Edmonston & Fong, 2011, p.10; Bauder & Sharpe, 2002; Bonifacio, 2013), relate to familial or cultural ties (Allen et al., 2021; Bonifacio, 2013; Chatman & Klein, 2013; Kataure & Walton-Roberts, 2014; Harun, 2021; Smart, 2015; Zhuang, 2021), or differ based on an individual's socio-economic position (Harun, 2021; Heisz & Schellenberg, 2004; Smart, 2015). Ultimately, every individual and their immigration experience are unique.

Recognizing heterogeneity between immigrant groups, not all recent immigrants are transit dependent and may not require transit near their home. Some recent immigrants may have the financial means to acquire a vehicle (Harun, 2021; Zhuang, 2020) or prioritize car ownership

(Perry & Scott, 2021). Also, trips to decentralized yet necessary destinations, such as places of employment, grocery shopping, or school, may be easier to complete via private vehicle. Since transit routes run on fixed networks, not all destinations may be accessible or reachable within a timeframe, making private vehicles and "learning to drive [a] 'dire necessity'" (Amar and Teelucksingh, 2015, p. 56). Although this study did not explore how recent immigrants are travelling across the three cities, other studies have found that car ownership among immigrants increases after the first five years of arrival to Canada (Heisz & Schellenberg, 2004) and recent immigrants may live in transit-poor suburban areas with existing social networks (Allen et al., 2021; Amar & Teelucksingh, 2015; Chatman & Klein, 2013), it is possible that recent immigrants within Winnipeg, Regina, and Saskatoon are relying on carpooling or other modes besides transit.

6.2 Is Transit Keeping Up with Growth?

Census data from Winnipeg, Regina, and Saskatoon shows that recent immigrant settlement is shifting toward suburban and greenfield developments. Almost all sample areas included at least one new route, apart from the furthest east greenfield CT in Saskatoon. The presence of routes within these areas, however minor, demonstrates that greenfield does trigger transit route addition or revision as confirmed by most interview respondents.

When interview respondents talked about how transit revision responded to city growth, most did so in relation to land use and new development – physical space, geography, and road geometry. Yet, respondents did not explicitly tie revisions to an increased size in their city's footprint. Some transit policies, such as Saskatoon Transit's Service Standards, requires an area to meet minimum density targets prior to increase servicing, which may explain why Saskatoon saw the least increase of routes to greenfield areas. However, minimum density thresholds may not be required for all cities. For instance, despite have a footprint larger than two and a half times greater and servicing four times as many routes, Winnipeg's population density per square kilometre is comparable to that of Regina.

Responses from transit professionals also suggested that economic growth was included as part of city growth. Saskatoon Transit refers to their city's OCP as a guiding document in transit planning processes since they have not yet adopted a transit master plan. The language used in Saskatoon's OCP frames transit goals through an economic lens, focusing on transit as another means of moving people to different goods and services at different locations throughout the city in the most efficient manner. In Saskatoon, almost all routes connect to its CBD and shopping malls located at different major corridors across the city. Similarly, almost all routes in Winnipeg and Regina converge at their respective CBDs, despite the changing travel and employer patterns noted by participants. The hub-and-spoke models currently serving all three cities are planned to be replaced with primary-feeder routes as per recent transit documents.

Closely linking transit planning and economic development goals may have implications for equity-seeking transit users. These paired outcomes often manifest as transit-oriented design, which has found to induce gentrification in other Canadian contexts (Allen et al., 2021; Harun 2021). Choosing to invest limited transit resources into projects which aim to attract car users may divert funds away from other projects that could improve transit experiences of equity-seeking riders (Linovski et al., 2018). Additionally, planning transit around destinations agencies believe riders are frequenting, without engaging with them, neglects to address connectivity needs of other trip types or destinations.

Only one participant noted demographics as a consideration in the route revision process, while other respondents focused on service performance. Additionally concerning, nearly all respondents said they do not regularly conduct public engagement or solicit feedback. No engagement occurs prior to introducing new routes to greenfield areas; a respondent mentioned that it is easier for agencies to collect meaningful feedback once service has been operational for a couple months. Policy such as the Saskatoon Transit's Service Standards supports this claim by noting that "new service implementations shall be monitored throughout the implementation period" prior to performance review but does not mention public engagement as part of the

process (Saskatoon Transit, 2021, p.9). Although all interview participants value customer demand, none made any distinction between customers. For agencies planning transit based on performance indicators, rather than demographics, can miss key "equity-related goals" (Litman, 2022, p.44). Furthermore, without strategies to identify marginalized transit users in ridership data, nor "statutory requirements" to uphold equity goals (Wellman, 2015, p.137) agencies may struggle to incorporate equity goals in transit planning.

Improving route efficiency and meeting customer demand, factors which all participants agreed were among the most important, may be incongruent with the other most important reported triggering factor: greenfield development. For instance, respondents expressed that their aim in route revision is to reduce a network's complexity for improved efficiencies in time, money, and connectivity; however, many greenfield developments are planned with curvilinear streets, which are less efficient for bus travel. Respondents also mentioned they would look to remove routes or reroute service based on low ridership or customer demand, yet people who move to areas outside the urban core may be more likely to be "'choice' riders" and use a private vehicle as a first option (Garrett & Taylor, 1999, p.7). Unfortunately, the interview questions did not ask respondents to rank criteria. Since no agency had a clear revision or evaluation process to begin with, the weight of each factor in decision-making processes remains uncertain; especially in cases it is not possible to accommodate all needs in a route revision, or in cases where conflicting goals and priorities arise in the transit planning process.

6.3 Equity & Transit Route Revision

In most interviews, the concept of equal transit service, what Litman (2022) refers to as "a fair share of resources" (p.44), was preferred over equity. Based on interview discussions, the primary focus for route revisions was providing equal levels of service for the most people; however, this sentiment was not reflected in all transit networks. For instance, in Winnipeg, the number or transit routes servicing the core CT sample areas is between four to 11 times higher than the suburban CT sample areas. Equal service is often associated with being more easily

measured and can align with mobility efficiencies in transit (Manaugh et al., 2015); however, trying to balance everyone's transit needs across a sprawling city and within limited budgets, as in the case of all three cities, may result in inequitable systems. Incorporating equity may also be a challenge if public engagement is infrequently used or under funded.

Throughout the interview process, none of the participants discussed route revisions in relation to recent immigrants. One participant who discussed how their agency was considering equity, described the concept in relation to universal design and fare pricing strategies based on income. Overall, participants' responses suggest that there is no formalized process for integrating equity in public engagement sessions or route evaluation criteria. Looking further to the agencies' policies, the RTMP is the only one to include equity as a main policy implementation goal. The goal is broken up into five different objectives and measurable strategies for equity inclusion, where one of the objectives specified how the system could be improved for newcomers.

Conversely, other agencies struggled with implementing equity, which may be a by-product of failing to define equity within processes. As exemplified by a quote from Planner 1: "We have had questions about how we factor in equity, which is a reasonable question - the trouble with answering it is: what does equity mean, and how can we address it since needs are often on a case-by-case basis?". Not having a clear definition for equity is also found in other studies (such as in Linovski et al., 2018) and may inhibit the potential for equity analysis of transit revisions.

One respondent stressed that their agency is a service provider, so route revisions must come down to the value of the transportation service. This respondent also mentioned that areas with low-income or marginalized populations end up being well-serviced since these groups often contribute more to ridership, defaulting to an equitable service. This response suggests that transit-dependent populations or neighbourhoods are recognized by agencies yet prioritized in the interest of increased ridership and patronage. In the case of Winnipeg, the greatest proportions of resent immigrant populations still exist within core CTs – areas which happen to also be serviced by nearly half of total routes. Settlement and transit presence alike have not

diminished in these areas, so using this logic these populations are being served by the system; however, other suburban CTs in Winnipeg demonstrating rising shares of recent immigrant populations are not seeing the same increase in transit provision. Vertical equity, which “assumes that disadvantaged people should receive favourable treatment” (Litman, 2022, p.44), should be incorporated within decision-making processes so it is not left as an afterthought or a occur as a mere coincidence.

7.0 Conclusion

This study shows that recent immigrant settlement across all three cities has generally shifted towards suburban and greenfield CTs over time, which reflects findings present in existing literature. Transit routes were introduced in most greenfield sample areas of each city; however, the presence of transit overall remains relatively low compared to other CTs. Furthermore, the number of transit routes serviced in older suburban sample areas have been low and relatively unchanged over the 20-year period. For transit agencies to truly keep up with the changing growth with populations, greater attention should be paid to shifting population and ridership needs in decentralized areas.

Conversely, in Winnipeg core CTs populations continue to demonstrate the highest shares of recent immigrants within the city. According to existing literature, recent immigrants may choose to settle in central areas if existing services, such as housing settlement services, are located there. Another influencing factor for this settlement may be transit, since nearly the core CTs demonstrate the highest presence of transit within the city. Based on information suggested by interview participants from Winnipeg Transit, transit presence is likely higher downtown because of sufficient ridership levels. Recognizing that not all recent immigrants residing in these CTs will be transit-dependent, the concentration of transit routes within the core may instead be connected to economic development goals.

Over time, the changes made to transit routes in sample areas in Winnipeg, Regina, and Saskatoon are minor, but overall service seems to be increasing within greenfield CTs. According to interviews with transit professionals the key information local transit agencies use to determine and design route revisions include funding, performance data, stakeholder feedback, conformance with existing documents, and land-use changes. However, without clear criteria and undefined processes for determining how and when public engagement should be included in a route revision, employees within agencies are left to make those distinctions themselves within a limited budget.

Future research on this topic should examine and inventory land uses within CTs with high rates of recent immigrants, to find if there are any enclaves or existing community within such areas. Since the overall population counts within greenfield sample areas were low, which may have skewed the data, it is possible that recent immigrant population rates represent individual households rather than cultural or social networks. Future studies should consider conducting interviews with settlement organizations or recent immigrants to further understand the settlement process and individuals' lived experiences in prairie cities. Such insight would also shed light on what transportation modes recent immigrants are using in these cities, if transit is a primary choice, and how transportation differs between immigrant groups. Additionally, future research may consider investigating the location of bus stops within these CTs over time, since bus stop locations can greatly influence transit accessibility, especially during the winter.

As immigration continues to lead population growth across Canada, prairie cities such as Winnipeg, Regina, and Saskatoon should consider how transit route changes and transit planning processes impact recent immigrants. Apart from implications for infrastructure development and resource management, there are equity implications that should be considered in future decision making and policy adoption.

First, transit agencies should intentionally seek out the voices of recent immigrants who may be transit dependent in public engagement. To do this, transit agencies should research the demographics of an area where a transit route revision will occur before conducting public engagement, to determine if there any equity-seeking and transit-dependent groups present in the area. Public engagement is recognized as a primary means of understanding "a community's equity needs and values" (Litman, 2022, p.48), and should be used wherever possible regardless of the scale of a route revision. Transit agencies should look beyond the 'equal' service provision and economic development goals, to include equitable service focused on improving the transit network for underserved groups. Attempting to balance all needs in mid-sized cities with limited financial and staff resources, low-density, a sprawling footprint, and low transit ridership to

begin with, is infeasible. Conducting research and public engagement prior to a route revision, will help inform transit agencies of the needs or concerns that existing riders may have to use resources more efficiently.

Second, transit agencies should develop a means of collecting ridership data that considers rider needs apart from commuting. Transit use is found to differ across race, gender, and income, and may be relied on to reach a variety of destinations within a city. Interview participants also acknowledge changing commuting patterns, and having a method or system to capture shifting travel patterns or ridership needs is important. Methods for gathering ridership data such as travel diaries, surveys, or advisory committees should be used and designed to incorporate equity goals.

Lastly, transit agencies should focus on developing evaluation criteria and processes for route revision. Without having clearly defining or ranking criteria, equity goals risk being excluded from the process altogether. Recognizing that transit agencies in Canadian, and especially mid-sized urban centres, may be under funded by the government (Linovski et al., 2018), agencies should focus on how they can better serve existing riders through incremental changes, rather than wait for the large capital projects or 25 years into the future.

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Appendices

Appendix A: Interview Guide

Appendix B: Sample Area Census Tract Definitions

Appendix C: Maps

Appendix A: Interview Guide

1. What is your position with this organization?
2. Can you briefly describe your role and responsibilities with the organization?
3. How many years have you been employed with the organization?
4. Can you describe the process for evaluating transit routes? What common factors trigger a transit route revision?
5. What are the main objectives/intended outcomes of revising transit routes?
6. How often are transit routes revised?
    a. Is this process separate from transit master plan revisions? Is it separate from scheduling revisions?
7. What factors are included in criteria for transit route revision? How are these factors weighted?
    a. What are the strengths and weaknesses of this approach?
8. What are the strategies your organization uses to communicate transit route revision to other municipal departments? Are revisions negotiated with these other departments?
9. Is public engagement a requirement of the transit revision processes?
    a. If yes, describe when and how public engagement is used.
10. Thinking of your organization, are there any additional criteria you would include for transit route revision?

