An Investigation of 15-Minute Neighbourhoods in Surrey, British Columbia: A Community-Informed Social Equity Analysis for a Fast-Growing, Diverse, Canadian City

by

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Declaration of Committee

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Abstract

This thesis developed a community-informed definition of 15-minute neighbourhoods and explored how this intersected with social equity in accessibility to amenities. We mapped 15-minute neighbourhoods in Surrey, B.C., a fast-growing, diverse community based on access to amenities. We shared this in focus groups with equity-deserving groups to get their insights. Our analysis found broad support for the concept and that half of Surrey's residents lived in a 15-minute neighbourhood. However, participants felt the maps missed vital aspects, such as infrastructure and safety; we incorporated this feedback by mapping microscale design features and combining this with access to amenities. Our social equity analysis found that youth living in one-parent households, Indigenous peoples, low income residents, and recent immigrants were more likely to live in 15-minute neighbourhoods. The community voices added insights into factors beyond amenities that matter. This demonstrates that as proximity-based planning proceeds, care is needed to ensure equitable implementation.

Keywords: 15-minute neighbourhood; Active travel; Built environment; Accessibility; Community engagement; Inequities

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List of Acronyms

B.C.	British Columbia
DA	Dissemination Area
PHIR	Population Health Intervention Research
REACH-Cities	REsearch and ACtion for Healthy Cities
SFU	Simon Fraser University

Preface

This is a manuscript-based thesis that meets the guidelines set by the Faculty of Health Sciences. This statement is to confirm that Aayush Sharma is the first author of the manuscript. Citations and author contributions are below.

Sharma, A., Chandi, A., & Winters, M. (2024). An investigation of 15-minute neighbourhoods in Surrey, British Columbia: A community-informed social equity analysis for a fast-growing, diverse, Canadian city. Manuscript submitted for publication.

AS conceptualized and developed the methodology under the guidance of MW. AS performed a formal analysis using r5r and ArcGIS and visualized the results. AC supported the investigation, prepared resources, and handled project administration. AS led manuscript writing with supervision from MW. All authors (AS, AC, MW) reviewed the draft manuscript before it was submitted for publication.

Chapter 1. Introduction

1.1. Background

Auto-centric urban design has led to adverse effects on health and the environment (King & Clarke, 2015). Studies link these designs with outcomes such as road-traffic injuries (Gössling, 2020), air pollution (Frank et al., 2006), chronic and heart disease related to emissions (Schweitzer & Zhou, 2010), noise pollution (Moudon, 2009), and climate change (Hamin & Gurran, 2009).

As an answer to sustainability, health, and livability challenges, the 15-minute neighbourhood concept is becoming more prominent (Moreno et al., 2021). The 15-minute neighbourhood, introduced by Carlos Moreno, is a planning concept where all amenities – living, working, commerce, healthcare, schools, and entertainment – are accessible within 15-minutes of walking, cycling, or public transit. 15-minute neighbourhoods use proximity-based planning to make amenities closer to where residents live and revitalize local communities.

The concept of 15-minute neighbourhoods relates to the more general field of walkability, where an established body of literature links walking with improved health outcomes (Gaglione et al., 2022). Improving neighbourhood walkability reduces non-communicable disease risk, including cardiovascular disease (Weng et al., 2019), as people have the opportunity to be more active in their daily activities (Di Marino et al., 2022) via proximity to amenities and a safe, social, walking experience (Nehme et al., 2016). A more walkable neighbourhood can also help reduce car emissions if people make fewer of their trips by car (Allam et al., 2022a). As a result, cities as diverse as Milan (Abdelfattah et al., 2022) and Beijing (Weng et al., 2019) have begun advocating for 15-minute neighbourhoods to improve population health.

Spatial inequities are historically ingrained into city design (Reardon & Bischoff, 2011). Studies have revealed a positive relationship between income inequality and the spatial segregation of neighbourhoods by income, with this effect more prominent in racialized communities. Household race is also a factor in exposure to environmental toxins (Downey & Hawkins, 2008). Additionally, as cities move toward urban designs focused on walkability, transportation access, and access to amenities (e.g., parks and

community centres), these properties increase in value (Newman et al., 2017). This leads to inequities in who benefits from healthy city design, as high income residents fill these spaces while low income residents move to more affordable areas with worse access to amenities and healthy transportation (Newman et al., 2017).

The 15-minute neighbourhood concept is prevalent in older European cities, which were primarily designed before the invention of the car (Birkenfeld et al., 2023). However, this concept is relatively untested in the North American, and more specifically Canadian, context (O'Sullivan & Bliss, 2020). The development of these areas was primarily after the invention of the car, and residents predominantly rely on cars for transportation. Some studies argue that, because of this car-dependent city design, the 15-minute city concept is not feasible in large North American cities (Birkenfeld et al., 2023). Despite this, several initiatives to create compact and walkable communities (including new urbanism, smart growth, and complete communities) have been discussed and implemented in Canada for several decades (Grant, 2024).

Geographically, this study focuses on Surrey, one of the fastest-growing communities in B.C. (City of Surrey, 2020a). Surrey expects to house 300,000 new residents in the next 30 years (City of Surrey, 2019). Despite Surrey's rapid growth, residents lack transportation options, with 81% relying on cars and only 4% using walking or cycling as their primary method to get to work (City of Surrey, 2016a). Demographically, Surrey has 580,000 residents (City of Surrey, 2019), with 58% being racialized, 33% being South Asian (the largest racialized group), and 43% being immigrants (City of Surrey, 2016a). However, according to the "Social Equity & Regional Growth Study Considerations for integrating social equity into regional planning and Metro 2050" report created for the Metro Vancouver Regional District, Surrey faces some of the most significant social inequities in B.C. (Keltie Craig Consulting et al., 2021). The inequities that disproportionately affect Surrey residents include significant income inequality, high overcrowding rates, and poor employment access.

In the context of Surrey's rapid future growth and growing inequities, city planners wonder about this idea of a 15-minute neighbourhood framework. Current and future land use planning may not support 15-minute neighbourhoods in Surrey, leading to residents missing out on the benefits of walkable neighbourhoods. However, there are also cautions. Even as city staff explore this concept, they know there is no 'one size fits

all' approach: different population groups within this diverse city may need specific amenities. Also, Surrey's housing affordability crisis (City of Surrey, 2016a) raises concerns about 15-minute neighbourhoods displacing residents.

With the current state of research on 15-minute neighbourhoods, questions remain. Where are 15-minute neighbourhoods in Surrey? Who currently lives in these 15-minute neighbourhoods? Furthermore, how does access to amenities relate to social equity?

1.2. Aims and Objectives

This study aimed to advance the literature by a) developing evidence on 15-minute neighbourhoods in the Canadian context, which is largely missing from the evidence base to date; b) including community voices around which amenities matter to understand if the typical GIS-based approaches are relevant in Surrey; and c) adding a social equity analysis to inform policy.

This research aimed to examine social equity questions around accessibility to amenities in Surrey. This study worked to develop a community-informed definition of a 15-minute neighbourhood by:

1) Identifying areas that were 15-minute neighbourhoods in Surrey and how this corresponded with geographic patterns of social equity
2) Exploring how the idea of 15-minute neighbourhoods resonated with Surrey residents, specifically those of equity-deserving groups, and revising the map accordingly

This is a manuscript-based thesis structured around one manuscript. Chapter 2 is an overview of the literature and describes literature gaps. Chapter 3 is an overview of City of Surrey policies related to 15-minute neighbourhoods and describes policy gaps. Chapter 4 is an empirical mixed methods study using mapping and community engagement methods to measure access to amenities in Surrey, develop a community-informed definition of 15-minute neighbourhoods, and determine social equity implications. Chapter 5 is a conclusion chapter with learnings and ideas for future research.