Appendix B: Sample Area Census Tract Definitions

Table 7. CTUID per Sample Area

Census Classification	City		CTUID
Core CTs	Winnipeg	A	6020013.00
		B	6020025.00
		C	6020023.00
Suburban CTs	Winnipeg	D	6020500.04
		E	6020102.04
	Regina	A	7050002.02
		B	7050100.11
		C	7050016.00
	Saskatoon	A	7250011.02
		B	7250011.01
		C	7250012.01
		D	7250011.03
Greenfield CTs	Winnipeg	F	6020500.13
	Regina	D	7050004.02
		E	7050100.20
		F	7050004.03
	Saskatoon	E	7250100.02
		F	7250100.03

Appendix C: Maps

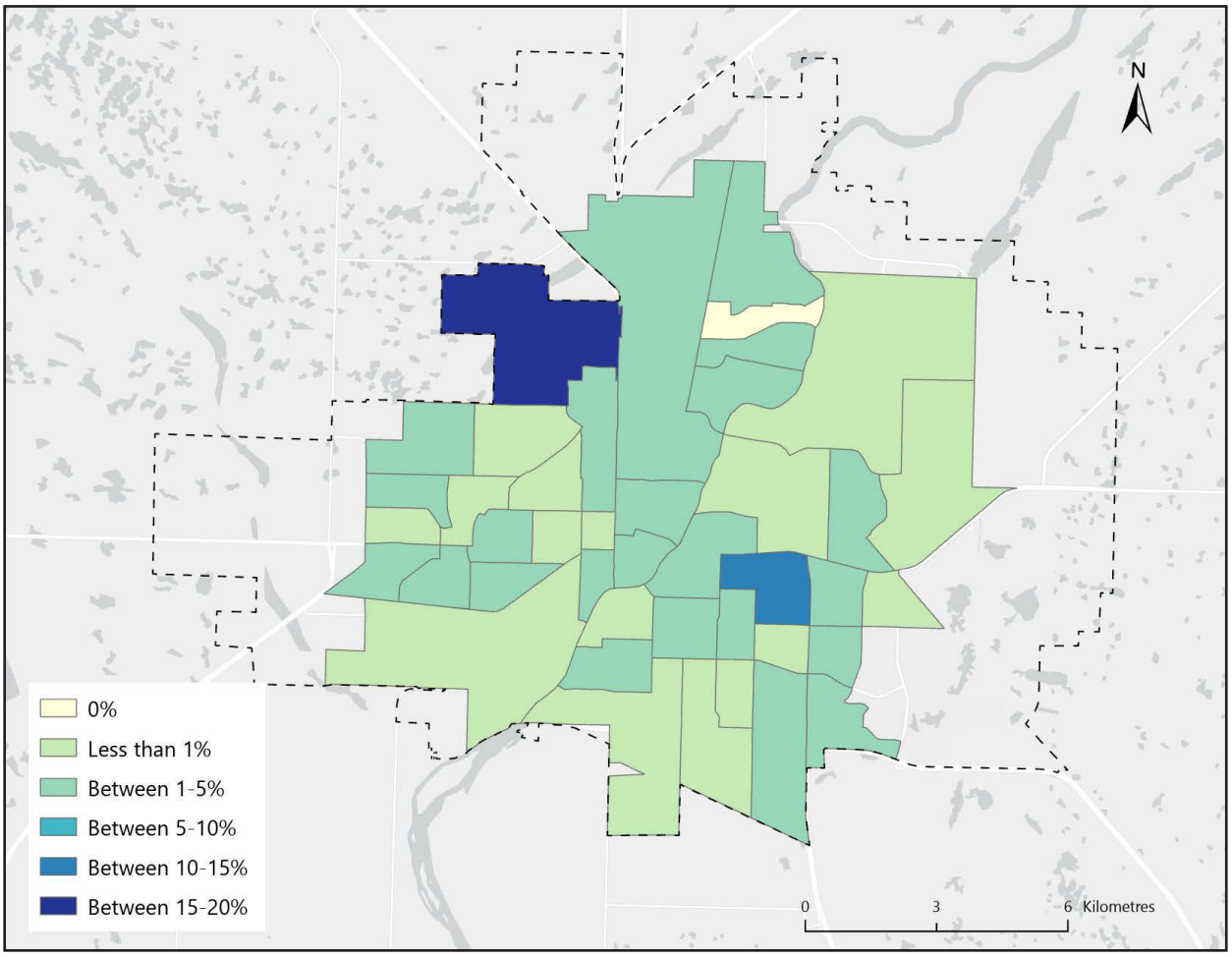

Figure 1. Rate of Recent Immigrant Population per CT, Saskatoon, 2001

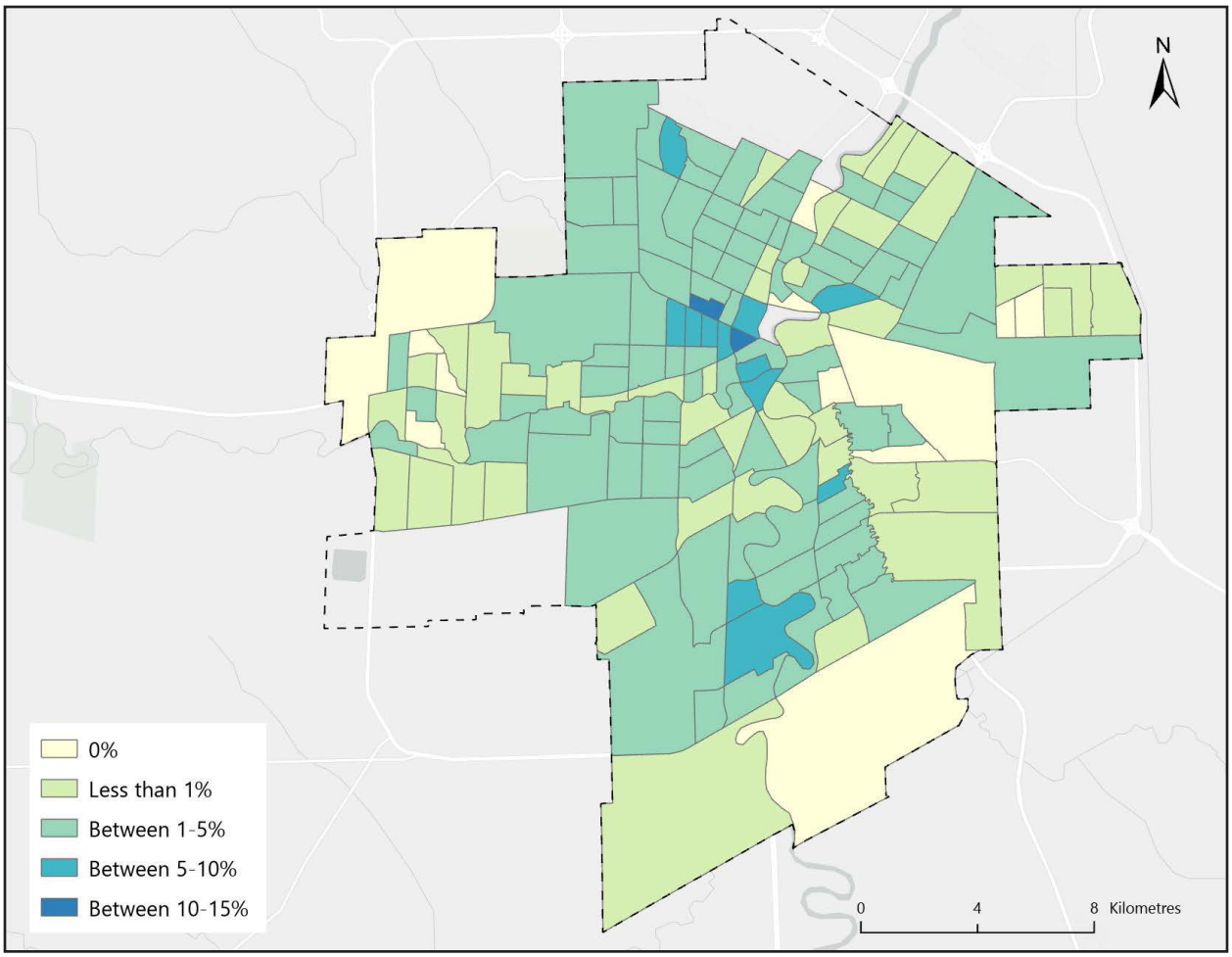

Figure 2. Rate of Recent Immigrant Population per CT, Winnipeg, 2001

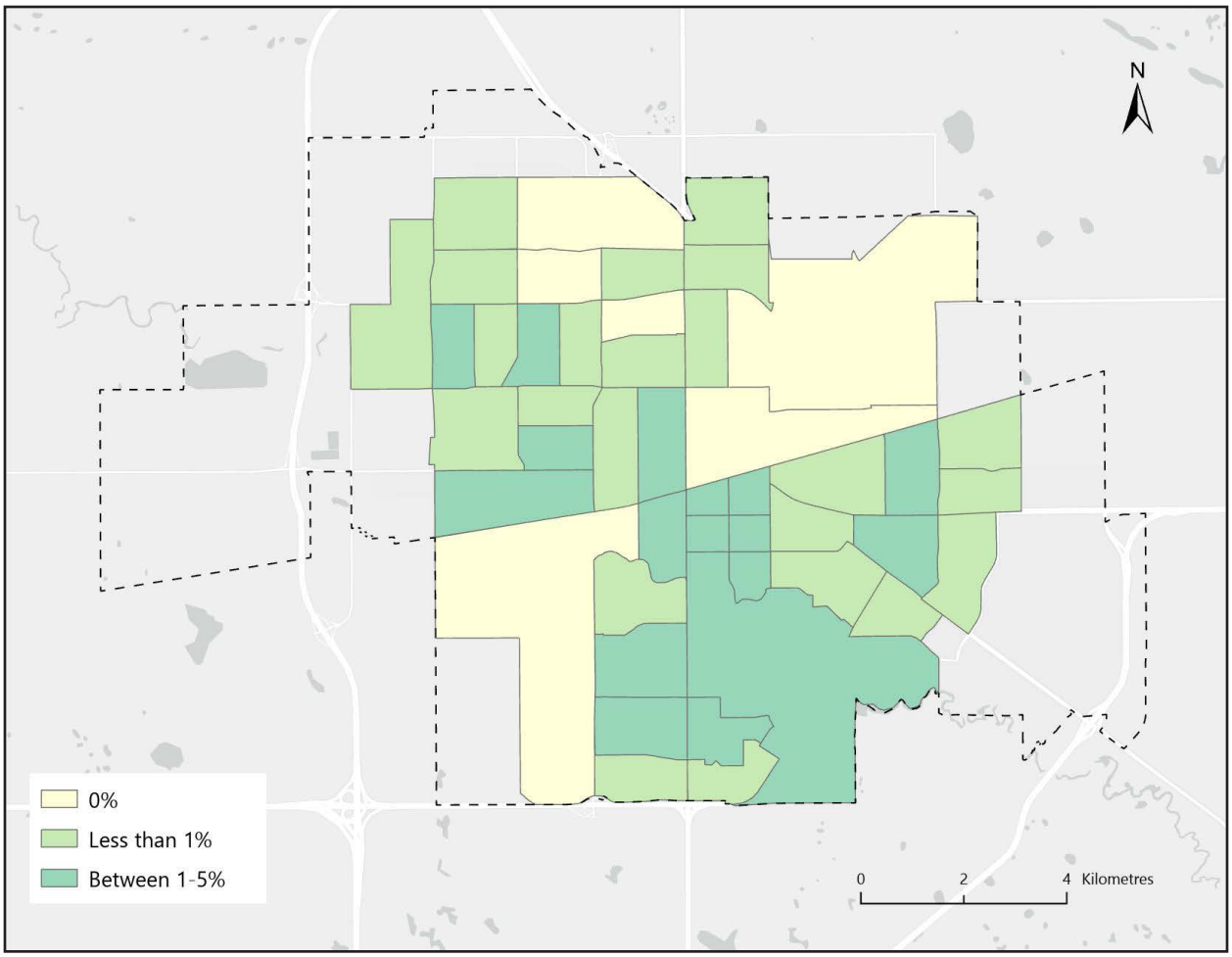

Figure 3. Rate of Recent Immigrant Population per CT, Regina, 2001

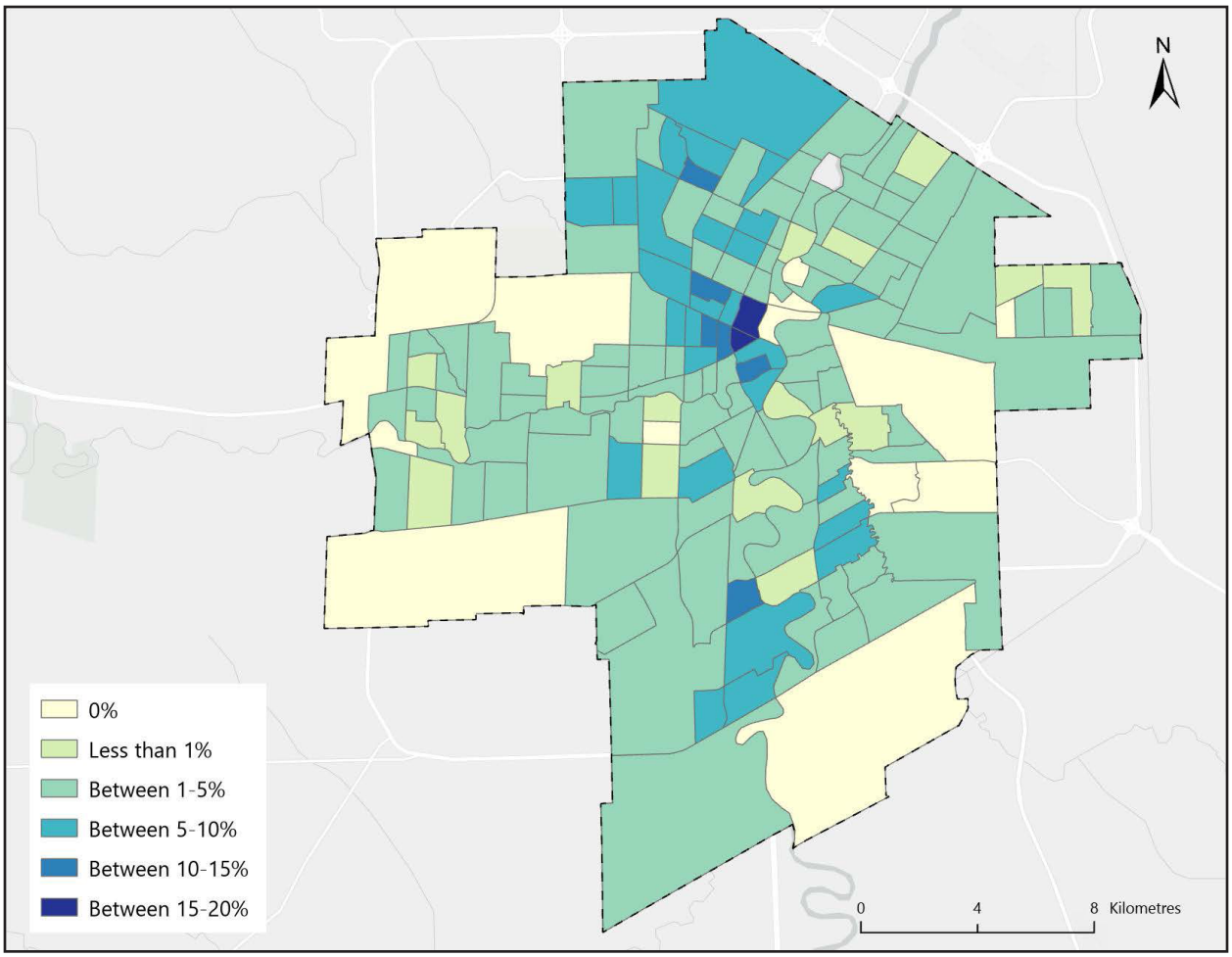

Figure 4. Rate of Recent Immigrant Population per CT, Winnipeg, 2006

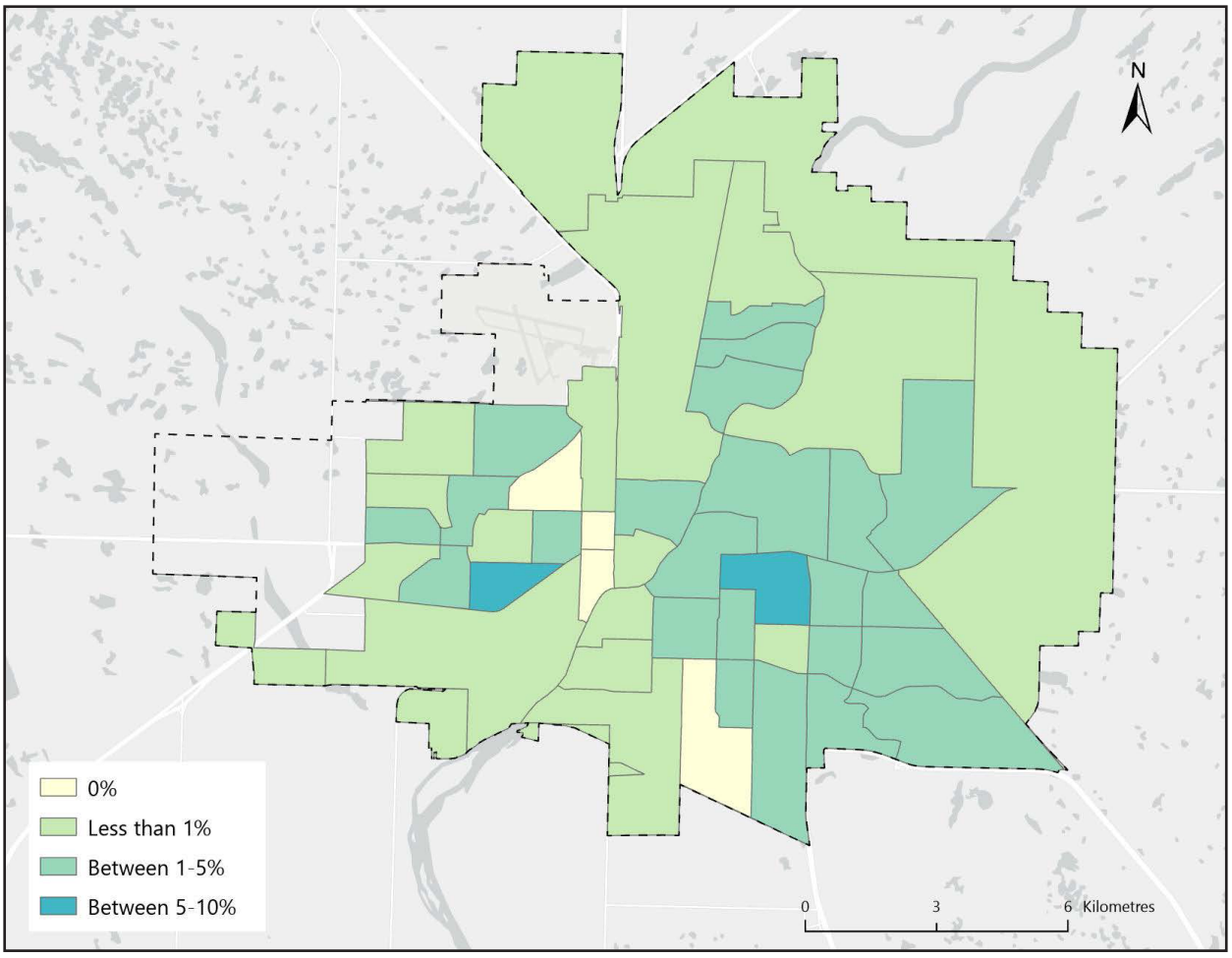

Figure 5. Rate of Recent Immigrant Population per CT, Saskatoon, 2006

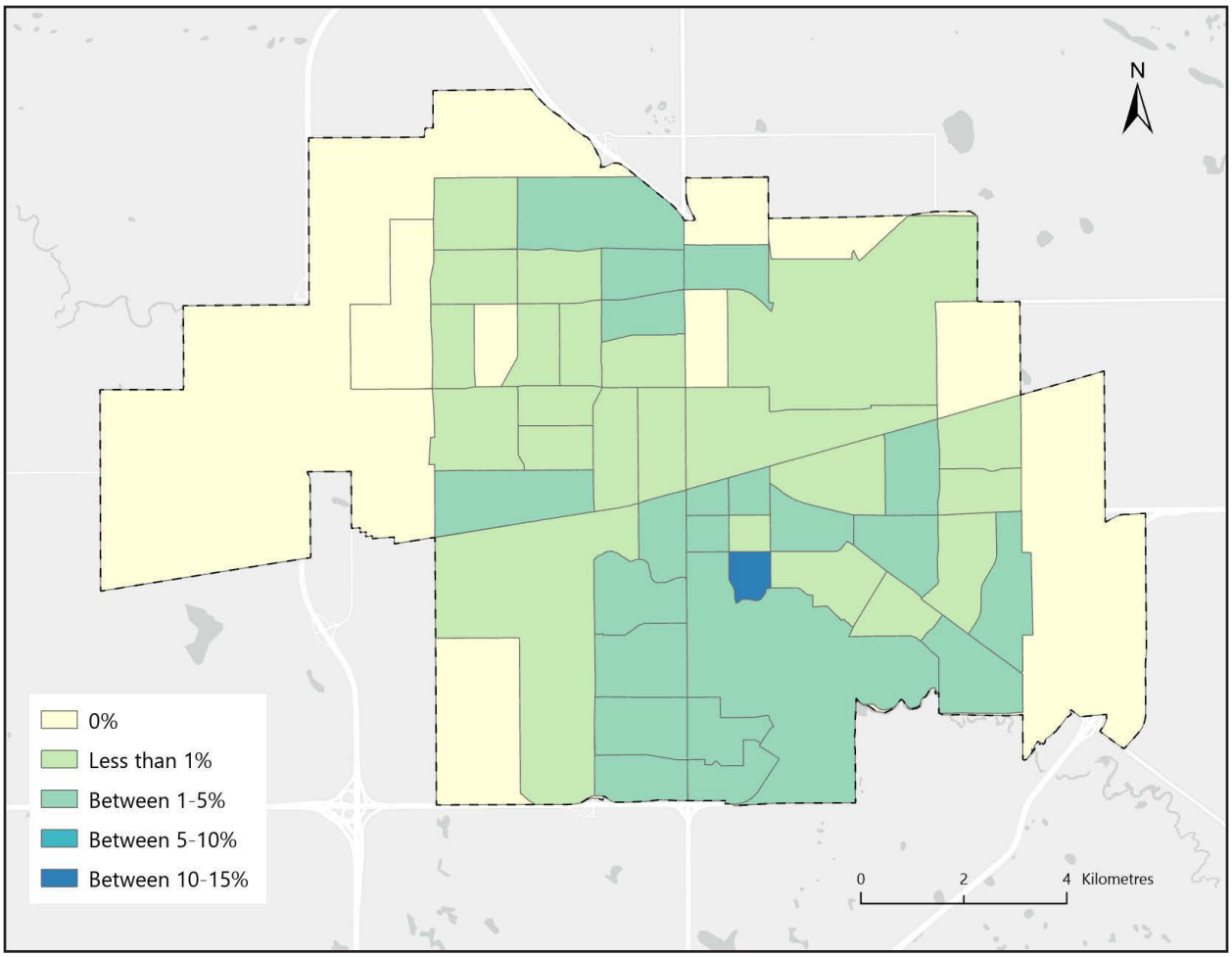

Figure 6. Rate of Recent Immigrant Population per CT, Regina, 2006

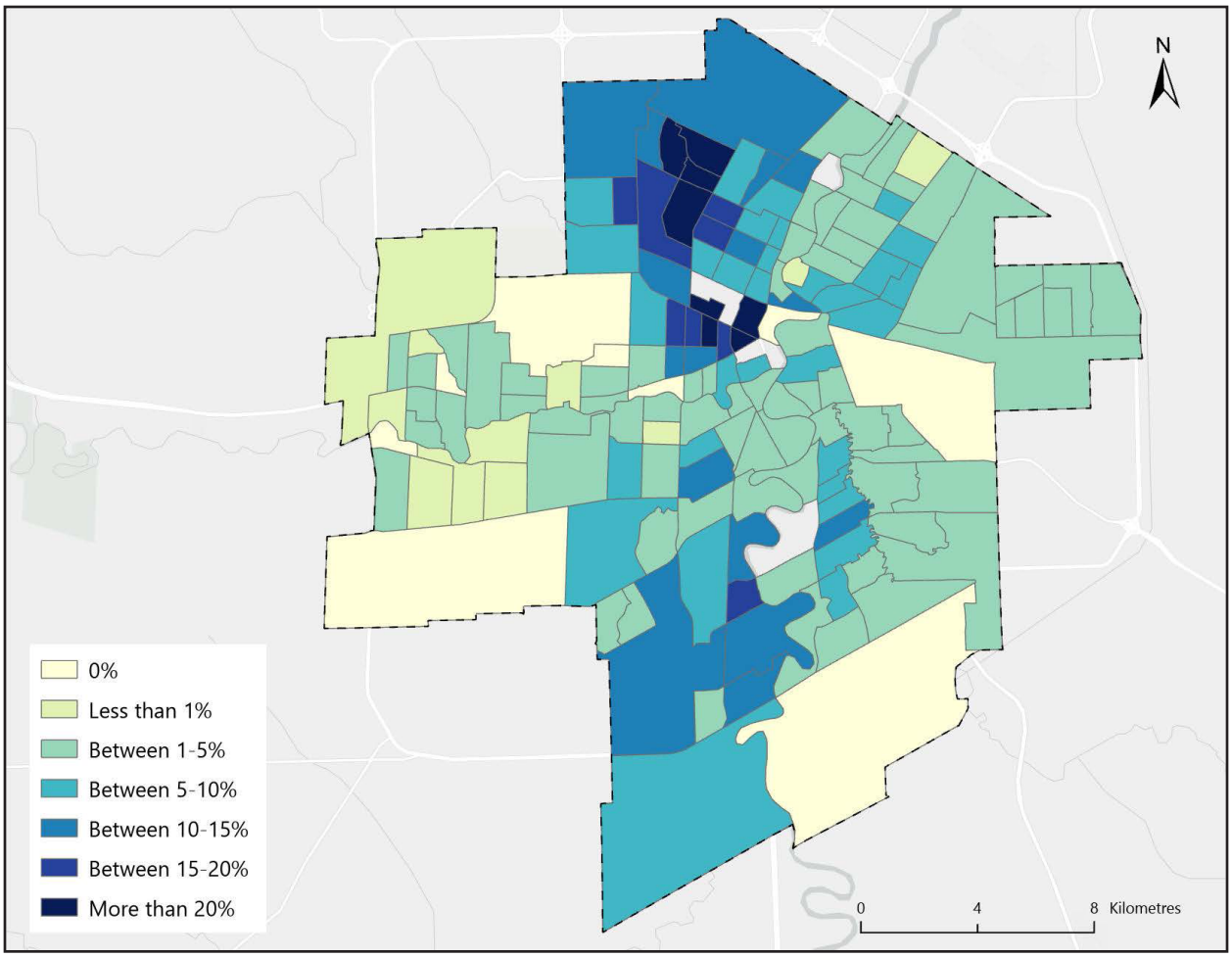

Figure 7. Rate of Recent Immigrant Population per CT, Winnipeg, 2011

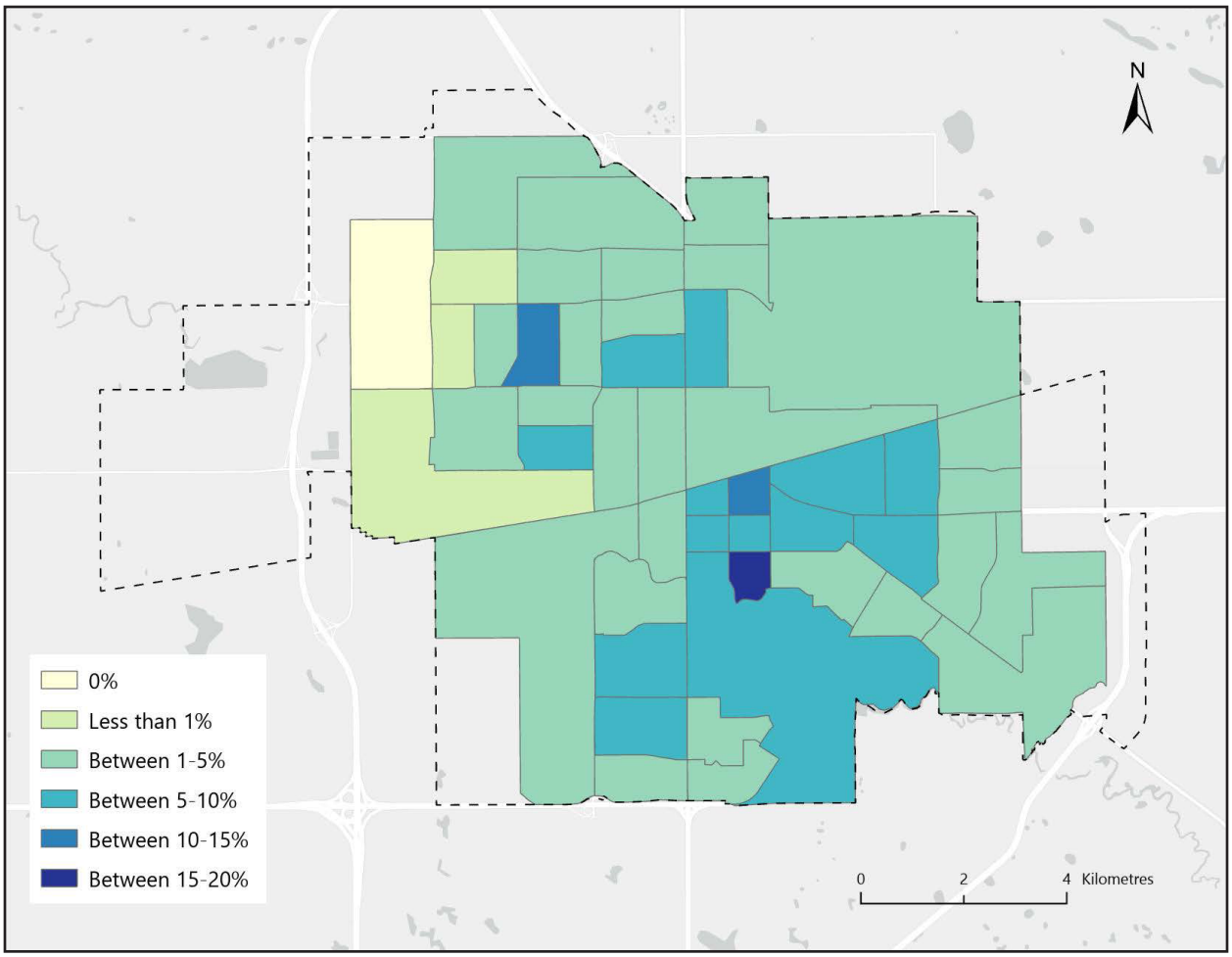