1.3. Study Context

1.3.1. Research Motivation

My research was motivated by the needs expressed by our partners, the City of Surrey and SFU Surrey. My research is nested within the "REsearch and ACtion for Healthy Cities" (REACH-Cities') project, led by my supervisor Dr. Meghan Winters through her CIHR Applied Public Health Chair, Gender and Sex in Healthy Cities (2022-2028). REACH-Cities' primary partner is the City of Surrey. REACH-Cities aims to improve health outcomes and social equity by empowering policymakers with data, methods, and tools required to support policy toward healthy, equitable, and sustainable cities.

1.3.2. Guiding Approach

My guiding research framework was Population Health Intervention Research (PHIR). PHIR addresses the upstream determinants of health, such as race and socioeconomic status (Hawe & Potvin, 2009). It also focuses on policies and programs outside the health sector that can impact health and health equity. One can view 15-minute neighbourhood policies as a population health intervention.

1.3.3. Social Equity

Guided by planning literature, I used Meerow's framework to define social equity (Meerow et al., 2019). We define social equity using a three-pronged approach, where distributional equity (the fair allocation of amenities, infrastructure, and opportunities), recognitional equity (acknowledging and respecting the needs of different equity-deserving groups), and procedural equity (equitable participation in developing plans and outreach to equity-deserving groups) shape community resilience. All three aspects of Meerow's framework align with this project and help guide our work. We incorporate distributional equity as we measure the fair allocation of amenities and infrastructure. We also use recognitional equity as we acknowledge and respect that different ages, abilities, populations, and intersecting identities have different wants and needs for their neighbourhoods; we also acknowledge the past harms and injustices that have limited equity-deserving populations' access to resources and participation in decision-making.

Regarding procedural equity, we conducted outreach with equity-deserving populations, had translators at our sessions, and selected culturally relevant foods to allow participants to engage equitably, meaningfully, and comfortably in our focus group sessions. In terms of specifying population groups for equity work, I looked at previous literature on transportation barriers. Linovski et al. (2021) named "indigenous peoples, LGBTQ2S+ (lesbian, gay, bi, trans, queer, two-spirit) people, people with disabilities, people living in poverty or experiencing homelessness, newcomers and immigrants, women and people with diverse gender identities, children and youth, and seniors and Elders" (p. 7), as key populations who face structural barriers to opportunities and resources. Our project aimed to hear from these populations to enrich our work and incorporate their diverse and unique experiences. In this work, I also applied a health equity lens. We define health equity as everyone having the opportunity to achieve their full potential to be healthy and not be hindered from achieving this due to barriers presented by social, economic, or environmental circumstances (Whitehead et al., 2006). I aimed to help address social inequities and health disparities (Corburn, 2017), particularly those of equity-deserving groups in Surrey, by hearing their lived experiences and sharing our findings with policymakers.

1.3.4. Positioning My Thesis on the Continuum of Community Engagement

I used the community-engaged research paradigm, specifically the Continuum of Community Engagement in Research (Figure 1.1), to centre this project (Key et al., 2019). Community-based participatory research emphasizes a collaborative approach to better understand the social contexts of health by involving partners in the process (Leung et al., 2004). I worked with equity-deserving groups in Surrey using community-informed and community consultation methodologies. These methods are both on the Continuum of Community Engagement in Research but require less community involvement than community-based participatory research. A project is community-informed when researchers take information from the community and use it to make research decisions (Key et al., 2019). My work is community-informed as I listened to the lived experiences of Surrey residents, which I used to inform my research process. A project uses community consultation methods when the community provides guidance or

feedback to researchers (Key et al., 2019). My work used community consultation methods, as the community provided feedback on my preliminary findings.

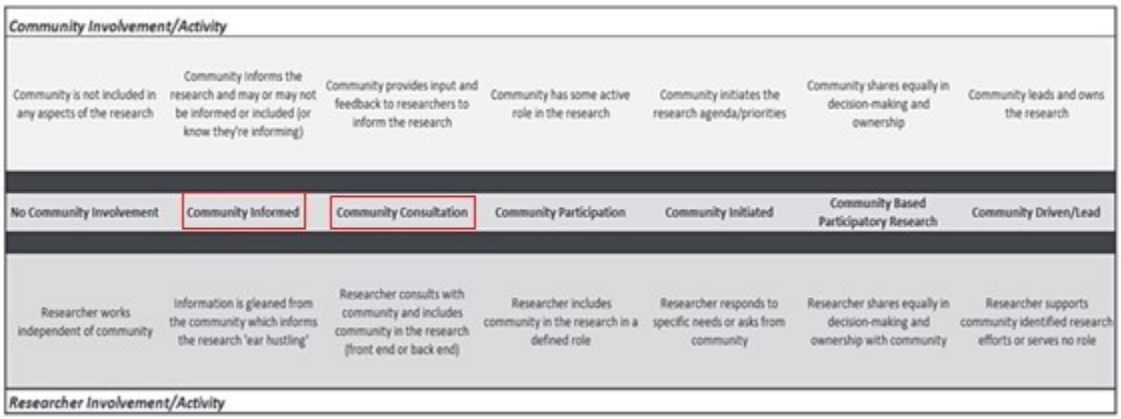


Figure 1.1: Continuum of Community Engagement in Research: Involvement and Activity. From: Key et al. (2019)

Chapter 2. Literature Review

2.1. History and Evolution of Density-Based Planning

Density-based planning concepts are not new and have evolved over time. Researchers have discussed the role of density and urban structure on transportation modes (Levinson & Wynn, 1963) and compact cities (Jacobs, 1961) since the '60s. In the '80s and '90s, researchers and planners began discussing meeting all essential needs by walking from their homes, using various planning theories (Grant, 2024). These theories included “healthy cities” (Hancock, 1993), “sustainable development” (Alexander, 2009), “new urbanism” (Duany et al., 2010), and “smart growth” (Filion, 2009). The common theme behind these theories was the importance of densification and the proximity of amenities, with this being supported by planners, researchers, and policymakers alike (Grant, 2024). However, some residents did not support how densification was described in these plans, as they thought these plans focused more on profits and meeting political objectives rather than livability (Robinson & Attuyer, 2020). Planners and policymakers then introduced the complete community concept in the late ’90s and early ’00s (Grant, 2024). Complete communities discuss meeting all of the residents’ needs, regardless of identity, within the community itself (Iravani & Rao, 2020). These policies are flexible and adaptable to different lived realities and have been tested in the Greater Vancouver region, Ontario, and some US cities (Grant, 2024). More recently, x-minute city policies (such as the 15-minute city/neighbourhood and the 20-minute suburb), where residents can meet all essential needs within x minutes from their homes using active transportation (Lu & Diab, 2023), were introduced in research and policy. These policies have caught favour as they are objective and measurable, meaning they can quantifiably improve access to amenities through policies (DeSandoli, 2021).

2.2. Background of a 15-Minute Neighbourhood

15-minute neighbourhoods are a planning concept made famous in recent years by Carlos Moreno, where all amenities are within a 15-minute walk, cycle, or public transit ride from one's home (Moreno et al., 2021). The amenities used by Moreno include living, working, commerce, healthcare, schools, and entertainment, but planners

can tailor these amenities to residents' specific needs. 15-minute neighbourhoods aim to incorporate proximity, diversity, and density into city design using policies (Allam et al., 2022a). The critical aspect of 15-minute neighbourhoods is proximity-based planning (Di Marino et al., 2022), where amenities are close to the residents, helping bring the amenities to the people rather than the people to the amenities (Pozoukidou & Chatziyiannaki, 2021). The other features are density and diversity, which describe a dense, sustainable city with diverse built environment (or mixed-use) structures and cultural practices (Allam et al., 2022a).

2.3. Benefits of a 15-Minute Neighbourhood

The benefits of 15-minute neighbourhoods come from proximity-based planning, diversity, and improved built environments (Moreno et al., 2021). Proximity-based planning emphasizes having amenities at shorter distances from residents' homes (Moreno et al., 2021), which reduces their reliance on cars (Calafiore et al., 2022). Reduced car travel leads to decreased urban air and noise pollution (Allam et al., 2022b) and traffic-related accidents (Pozoukidou & Chatziyiannaki, 2021). Having amenities close to home also encourages active transportation methods, including walking and cycling (Gaglione et al., 2022), which can improve residents' cardiovascular health (Weng et al., 2019). Regarding diversity, 15-minute neighbourhoods promote diverse cultural practices, housing designs, and land use (Pozoukidou & Chatziyiannaki, 2021). Diversity also entails diverse land use through reimagined open spaces, such as temporary spaces, granting planners options to reintroduce local city life to residents (Gaglione et al., 2022). Planners can also alter the local built environment to improve safety and appeal, motivating residents to walk and cycle more. These improved environments could encourage residents to interact more, which is a way to improve socializing and reduce exclusionary practices (Allam et al., 2022b).

2.4. Critiques of a 15-Minute Neighbourhood

Alongside these benefits, there are several critiques of the concept. A primary critique is that the concept would be harder to apply in North American built environments as they are newer and designed for cars (Birkenfeld et al., 2023). These designs lead to more space between amenities, which goes against 15-minute

neighbourhood thinking. 15-minute neighbourhoods would also disrupt social norms in North America, primarily because cars are the preferred transportation mode, which may be a difficult transition for many residents (Pinto & Akhavan, 2022). Additionally, if policymakers do not improve road safety measures, such as sidewalks and bicycle lanes, alongside the introduction of 15-minute neighbourhoods, active transportation might be harder to implement with the general population in North America who tend to drive (Abdelfattah et al., 2022). Other critiques target the concept of 15-minute neighbourhoods itself. A significant concern regards how vague the concept is, which could lead to inactive policymaking (Gower & Grodach, 2022). Other critics argue that the 15-minute neighbourhood concept is flawed and will simply shift traffic and pollution elsewhere (Calafiore et al., 2022). Critics also note the potential to displace (Marchigiani & Bonfantini, 2022) and gentrify (Markley, 2018) equity-deserving residents if 15-minute neighbourhoods increase the cost of living in areas they currently live, worsening inequities by isolating and segregating these populations.

2.5. 15-Minute Neighbourhood Conspiracy

Recently, 15-minute neighbourhoods have been in the news, with claims that the concept is part of a larger ploy to remove residents' ability to move and confine people to their neighbourhoods (Dawson, 2023). These claims stem from Oxford, United Kingdom, where people conflated two concepts: 15-minute neighbourhoods and low-traffic neighbourhoods (Cunningham, 2023). The goal of 15-minute neighbourhoods is to improve accessibility by having amenities near residents' homes so that they have the option to walk, cycle, or take transit (Butterfield, 2023). Rather than confining residents, the aim is to offer alternative modes of transportation to residents and improve people's ability to get around without having to rely on a car (Dawson, 2023). There is a 15-minute time attached to the concept because people do not want to walk more than 15 minutes to get to their necessary amenities (Whittle, 2023). Also, no 15-minute neighbourhood policies discuss taking away people's cars (Moscovitch, 2023). The second concept is low-traffic neighbourhoods, which aim to limit car traffic in certain areas (Butterfield, 2023). These neighbourhoods will enact similar policies to toll bridges to limit car congestion in certain areas during certain times (Anderssen, 2023). There are no restrictions to leaving residents' neighbourhoods discussed in either of these policies (Calafiore et al., 2023).

Given the nationwide controversy and threats to planners, the Canadian Institute of Planners has put out a statement clarifying what a 15-minute neighbourhood is (a planning concept to improve access to amenities) and what it is not (a surveillance or lockdown measure) (Canadian Institute of Planners, 2023). Provincial planning organizations from across Canada have supported this message. The City of Edmonton, which has been working on 15-minute neighbourhood policies, followed suit with this message (Butterfield, 2023), with text added to Edmonton's District Planning website explaining that the idea is not to monitor residents' emissions or movement or limit the movement of residents. Instead, they aim to develop Edmonton to be a healthier and increasingly connected city that is more climate resilient. The chief administrative officer of the town of Olds, Alberta, has addressed the issue differently by clarifying that they are not transforming their city into a 15-minute neighbourhood (Collie, 2023). They explained the conspiracy and its flaws, increased misinformation with social media, and increased mistrust among residents during the post-COVID period.

2.6. Equity and 15-Minute Neighbourhoods

Equity is a crucial critique of 15-minute neighbourhood policies as city design can create social and economic inequities (Wu & Liu, 2022). Studies show that people with low income (Calafiore et al., 2022), racialized groups, people with lower educational attainment, and those at the intersections of these disadvantages (Hu, 2019) have worse access to amenities and work and live in less walkable neighbourhoods. However, other studies show that this may not be the case, as research shows that areas with low socioeconomic status or highly educated residents tend to be more walkable (King & Clarke, 2015); areas with youth and older adults tend to be less walkable. Some studies show that equity-deserving groups may have worse access to amenities, including healthcare (Vadrevu & Kanjilal, 2016), grocery stores (Smiley et al., 2010), and recreation (Gordon-Larsen et al., 2006); however, other studies contest this (King & Clarke, 2015). Access to amenities is not the only equity issue, as low income and racialized households also face higher exposure rates to air pollution (Schweitzer & Zhou, 2010). Previous research also shows that 15-minute neighbourhoods alone will not mitigate existing inequities due to city design (Guzman et al., 2021). Researchers must consider whether areas are segregated by socioeconomic status, residents' mobility needs, and whether people have the amenities they need and want near them.

Methodologically, researchers have primarily relied upon ordinary least squares and geographically weighted regression to examine the relationships between access to amenities and equity indicators and to determine inequities (Park & Guldmann, 2020).

2.7. Cities with 15-Minute Neighbourhood Policies

The 15-minute neighbourhood concept has had widespread adoption in Europe (Birkenfeld et al., 2023). In France, Paris Mayor Hidalgo used Moreno's 15-minute neighbourhood concept to transform Paris in 2020 (Moreno et al., 2021). Hidalgo emphasized key policies to transform spaces, such as converting highways to promenades and investing in 620 miles of additional bike lanes (Campbell, 2019). Milan also moved toward 15-minute neighbourhoods during the COVID-19 pandemic to combat pandemic challenges while improving neighbourhood livability; the city aimed to do this by strengthening public amenities, improving access to healthcare, and redesigning amenities for different neighbourhoods (Pinto & Akhavan, 2022). Barcelona is another city with 15-minute neighbourhoods due to long-standing urban plans, such as renewing local spaces and providing funding to improve access to amenities in peripheral areas (Ferrer-Ortiz et al., 2022). Recently, Oxford in the United Kingdom has faced pushback as the city looked to implement the 15-minute neighbourhood concept, explained earlier in section 2.5. (Cunningham, 2023).

In the Canadian context, the City of Ottawa put forward 'Five Big Moves' within Ottawa's Draft Official New Plan, where 15-minute neighbourhoods were one strategy (City of Ottawa, 2021). Ottawa aims to tackle issues such as gender equity, climate change, and culture while developing healthy, sustainable neighbourhoods. The City of Brampton also released a 20-minute neighbourhood plan aiming to invest heavily in public transit and active transportation while creating mixed-use community districts with specific focuses (City of Brampton, 2022). Other examples in Canada include Montreal and Liberty Village in Toronto (Gower & Grodach, 2022).