Figure 8. Rate of Recent Immigrant Population per CT, Regina, 2011

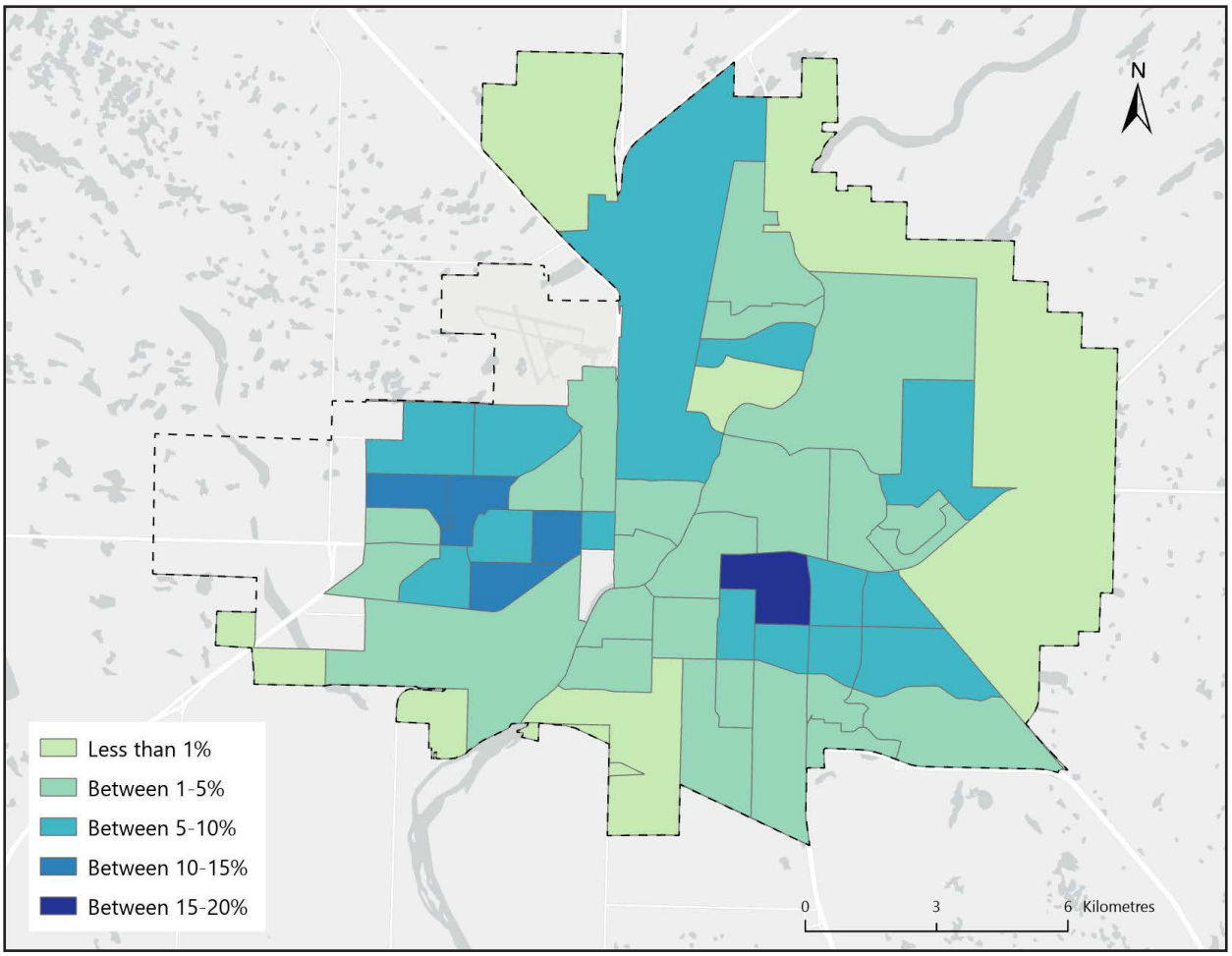

Figure 9. Rate of Recent Immigrant Population per CT, Saskatoon, 2011

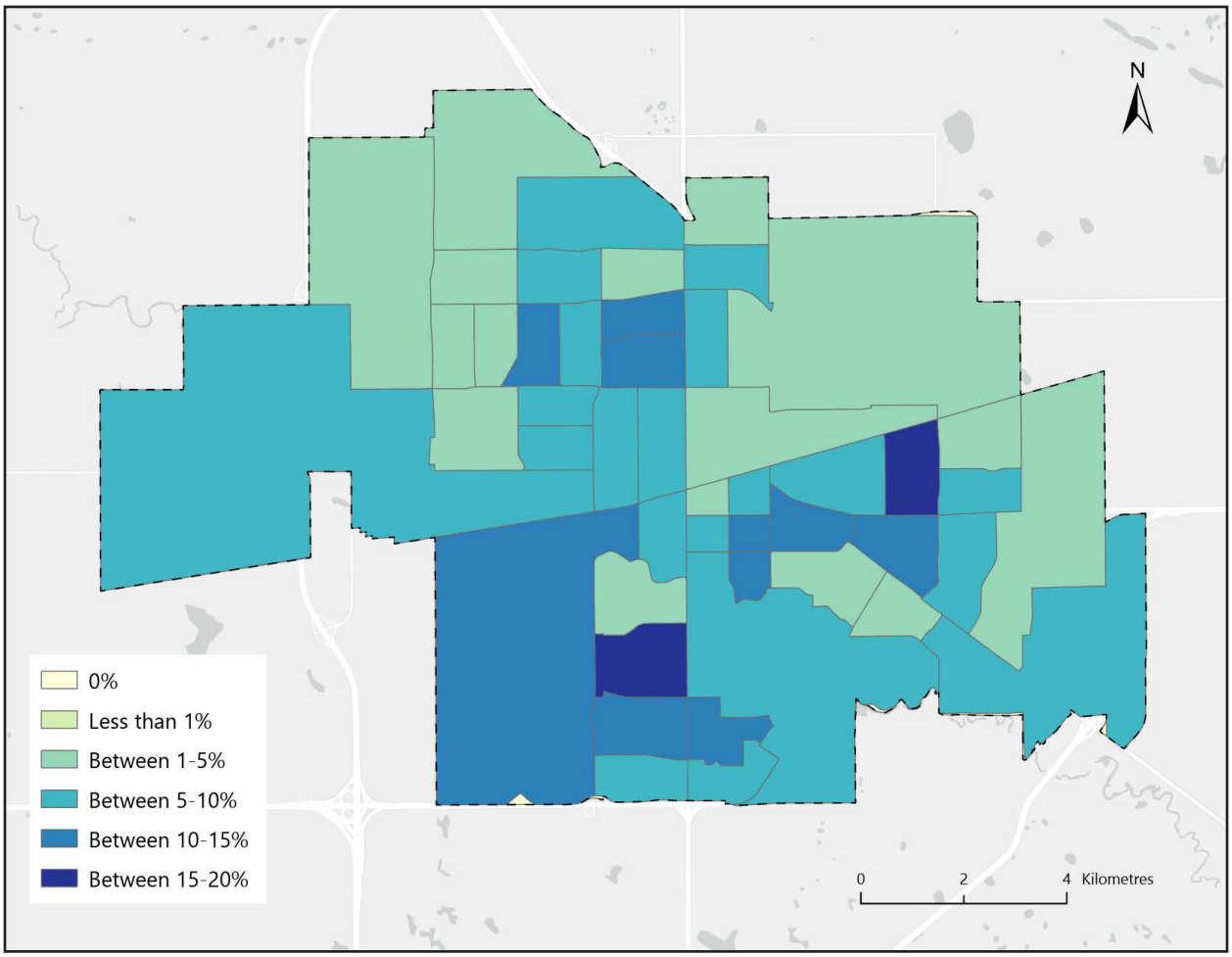

Figure 10. Rate of Recent Immigrant Population per CT, Regina, 2016

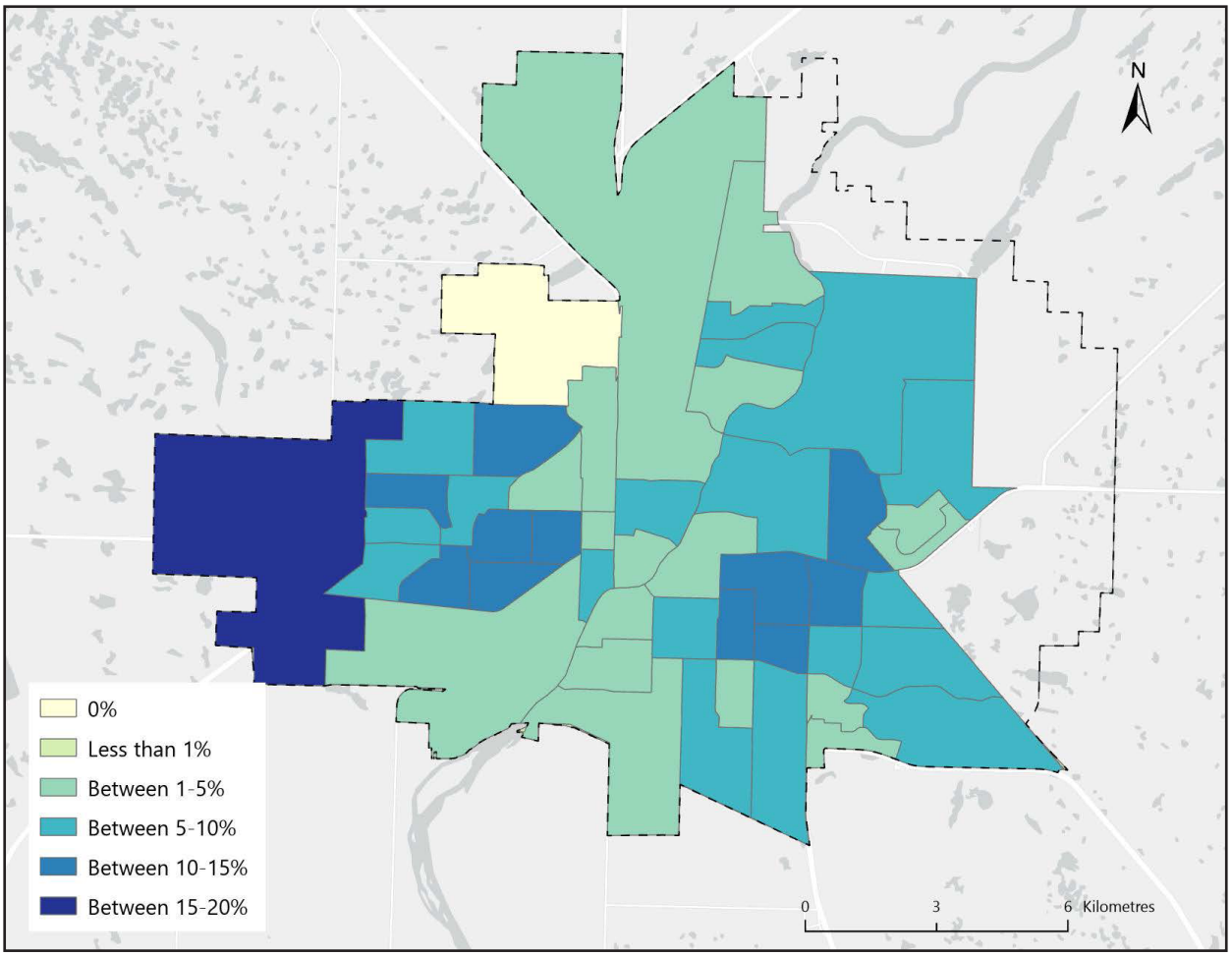

Figure 11. Rate of Recent Immigrant Population per CT, Saskatoon, 2016

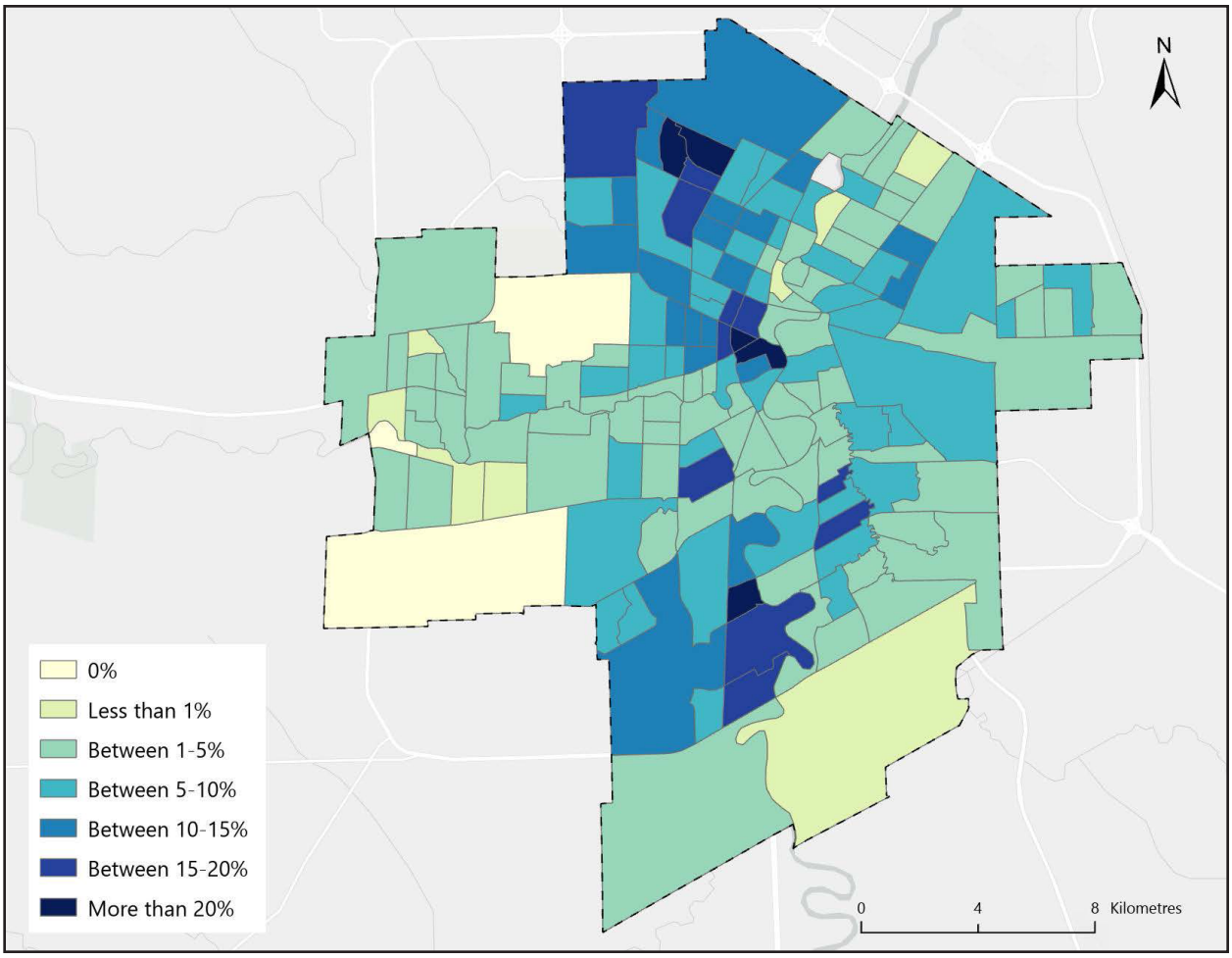