2.8. How to Operationalize a 15-Minute Neighbourhood: Practice and Research

Many policy documents do not define how they plan to operationalize 15-minute neighbourhoods and related concepts (Gower & Grodach, 2022). Those who have

expressed their plans used various methods (Lu & Diab, 2023). For example, the City of Portland aims to have 80% of residents able to access essential non-work amenities within a 20-minute walk from their homes by 2035 (City of Portland, 2012). They created a 20-minute neighbourhood index to measure their progress, with scores of 70 or above on a scale of 0-100 considered a relatively complete neighbourhood. The amenities used to calculate these scores are grocery stores, parks, community centres, elementary schools, and transit.

Further, the City of Ottawa introduced the 15-minute neighbourhood concept to try to improve residents' access to essential services within a 15-minute walk (City of Ottawa, 2021). The report creates several types of maps, including the number of amenity types, amenities weighted based on public feedback, and service concentration. The amenities used to create these maps were grocery stores, parks, retail, bus stops, health facilities, light rail transit stops, indoor community facilities, schools, and childcare facilities. However, the report does not declare which neighbourhoods are 15-minute neighbourhoods. Rather, it is creating a baseline for access to amenities.

Researchers have operationalized 15-minute neighbourhoods and related approaches using various methods. The most common may be using an accessibility metric and Geographic Information System (GIS) based methods to measure access to amenities within a specific time frame, primarily via walking (Gower & Grodach, 2022). Accessibility metrics measure residents' ability to get where they want to go using various modes of transportation (Litman, 2024). This definition aligns well with 15-minute neighbourhoods and related concepts, as they use access to amenities with several transportation modes, including walking, cycling, and public transit (Moreno et al., 2021). In the Metro Vancouver context, Hosford et al. (2022) used r5r software in R-studio to measure access to a specific amenity (grocery stores) in a 15-minute walk or cycle ride to resemble an aspect of the 15-minute neighbourhood concept. Researchers also assessed whether residents in several cities could meet all daily needs within a 20-minute time frame, with this conducted in Tempe, Arizona (Capasso Da Silva et al., 2020) and Liverpool, England (Calafiore et al., 2022), with the latter study labelling areas with access to all amenities as 20-minute neighbourhoods.

2.9. Incorporating Community Voices in Health Sciences Research

The literature shows that a community-informed approach can be key to research emphasizing health equity and addressing inequities (Hudson et al., 2023). Engaging with those directly impacted by policies helps buy-in among residents and produces data that policymakers are more likely to use (Finio et al., 2020). The San Francisco Health Improvement Partnership (SFHIP) is an example of a program that exemplifies this (Grumbach et al., 2017). This program used community engagement to empower community groups to advocate for policy changes that reduce structural inequities.

In the field of healthy cities research, community perspectives are vital. Engaging with residents allows researchers to better understand community needs and centre research on a local context, providing the tools needed to aid policymakers (Mahoney et al., 2021). In the 15-minute neighbourhood context, planners can tailor neighbourhoods to their residents' needs (Moreno et al., 2021). However, equity-deserving residents are often not included in planning and transportation conversations, meaning planners and policymakers may miss their unique perspectives (Linovski et al., 2021; Meerow et al., 2019). For these reasons, there are calls for 15-minute neighbourhoods to engage with diverse partners when implementing the concept (Luscher, 2020), as one can only meet everyone's needs when everyone helps design cities (Jacobs, 2011). Policymakers have answered this call by using public feedback to ensure that 15-minute neighbourhood policies match residents' needs (Lu & Diab, 2023).

Engaging the community is vital in determining whether the assumptions made in GIS-based research are valid. GIS-based methods assume residents will use the amenities closest to them regardless of cost, preference, or other factors (Song et al., 2022); they do not consider barriers and facilitators to active transportation in the built environment.

2.10. Literature Gaps

My work aims to address gaps in knowledge identified in the literature review. First, research on 15-minute neighbourhoods in the North American context remains relatively new (Birkenfeld et al., 2023). Research in the context of a rapidly developing

city like Surrey, with a large land area and limited density (Statistics Canada, 2022a), is also needed. Second, although there are some studies on the relationship between access to amenities and equity indicators, they often rely on ordinary least squares and geographically weighted regression to determine inequities (Park & Guldmann, 2020). Thus, studies utilizing mixed methods in 15-minute neighbourhood research are lacking. Finally, more research regarding equity-deserving residents' preferences for the planning and design of their neighbourhoods is required (Linovski et al., 2021; Meerow et al., 2019), as GIS-based methods alone cannot accurately depict residents' needs (Song et al., 2022). Researchers should also not extrapolate this information as communities differ drastically in composition and the amenities they require (Brookfield, 2017).

Chapter 3. City of Surrey Policies

The City of Surrey looks the way it does today because of decades of planning decisions that have shaped land use, transportation, and development. For example, the Agricultural Land Reserve, established in 1973, designates areas where agriculture is the primary use, and development and other uses are restricted (Provincial Agricultural Land Commission, 2022). Likewise, the current policies will shape the City of Surrey for the decades to come. This chapter looks at recent or current City of Surrey policies to assess how they refer to 15-minute neighbourhoods.

This chapter discusses City of Surrey policies that explicitly or implicitly discuss 15-minute neighbourhoods and related concepts. The City of Surrey is central to this project because it is the local context in which this research is grounded. My research team at REACH-Cities and I are partnered with the City of Surrey and were in constant dialogue regarding the progress of my project. I identified the content in this section by exploring City of Surrey policy archives. I also used several policy documents released by the City of Surrey as a basis for various preliminary definitions in the research chapter. My research team and I also shared the preliminary findings with City of Surrey staff and partners, who guided us to other policies released by the city that matched my work. This chapter concludes with a critique of the current policies, discussing their shortcomings.

3.1. Explicit Mentions of 15-Minute Neighbourhoods

3.1.1. Resilient Zero-Carbon Neighbourhood Plan

In 2022, the City of Surrey outlined their goals and steps for 15-minute neighbourhoods in its Resilient Zero-Carbon Neighbourhood Plan (Figure 3.1) (City of Surrey, 2022h). Surrey plans to have 75-90% of households able to access all their daily needs within a 15-minute walk, roll, or cycle by 2050 and claims that around 23% currently meet this threshold. They outlined steps to accomplish this, including aligning all land-use policies with climate policies, upholding higher climate standards when planning and developing new neighbourhoods, and making the streets more people-centred.

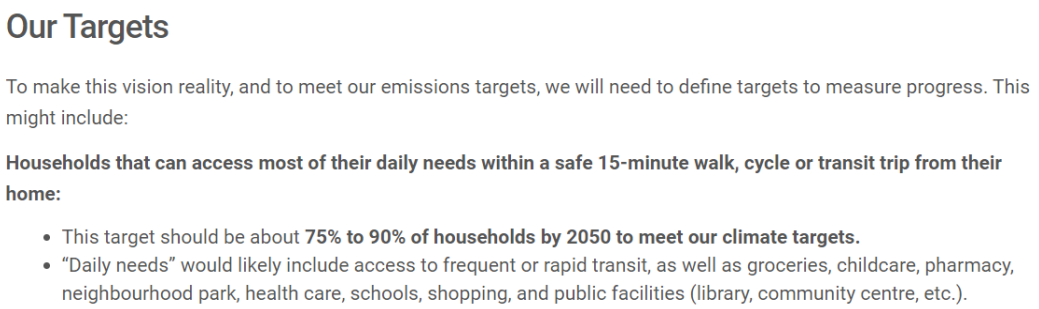


Figure 3.1: Resilient Zero-Carbon Neighbourhood Plan. From: City of Surrey (2022h)

3.1.2. Surrey Transportation Plan

The Surrey Transportation Plan has been a long process, starting in 2020 (Figure 3.2) (City of Surrey, 2022g). Phase 3 (Spring to Summer 2021) included a public survey with 4119 respondents who were residents of Surrey. The survey found that 90% of respondents supported 15-minute neighbourhoods, with most residents expressing that improved mental and physical health and environmental benefits were vital. Although there was considerable support for the concept, a minority of people expressed concerns. The 3% of residents who opposed the idea were primarily concerned about the shift away from cars and the urban sprawl in Surrey. Residents also feared these neighbourhoods might be limited to new and upcoming communities.

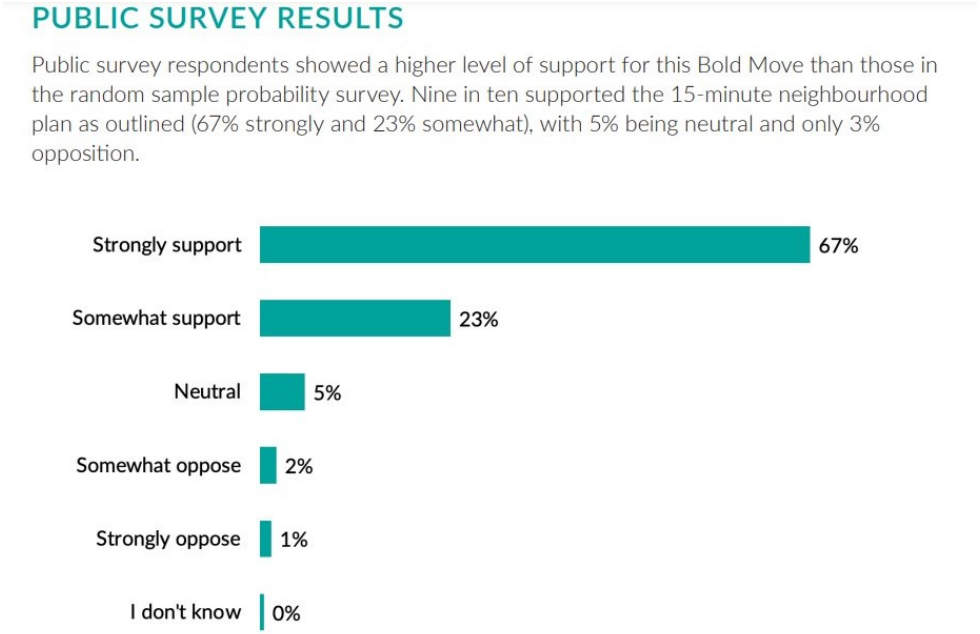
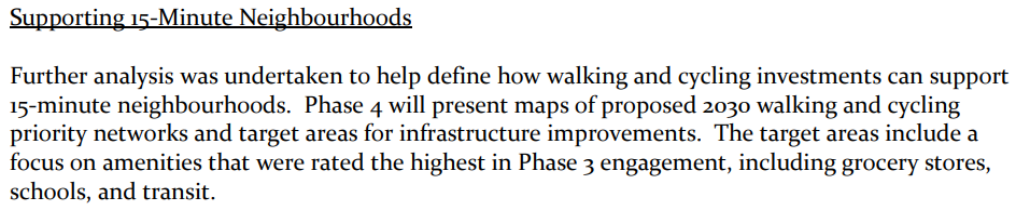


Figure 3.2: Surrey Transportation Plan Phase 3. From: City of Surrey (2022g)

In the Summer of 2023, the City of Surrey was meant to release the Surrey Transportation Plan Phase 4 (Figure 3.3) (City of Surrey, 2023f), which builds upon the work from the Surrey Transportation Plan Phase 3. Here, Surrey planned on operationalizing how they intend to move toward 15-minute neighbourhoods. The plan was to showcase walking and cycling maps for priority transportation networks that need infrastructure improvements. The plan was also meant to discuss improvements to target areas, focusing on grocery stores, schools, and transit, as residents considered these amenities the most important to have near their homes. However, the full version of this document is not yet publicly available, and the image below is from a corporate report.



Supporting 15-Minute Neighbourhoods

Further analysis was undertaken to help define how walking and cycling investments can support 15-minute neighbourhoods. Phase 4 will present maps of proposed 2030 walking and cycling priority networks and target areas for infrastructure improvements. The target areas include a focus on amenities that were rated the highest in Phase 3 engagement, including grocery stores, schools, and transit.

Figure 3.3: Surrey Transportation Plan Phase 4 (Corporate Report). From: City of Surrey (2023f)

3.1.3. Climate Change Action Strategy

In the Summer of 2023, the City of Surrey also released the Climate Change Action Strategy (CCAS), intending to achieve a zero-carbon and climate-resilient city (Figure 3.4) (City of Surrey, 2023c). The CCAS listed building resilient 15-minute neighbourhoods by 2050 as one of the strategies to achieve their climate goals. The plan built upon findings from the Surrey Transportation Plan Phase 3 by discussing amenities and benefits residents want near their homes, including frequent transit, groceries, parks, and schools. The CCAS has a goal of building and developing a network of 15-minute neighbourhoods by updating land-use policies and tackling automobile dependence. The plan also discussed involving equity-deserving groups, such as Indigenous groups, in these conversations to create opportunities for reconciliation. Transit-centred and town-centre-focused development are strengths that the CCAS plans to build upon.

Figure 3.4: Climate Change Action Strategy. From: City of Surrey (2023c)

3.1.4. City of Surrey Economic Strategy

In 2024, the City of Surrey also released an economic strategy to tackle the rapidly growing population and need for jobs in Surrey (Figure 3.5) (City of Surrey, 2024). One of the actions the City of Surrey listed to help accomplish this strategy was promoting 15-minute communities. This approach can support growth in Surrey's six communities by attracting businesses and ensuring each community is a livable, distinct, self-sufficient area for business. The city has set a timeline of 2024-2027 for this action.

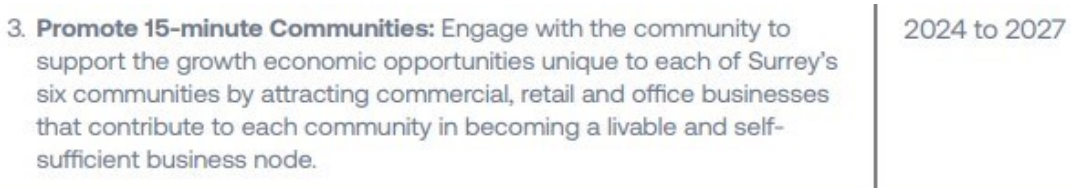


Figure 3.5: City of Surrey Economic Strategy. From: City of Surrey (2024)

3.2. Implicit Mentions of 15-Minute Neighbourhoods

3.2.1. City of Surrey Official Community Plan

In 1996, the City of Surrey released an Official Community Plan (OCP) (City of Surrey, 1996). The OCP guides planning decisions for various sectors, including land use, transportation systems, development, and agricultural land use. This version of the

plan discussed developing compact and complete communities with services close to people's homes; both concepts are related to 15-minute neighbourhoods. Additionally, the plan discussed building sustainable local economies and providing transportation choices, key tenets of 15-minute neighbourhoods.

In 2014, the City of Surrey released their latest version of the OCP (Figure 3.6) (City of Surrey, 2014). This version of the OCP aimed to make Surrey a more sustainable and resilient city. In this plan, the city discussed complete neighbourhoods in Theme B. The complete, walkable, and green neighbourhood plan focused on accessibility, density, neighbourhood centres, and social cohesiveness using policies.