Figure 12. Rate of Recent Immigrant Population per CT, Winnipeg, 2016

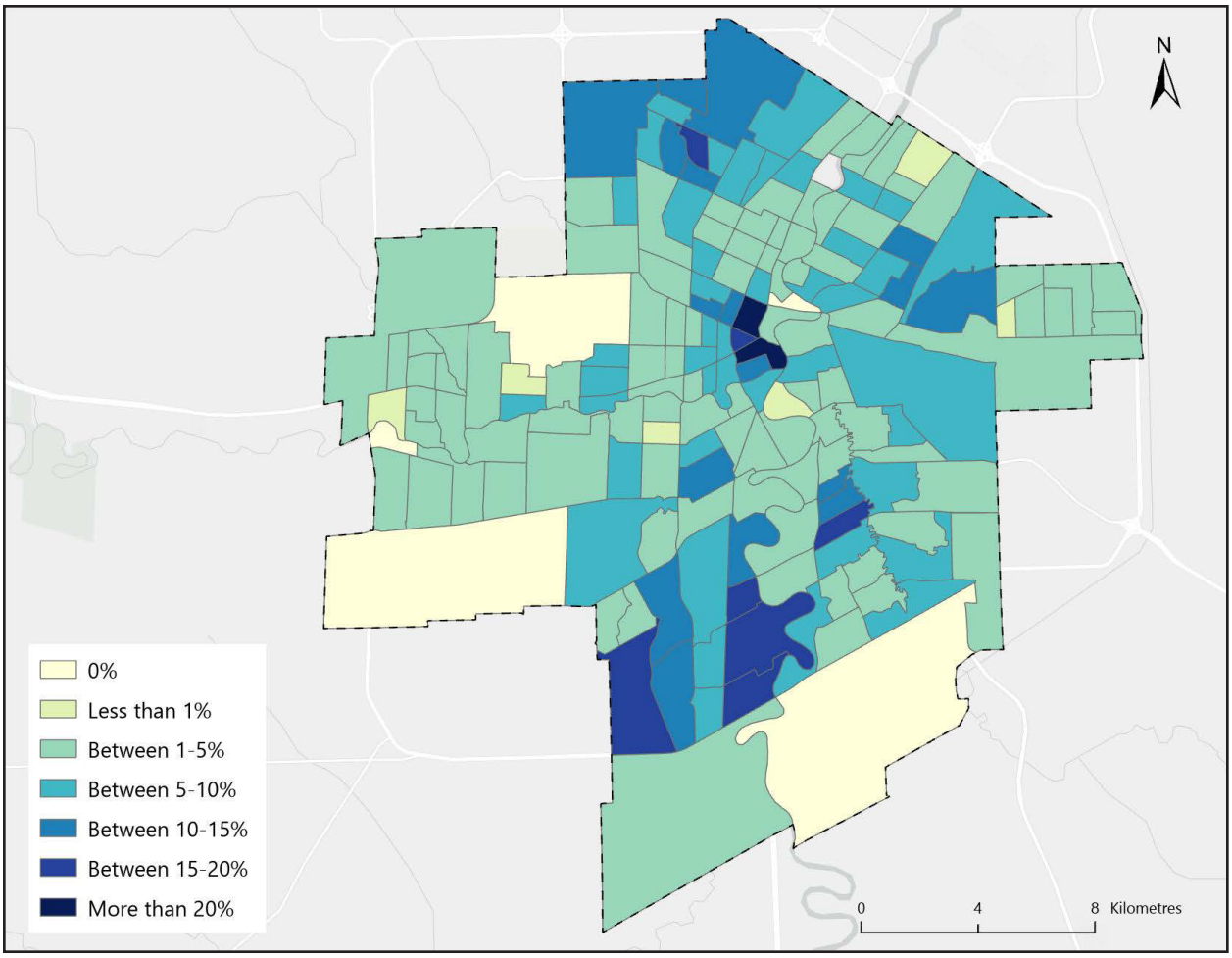

Figure 13. Rate of Recent Immigrant Population per CT, Winnipeg, 2021

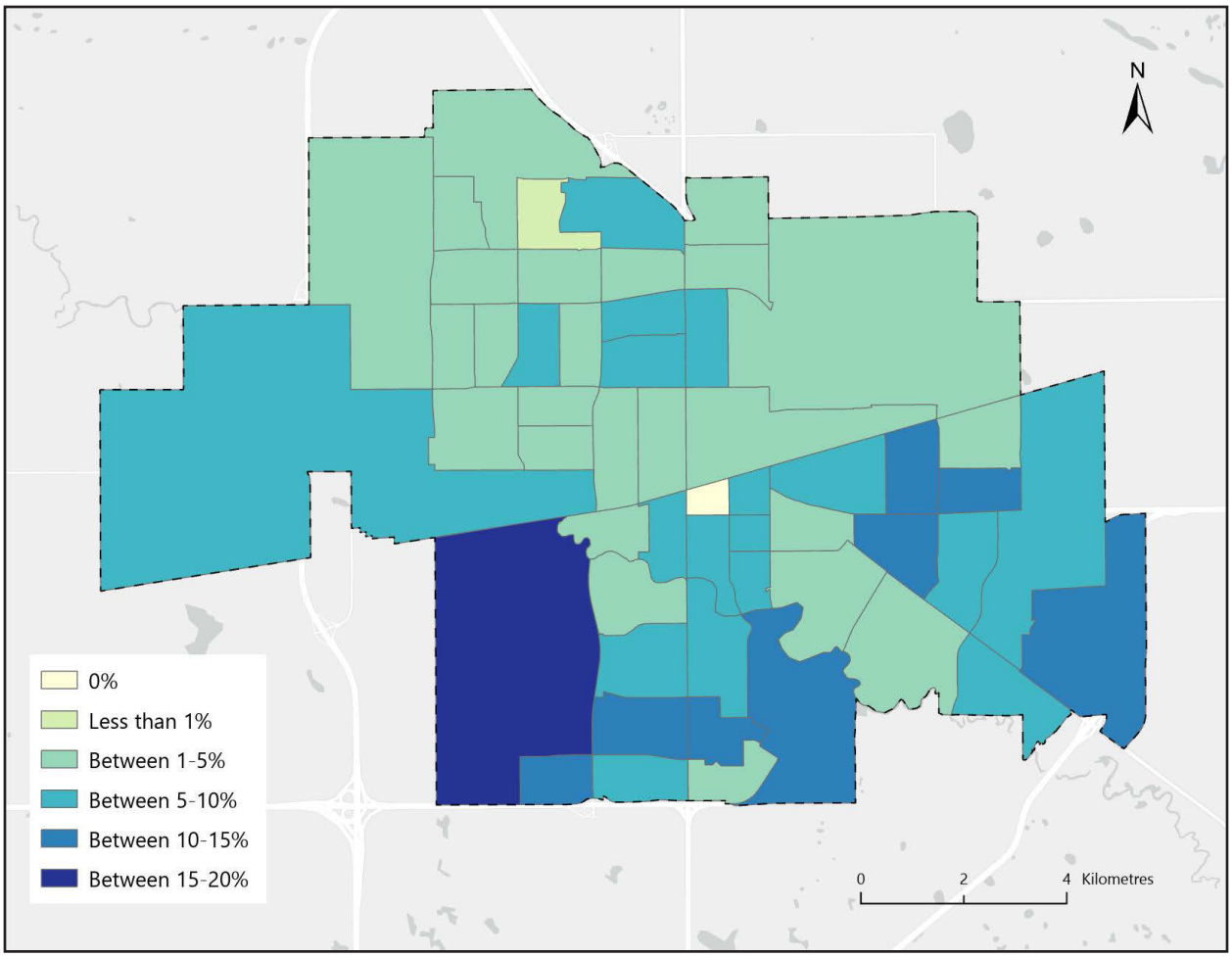

Figure 14. Rate of Recent Immigrant Population per CT, Regina, 2021

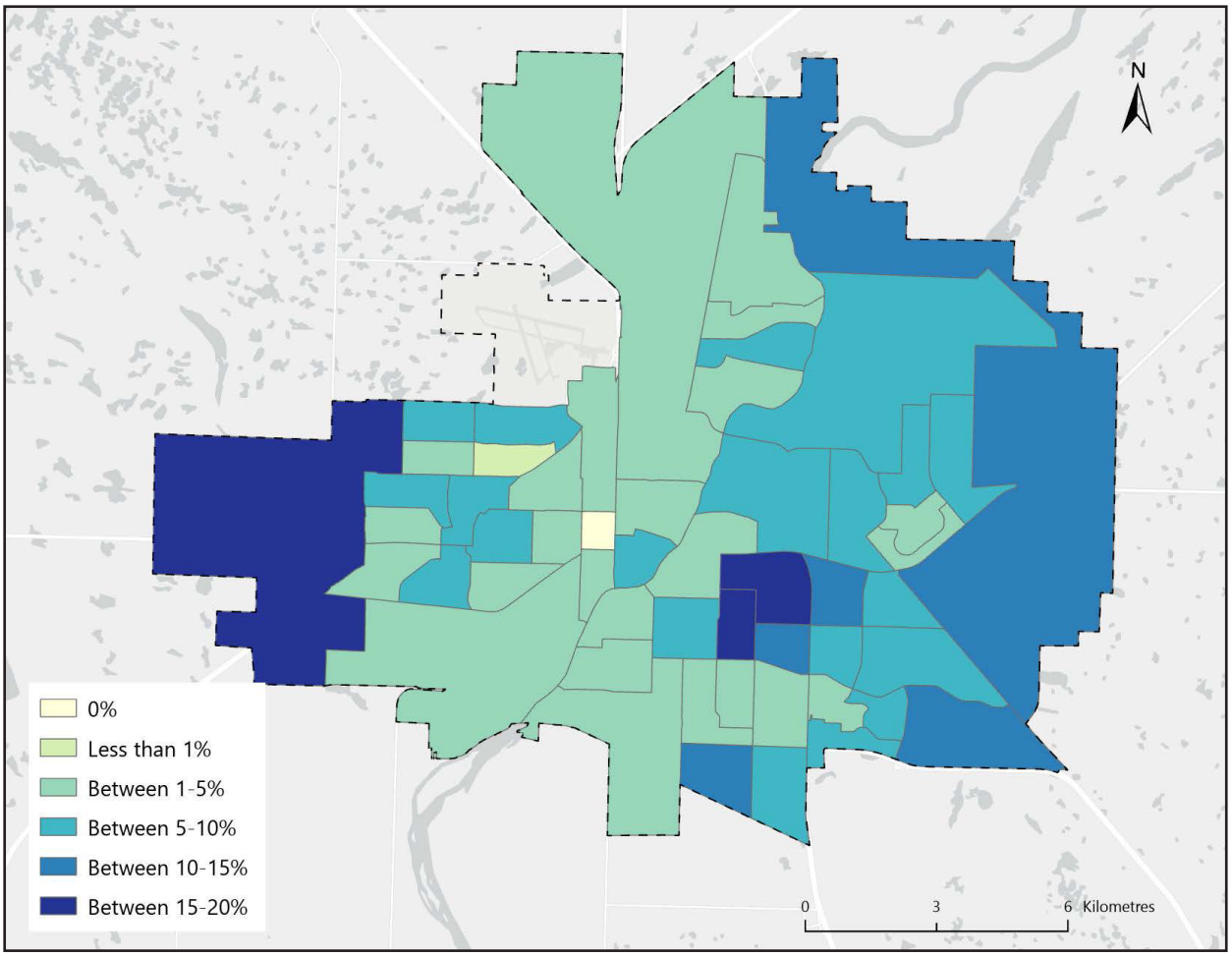

Figure 15. Rate of Recent Immigrant Population per CT, Saskatoon, 2021

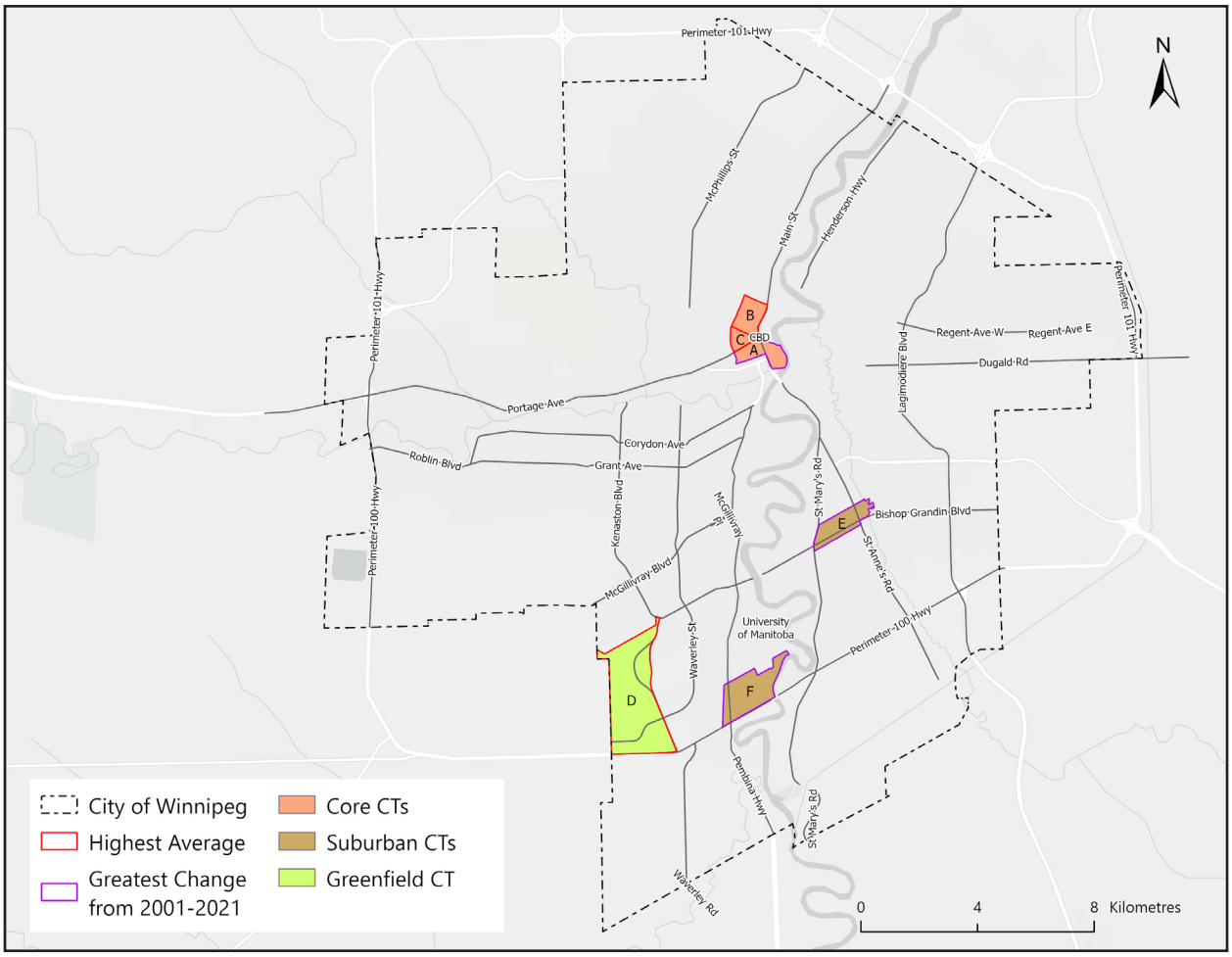

Figure 16. Sample Areas in Winnipeg

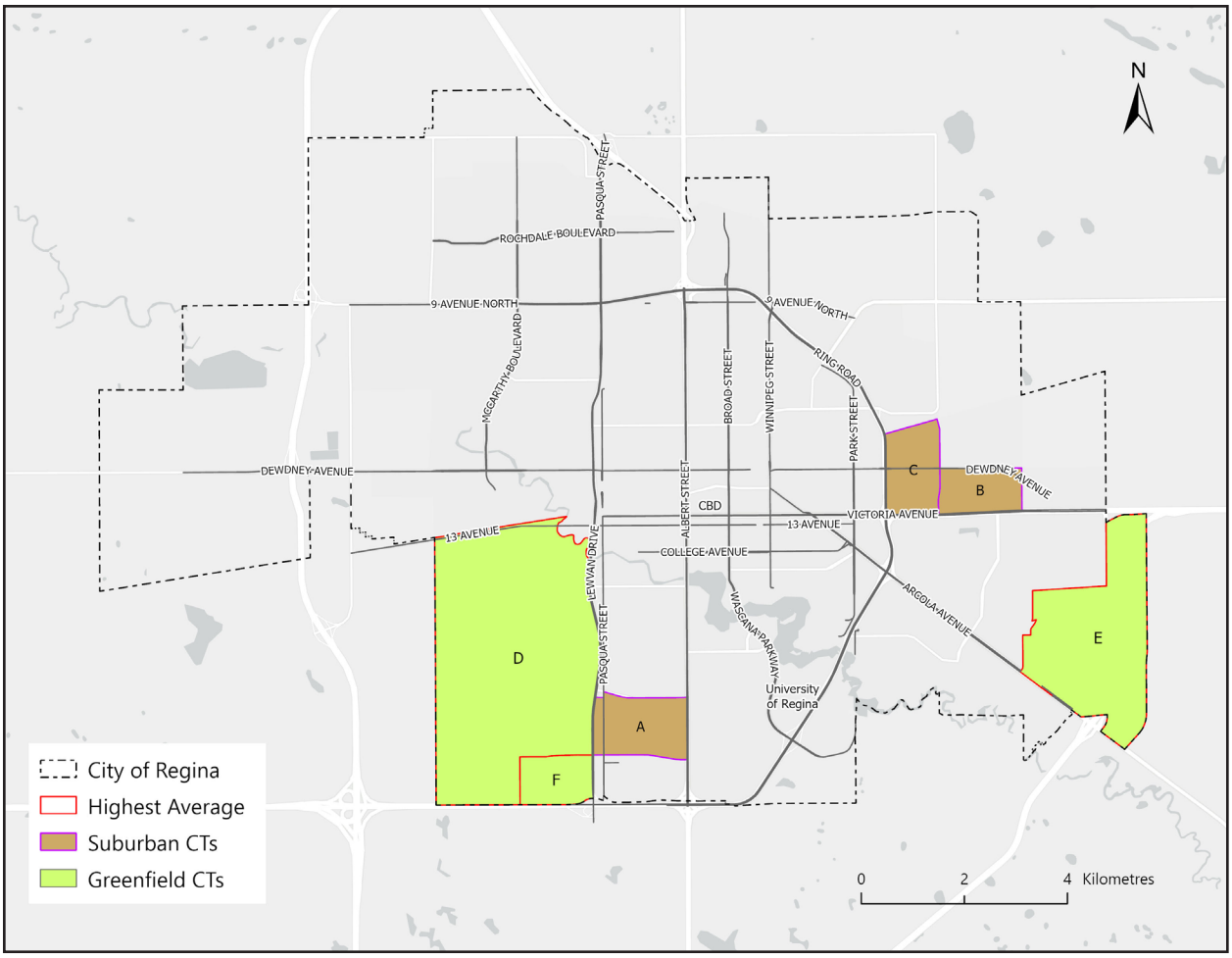

Figure 17. Sample Areas in Regina

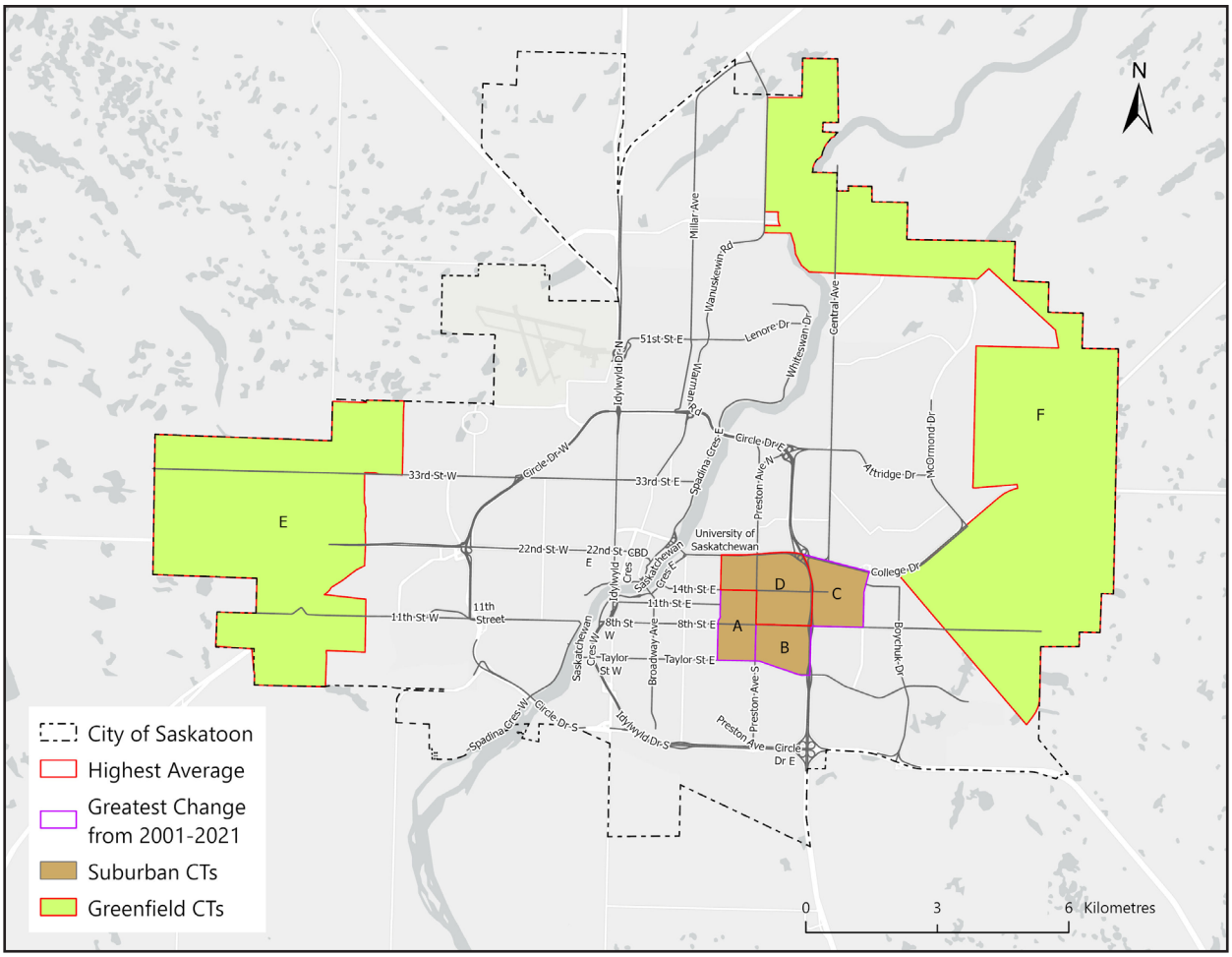

Figure 18. Sample Areas in Saskatoon

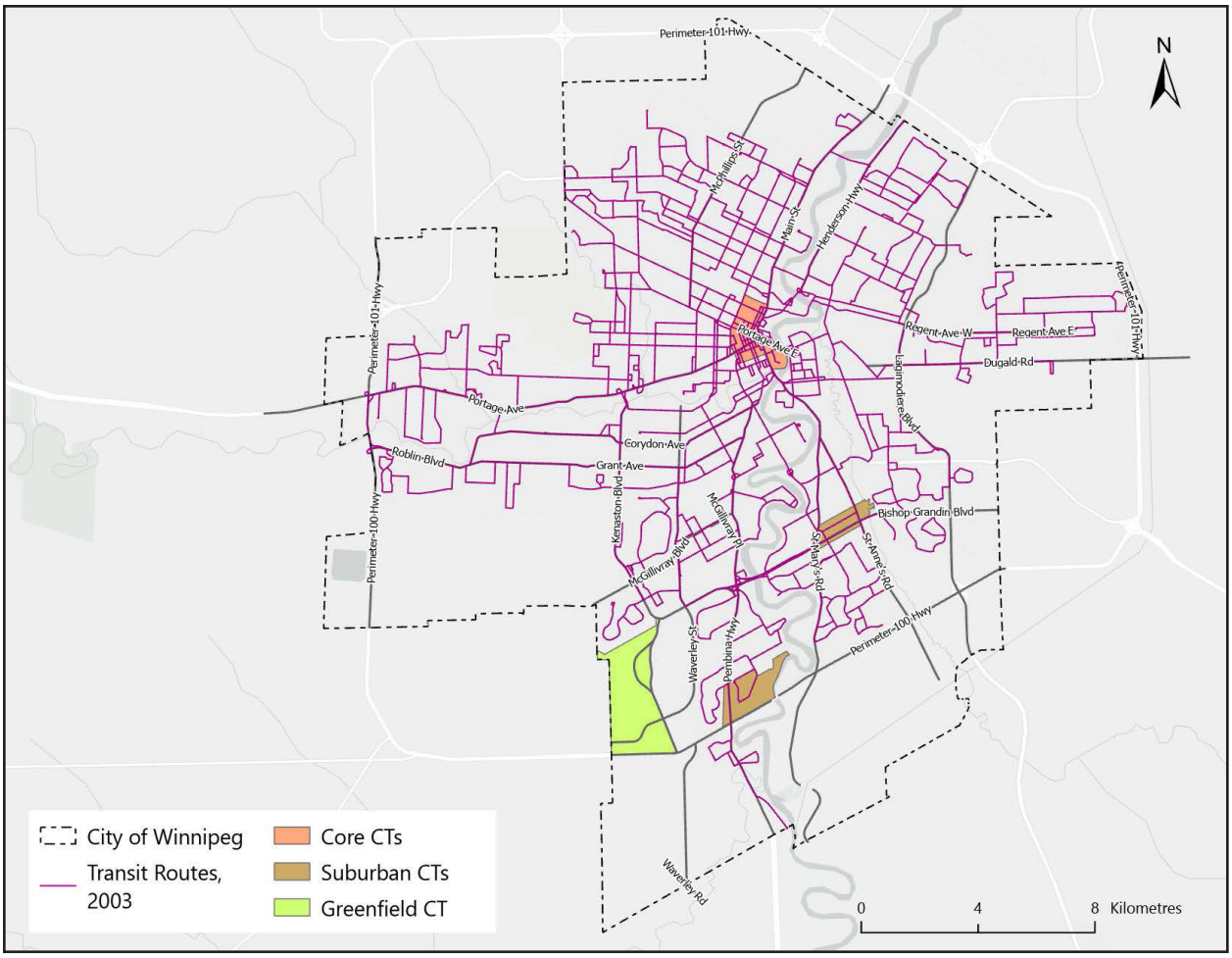

Figure 19. Winnipeg Transit Routes in Relation to Sample Areas, 2003

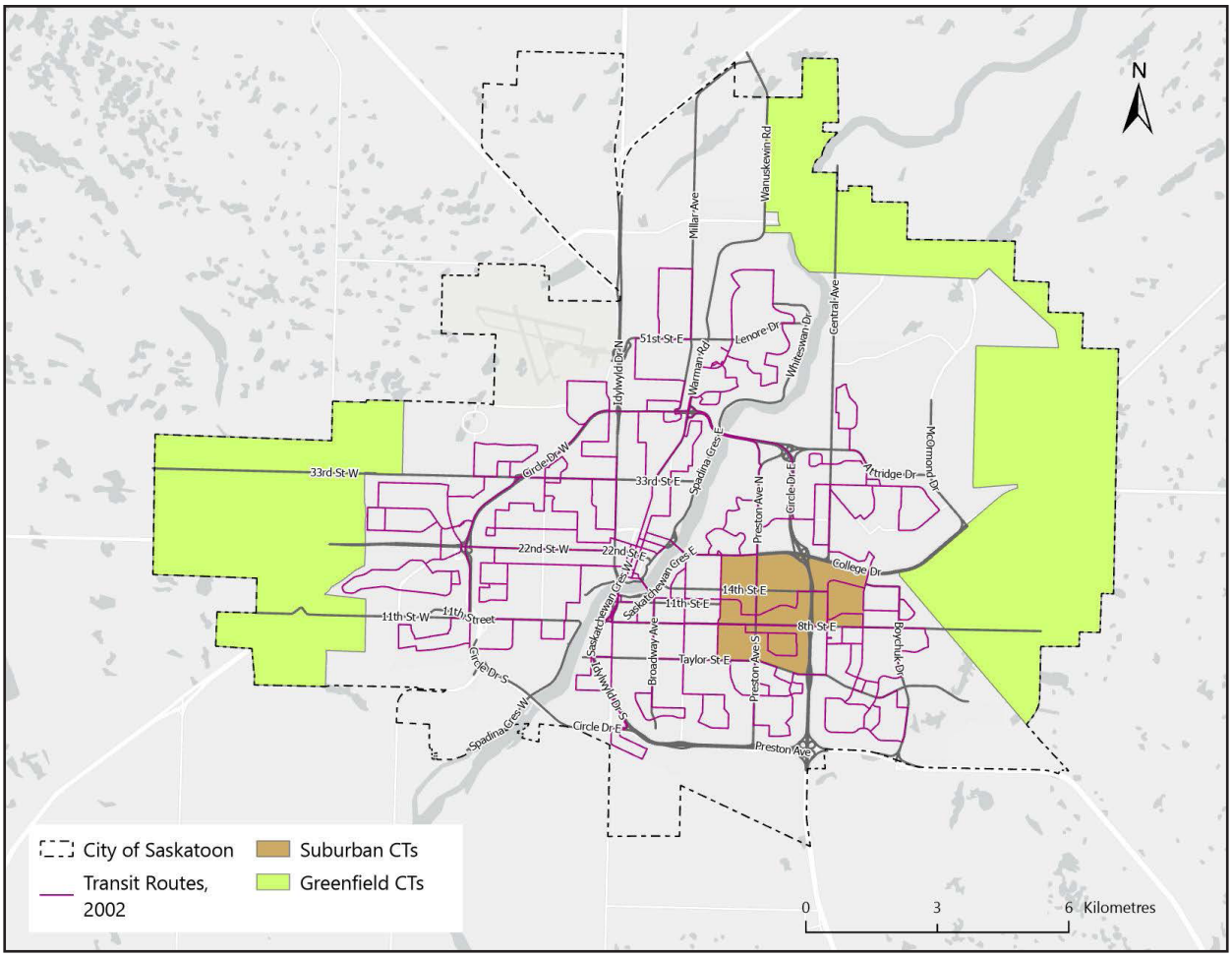

Figure 20. Saskatoon Transit Routes in Relation to Sample Areas, 2002