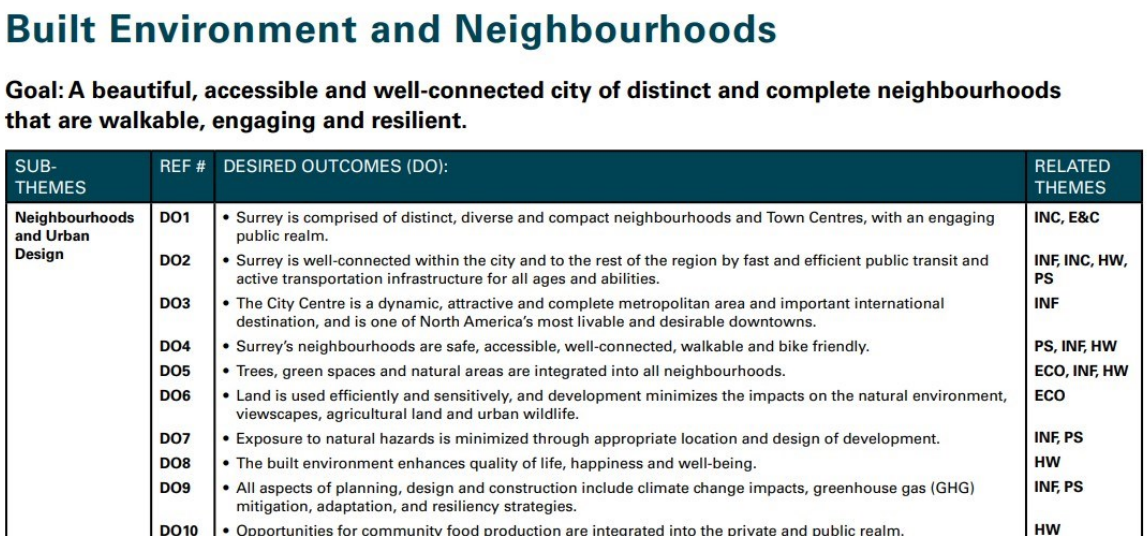
Figure 3.6: City of Surrey Official Community Plan. From: City of Surrey (2014)

3.2.2. Sustainability Charter and Sustainability Charter 2.0

In 2008, the City of Surrey released the Sustainability Charter as a 50-year vision for Surrey to help guide policy and decision-making (City of Surrey, 2008). This plan used an action framework based on social, environmental, and economic sustainability pillars. This version of the charter had many sustainability initiatives, including protecting the environment, supporting diverse housing options, and promoting a sense of

belonging. Regarding the 15-minute neighbourhood, the charter discussed having accessible services (health and social) and making walking, cycling, and transit the preferred transportation modes for most people.

In 2016, the City of Surrey updated their Sustainability Charter from 2008 (Figure 3.7) (City of Surrey, 2016b). The Sustainability Charter 2.0 is a 40-year plan depicting Surrey's plans for being a thriving, greener, and more inclusive city. Regarding the 15-minute neighbourhood, the Sustainability Charter 2.0 aims to develop an accessible and connected city of distinct, complete, walkable, engaging, and resilient neighbourhoods. The plan mentioned keywords in their desired outcomes that resonate with the 15-minute neighbourhood concept, including compact, accessible, walkable, and bike friendly neighbourhoods.



Built Environment and Neighbourhoods

Goal: A beautiful, accessible and well-connected city of distinct and complete neighbourhoods that are walkable, engaging and resilient.

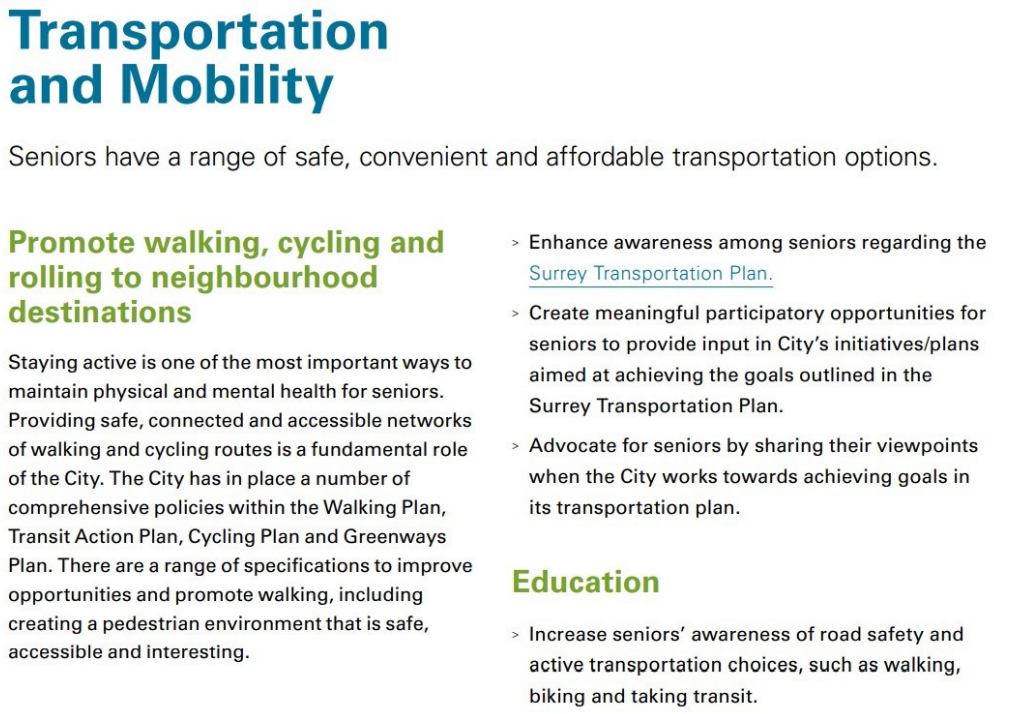
SUB-THEMES	REF #	DESIRED OUTCOMES (DO):	RELATED THEMES
Neighbourhoods and Urban Design	**DO1**	• Surrey is comprised of distinct, diverse and compact neighbourhoods and Town Centres, with an engaging public realm.	**INC, E&C**
	DO2	• Surrey is well-connected within the city and to the rest of the region by fast and efficient public transit and active transportation infrastructure for all ages and abilities.	**INF, INC, HW, PS**
	DO3	• The City Centre is a dynamic, attractive and complete metropolitan area and important international destination, and is one of North America's most livable and desirable downtowns.	**INF**
	DO4	• Surrey's neighbourhoods are safe, accessible, well-connected, walkable and bike friendly.	**PS, INF, HW**
	DO5	• Trees, green spaces and natural areas are integrated into all neighbourhoods.	**ECO, INF, HW**
	DO6	• Land is used efficiently and sensitively, and development minimizes the impacts on the natural environment, viewscapes, agricultural land and urban wildlife.	**ECO**
	DO7	• Exposure to natural hazards is minimized through appropriate location and design of development.	**INF, PS**
	DO8	• The built environment enhances quality of life, happiness and well-being.	**HW**
	DO9	• All aspects of planning, design and construction include climate change impacts, greenhouse gas (GHG) mitigation, adaptation, and resiliency strategies.	**INF, PS**
	DO10	• Opportunities for community food production are integrated into the private and public realm.	**HW**

Figure 3.7: Sustainability Charter 2.0. From: City of Surrey (2016b)

3.2.3. Age Friendly Strategy For Seniors

In 2023, the City of Surrey updated the Age Friendly Strategy For Seniors, which they initially released in 2013 (Figure 3.8) (City of Surrey, 2023a). The Age Friendly Strategy For Seniors aimed to provide an integrated approach to address the needs of older adults across Surrey. The strategy mentioned a concept similar to the 15-minute neighbourhood, with the idea of being able to walk, cycle, and roll to destinations. The strategy discussed various transportation options that were safe and conveniently

available to older adults while ensuring that they were engaged in civic processes and aware of current policies.



Transportation and Mobility

Seniors have a range of safe, convenient and affordable transportation options.

Promote walking, cycling and rolling to neighbourhood destinations

Staying active is one of the most important ways to maintain physical and mental health for seniors. Providing safe, connected and accessible networks of walking and cycling routes is a fundamental role of the City. The City has in place a number of comprehensive policies within the Walking Plan, Transit Action Plan, Cycling Plan and Greenways Plan. There are a range of specifications to improve opportunities and promote walking, including creating a pedestrian environment that is safe, accessible and interesting.