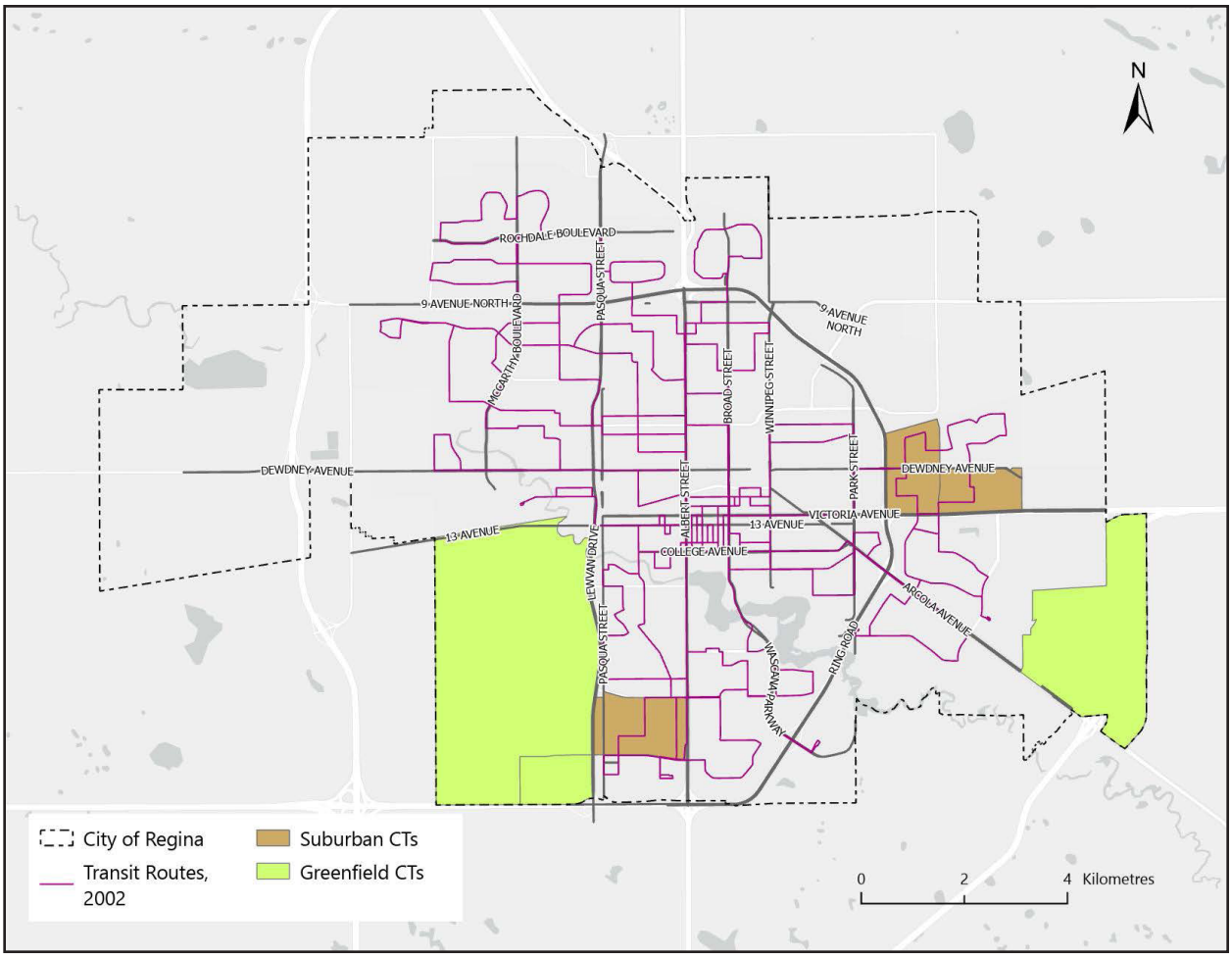

Figure 21. Regina Transit Routes in Relation to Sample Areas, 2002

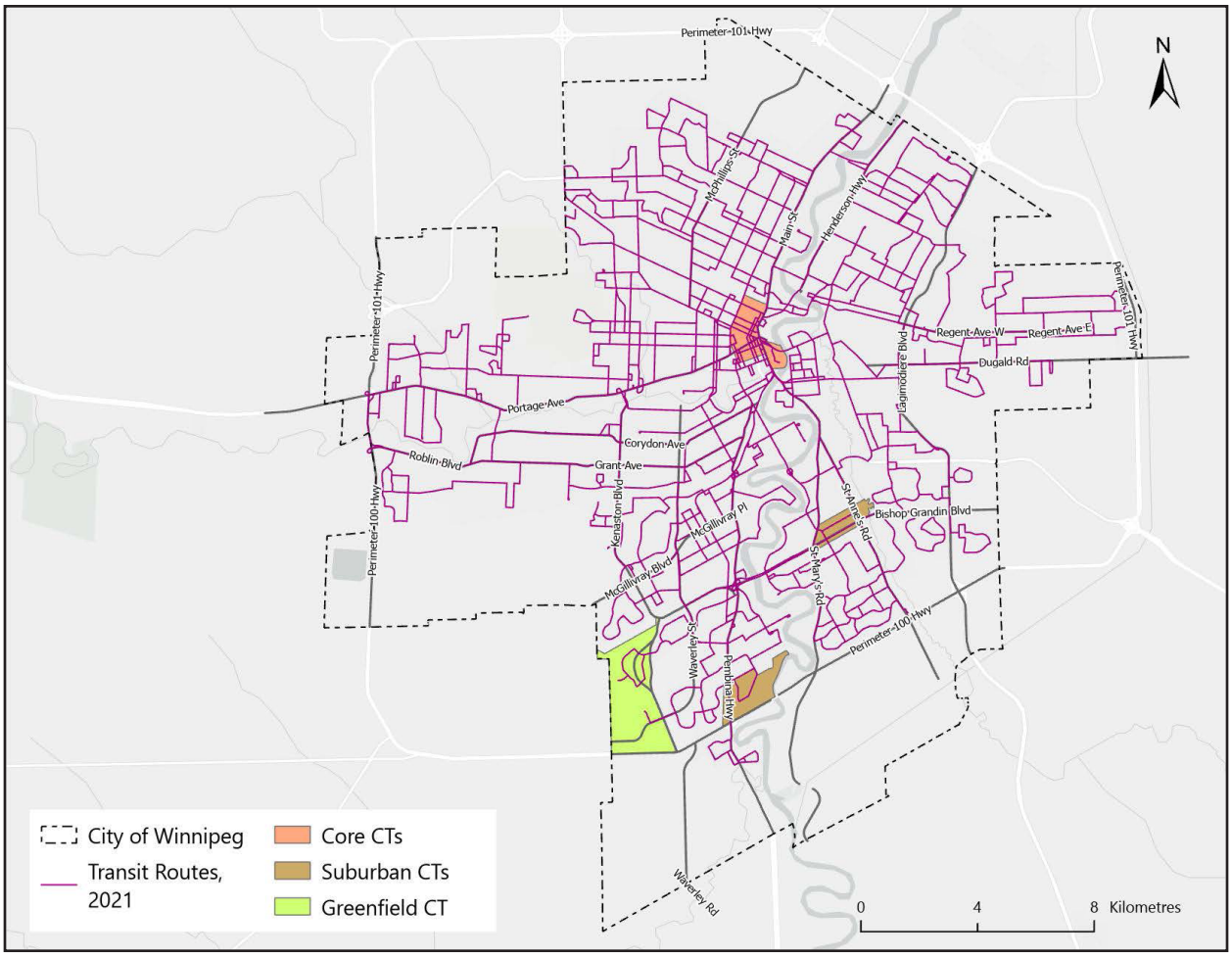

Figure 22. Winnipeg Transit Routes in Relation to Sample Areas, 2021

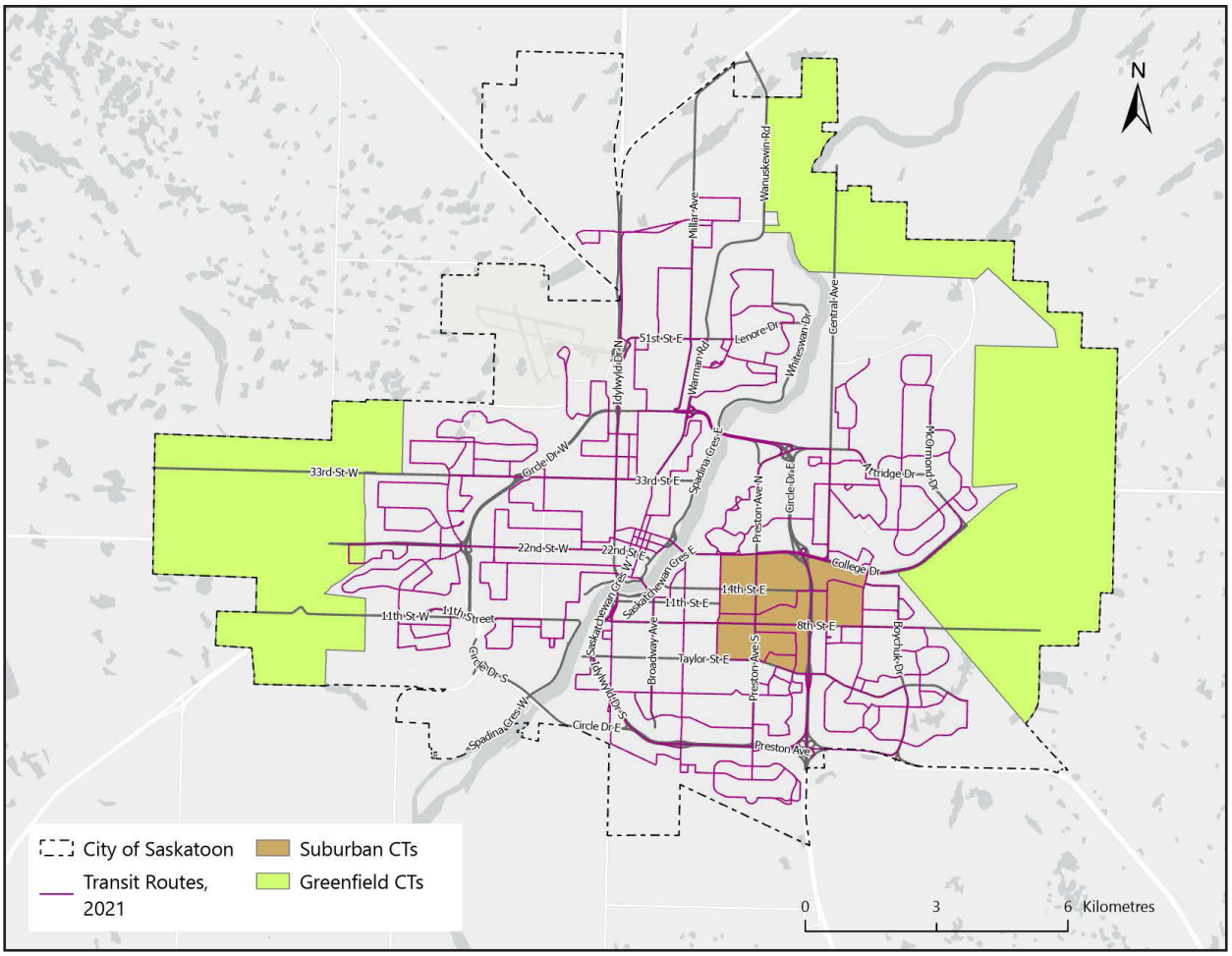

Figure 23. Saskatoon Transit Routes in Relation to Sample Areas, 2021

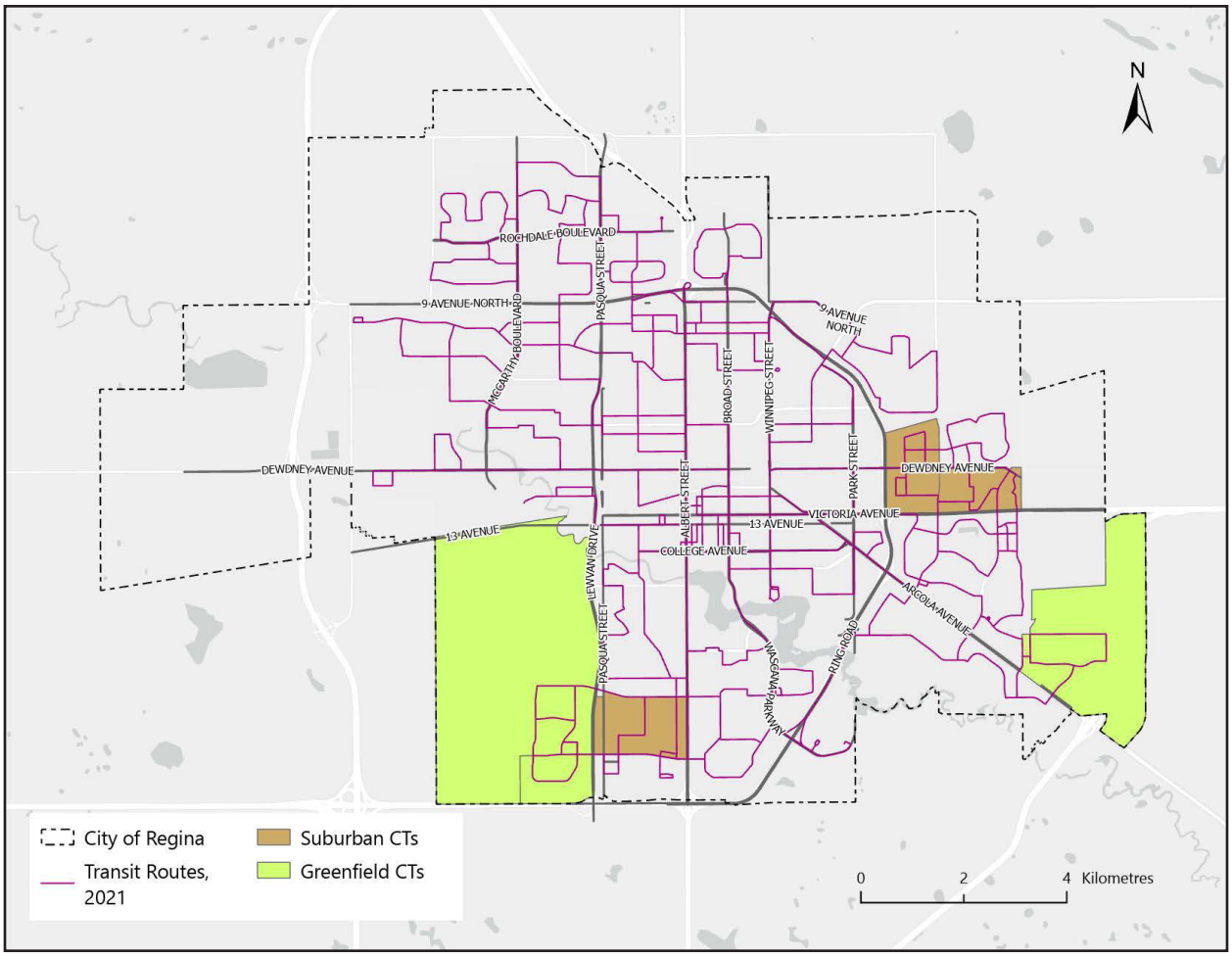

Figure 24. Regina Transit Routes in Relation to Sample Areas, 2021