- Enhance awareness among seniors regarding the Surrey Transportation Plan.
- Create meaningful participatory opportunities for seniors to provide input in City's initiatives/plans aimed at achieving the goals outlined in the Surrey Transportation Plan.
- Advocate for seniors by sharing their viewpoints when the City works towards achieving goals in its transportation plan.

Education

- Increase seniors' awareness of road safety and active transportation choices, such as walking, biking and taking transit.

Figure 3.8: Age Friendly Strategy For Seniors. From: City of Surrey (2023a)

3.3. Discussion

This chapter includes City of Surrey policies that both explicitly and implicitly mention 15-minute neighbourhoods. I included these policies that refer to related concepts so as to show the progression of concepts related to 15-minute neighbourhoods; most of these policies are now dated and being updated.

Here, I discuss some observations from the policies that explicitly mention 15-minute neighbourhoods. First, in the Resilient Zero Carbon Neighbourhood Plan, the City of Surrey plans to update and refine what it considers a daily need in its preliminary analysis (City of Surrey, 2022h). With this, it is also unclear how the city operationalized the 15-minute neighbourhood concept regarding amenities, data sources, and definition. Second, there is a lack of clarity on how Surrey selected the amenities most important to residents, as the amenities ranked highest in the Surrey Transportation Plan Phase 3 (City of Surrey, 2022g) are not the same as those prioritized in the Surrey Transportation Plan Phase 4 (City of Surrey, 2023f) or the Climate Change Action Strategy (City of

Surrey, 2023c). Third, there may be a temporal disconnect, as the Economic Strategy aims to promote 15-minute neighbourhoods over the next 3 years (2024- 2027) (City of Surrey, 2024), while other plans have long time horizons (until 2050) (City of Surrey, 2022h). Finally, there is a lack of transparency regarding whether the concerns raised by Surrey residents in the Surrey Transportation Plan Phase 3 are being addressed (City of Surrey, 2022g). Thus, although the City of Surrey has goals and plans for 15-minute neighbourhoods, there seems to be a need for transparency and coordination across the city's efforts.

Chapter 4. An Investigation of 15-Minute Neighbourhoods in Surrey, British Columbia

4.1. Introduction

Auto-centric urban design has led to adverse health and environmental outcomes (King & Clarke, 2015). Research links these designs with outcomes such as road traffic injuries (Gössling, 2020), air (Frank et al., 2006) and noise pollution (Moudon, 2009), chronic and heart disease (Schweitzer & Zhou, 2010), and climate change (Hamin & Gurran, 2009). The 15-minute neighbourhood concept, initially introduced by Carlos Moreno, has been touted as a potential solution to these issues (Moreno et al., 2021). A 15-minute neighbourhood is where all essential amenities are within a 15-minute walk, cycle, or transit ride from one's home. The fundamental tenet of the concept is proximity, where people have their daily amenities within short distances from their homes. Other aspects include diversity, which discusses various building types and cultures, and density, which describes improving the amount of amenities and people within smaller distances in sustainable cities. The 15-minute neighbourhood planning concept originates in Europe, which has starkly different urban settings than North America (O'Sullivan & Bliss, 2020). North American cities are newer and have been designed to rely on cars. Critics argue that 15-minute neighbourhoods may not be feasible in North America because of this different built environmental context (Birkenfeld et al., 2023).

Previous research has used mapping and statistical analyses to identify 15-minute neighbourhoods. Studies have used Geographical Information Systems (GIS) to map accessibility to destinations within time-based parameters (Gower & Grodach, 2022). Each study sets specific travel times, travel modes, and which destinations are relevant (Litman, 2024). For example, previous studies have examined 15-minute access to grocery stores in the Metro Vancouver context (Hosford et al., 2022), while others have examined 20-minute access to all daily needs in Tempe, Arizona (Capasso Da Silva et al., 2020) and Liverpool, England (Calafiore et al., 2022).

These mapping-based methods have limitations. For example, objective measures typically fail to incorporate community perspectives; they do not reflect residents' decision-making processes, such as quality, cost, or preference (Song et al., 2022); rather, they assume that residents want to use the services closest to them.

Overlooking community perspectives is of particular concern when considering equity-deserving groups, such as racialized populations, older adults, or those in core housing need, who have been disproportionately harmed through historical and persistent urban planning practices and face inequities in their access to resources (Linovski et al., 2021). Specifically, equity-deserving populations may rely more heavily on amenities closer to their homes because of transportation barriers. Financial barriers may also limit which amenities these populations can use. Particular groups could also be drawn to culturally specific foods or activities available only at specialized locations. These equity-deserving groups also often do not have the opportunity to have their voices heard in planning and practice (Meerow et al., 2019). Thus, incorporating the perspectives of equity-deserving groups into 15-minute neighbourhood research can help ensure that the research findings better reflect the needs of all residents (de Freitas & Martin, 2015).

This research aims to address the gaps in the current literature and methodology by examining social equity questions around accessibility to amenities in Surrey, a fast-growing, diverse municipality in British Columbia (B.C.). This study worked to develop a community-informed definition of a 15-minute neighbourhood by (1) identifying areas that are 15-minute neighbourhoods in Surrey and how this corresponds with geographic patterns of social equity and (2) exploring how the idea of 15-minute neighbourhoods resonates with Surrey residents, specifically those from equity-deserving groups.

4.2. Methods

4.2.1. Study Context

The City of Surrey has a population of approximately 580,000 and is one of the fastest-growing communities in B.C. (City of Surrey, 2020a), with 300,000 new residents expected in the next 30 years (City of Surrey, 2019). This population is diverse, with 58% being racialized, 33% being South Asian (the largest racialized group), and 43% being immigrants (City of Surrey, 2016a). Surrey is auto-oriented, with 81% of residents relying on cars and only 4% using walking or cycling as their primary transportation mode (City of Surrey, 2016a). Surrey also faces significant social inequities, including considerable income inequality, high overcrowding rates, and poor access to employment (Keltie Craig Consulting et al., 2021). Certain City of Surrey policies speak to 15-minute neighbourhoods, explicitly and implicitly. Specifically, within the Resilient

Zero-Carbon Neighbourhood Plan, the city has set a benchmark of having 75-90% of households able to access all their daily needs within a 15-minute walk, cycle, or roll by 2050, with 23% currently meeting this threshold (City of Surrey, 2022h). The city also conducted a public survey for the Surrey Transportation Plan Phase 3, asking 4119 residents which amenities they wanted near their homes and their thoughts on the 15-minute neighbourhood concept (City of Surrey, 2022g). The survey found that most residents supported the 15-minute neighbourhood concept, although some were concerned about the shift away from cars and urban sprawl in Surrey.

4.2.2. Data Collection

Data collection occurred from July to September 2023. Our project received ethics approval from the Simon Fraser University Research Ethics Board on July 7th, 2023 (study no. 30001551). The research stages involved: developing a preliminary map according to how this has been done in past scholarly research, sharing this with community members in focus group sessions to prompt discussions on the amenities they want near their homes and the 15-minute neighbourhood concept to co-create a community-informed definition of 15-minute neighbourhoods in Surrey, and refining the preliminary map to make a community-informed 15-minute neighbourhood map.

4.2.2.1. Preliminary Maps of 15-Minute Neighbourhoods

We used the dissemination area (DA) as the unit of analysis. These are areas of 400-700 people and the smallest geographic level at which Statistics Canada releases all census data (Statistics Canada, 2018). In 2021, Surrey had 665 DAs, after excluding 1 DA with no population.

4.2.2.1.1. Amenity Data

We explored prior literature to inform which amenities to include (Table 4.1), specifically, Surrey's policy documents and past surveys (City of Surrey, 2022g) and research on the topic (Moreno et al., 2021; Li, 2022). We emphasized findings from the Surrey Transportation Plan Phase 3 public consultation (City of Surrey, 2022g), given that it asked residents which amenities they wanted near their homes and reflected the local context. Ultimately, we selected the 6 amenities that ranked highest in the Surrey

Transportation Plan Phase 3: community centres, educational facilities, grocery stores, health facilities, parks, and public transit, and we did not include childcare or retail.

Table 4.1: Research that informed amenity selection.

	Amenities included in guiding documents		
Amenities	Surrey Transportation Plan Phase 3 (City of Surrey, 2022g) - rank	Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities (Moreno et al., 2021)	15-minute city: access to essential services in Metro Vancouver (Li, 2022)
Childcare	X – 8		
Community centres	X – 4		X
Educational facilities	X – 6	X	X
Grocery stores	X – 2	X	X
Health facilities	X – 5	X	X
Parks	X – 1		X
Public transit	X – 3		X
Retail	X – 7	X	

We identified spatial datasets for the 6 amenities by considering the completeness and temporality of available data. We assessed this using the research team's lived experiences in Surrey and ground-truthing within the focus groups done as part of this project. Each amenity type included many sub-types (Table 4.2).

Table 4.2: Description of amenity data sources.

Amenity	Data sources	Name of dataset	Temporality	Types of locations included
Community centres	Surrey's Open Data – (City of Surrey, 2022f)	Places of Interest	2022	Arenas, community centres, libraries, movie theatres, shopping centres, swimming pools, recreation centres, youth centres
Educational facilities	Statistics Canada Linkable Open Data Environment Viewer – (Statistics Canada, 2021)	Open Database of Educational Facilities (ODEF)	2021	Independent schools, private institutions, public schools, universities
Grocery stores	Surrey Business Directory – (City of Surrey, 2022c)	Business Directory	2022	Convenience stores, gas stations, grocery stores, supermarkets
Health facilities	British Columbia Data Catalogue – (Government of British Columbia, 2022a, 2022b)	Multiple datasets (Pharmacies, Hospitals)	2022	Emergency rooms, family physicians, hospitals, medical clinics/offices, pharmacies, walk-in clinics
	Surrey Business Directory – (City of Surrey, 2022c)	Business Directory	2022	
Parks	Surrey's Open Data – (City of Surrey, 2022e)	Parks	2022	Biodiversity reserves, greenbelts, parks, ponds
Public transit	TransLink GTFS Data – (TransLink, 2022)	google_transit - stops	2022	Transit stops

4.2.2.1.2. Accessibility to Amenities

We used R-studio's Rapid Realistic Routing (r5r) to determine areas that were 15-minute neighbourhoods (Pereira et al., 2021). r5r creates origin and destination pairs and determines whether it is possible to reach the destination from the origin using street networks (Pereira et al., 2021). We used DA-level population-weighted centroids as the origin points (Statistics Canada, 2022c), spatial data for amenities as the destinations (Table 4.2), and Open Street Map for the street network. We applied a 15-minute travel

time parameter and considered both walking and cycling separately. Given that different populations travel at various speeds, we used standard speeds but also included a slower speed (e.g., more relevant to youth, older adults, or people with mobility challenges). The 4 speed and transportation mode scenarios were: walking speeds of 3.6 km/hr and 4.8 km/hr, respectively, and cycling speeds of 13.9 km/hr and 16.2 km/hr, respectively, based on previous studies (Hosford et al., 2022).

This study defined 15-minute neighbourhoods as having access to at least one of each amenity type within 15 minutes of residents' homes. We measured access to amenities in each DA for the 4 scenarios. The outcome in r5r is the number of cumulative opportunities. We had a binary outcome for each of the 6 amenity types (access to the amenity/no access); to assess if a DA was a 15-minute neighbourhood, we summed the 6 values (where 6 indicated a 15-minute neighbourhood).

We used this data to create our maps in ArcGIS Pro (ArcGIS Pro version 3.0.2), which showed the number of amenity types (ranging from 0-6) people living in each DA could access within 15 minutes. Walking at 4.8 km/hr is the basis of our preliminary map. We also created auxiliary maps that show the other speed/mode scenarios.

4.2.2.2. Focus Groups

4.2.2.2.1. Equity

We used Meerow's framework to help define social equity in this project (Meerow et al., 2019). We define social equity through the lens of distributional, recognitional, and procedural equity. We incorporate distributional equity as we measure the fair allocation of amenities and infrastructure. We also use recognitional equity as we acknowledge and respect that different ages, abilities, populations, and intersecting identities have different wants and needs for their neighbourhoods; we also acknowledge the past harms and injustices that have limited equity-deserving populations' access to resources and participation in decision-making. Regarding procedural equity, we conducted outreach with equity-deserving populations, had translators at our sessions, and selected culturally relevant foods to allow participants to engage equitably, meaningfully, and comfortably in our focus group sessions. In terms of specifying population groups for equity work, past work on transportation barriers indicates that equity-deserving populations include "indigenous peoples, LGBTQ2S+ (lesbian, gay, bi, trans, queer, two-

spirit) people, people with disabilities, people living in poverty or experiencing homelessness, newcomers and immigrants, women and people with diverse gender identities, children and youth, and seniors and Elders" (Linovski et al., 2021, p. 7), as key populations who face structural barriers to opportunities and resources. We aimed to hear from these populations in our focus groups to hear their unique experiences and perspectives. In this work, I also applied a health equity lens. We define health equity as everyone having the opportunity to achieve their full potential to be healthy and not be hindered from achieving this due to barriers presented by social, economic, or environmental circumstances (Whitehead et al., 2006). I aimed to help address social inequities and health disparities (Corburn, 2017), particularly those of equity-deserving groups in Surrey, by hearing their lived experiences and sharing our findings with policymakers.

4.2.2.2.2. Participants and Protocol

We conducted the focus groups across Surrey from July to September 2023. Guided by past work and partners at the city and the university, we contacted community organizations that facilitated connections to key equity-deserving groups in Surrey. We held 8 separate focus groups, gathering at the times and places where groups typically convene. To be eligible for this study, participants had to be residents of Surrey and capable of giving consent. We offered refreshments and a $40 honorarium to each participant. The research manager and two research assistants conducted the sessions. We did not record the sessions but took handwritten notes documenting the conversation. Several focus groups had participants with limited English proficiency. To ensure these participants could engage in the discussion, we drew on the skills of the multilingual research team members, professional translators, and staff from the community organizations.

At the sessions, participants first completed a demographics questionnaire (age, gender, race, neighbourhood, income sufficiency, housing, and transportation behaviours). The discussion focused on the following key questions: Did the preliminary 15-minute neighbourhood map match residents' experiences living in Surrey?; Which amenities did residents want near their homes?; What are residents' thoughts on the benefits and concerns of 15-minute neighbourhoods? Participants also ranked the 8 amenity options (Table 4.1) in terms of how essential they would be to have within a 15-

minute walk in their ideal neighbourhood. We ranked the 8 amenity options to assess if the 6 amenities we selected based on the Surrey Transportation Plan Phase 3 were also ranked highest by our participants.

4.2.2.2.3. Analysis

Each research team member transcribed their notes and wrote a personal reflection after each focus group. These reflections covered what went well and what did not, preliminary themes, participants' general attitudes toward the 15-minute neighbourhood concept, content related to amenities participants preferred, and definitions of the amenities. The research team debriefed after each session and held weekly meetings to discuss emerging themes.

We used qualitative analysis methods (in thematic content analysis and inductive reasoning) to extract themes (Green & Thorogood, 2018). First, we familiarized ourselves with the data by reviewing the handwritten notes and themes we took after each focus group session. Next, we identified themes using a deductive approach, as we split the notes into three categories: residents' thoughts on amenity definitions, responses to the map, and benefits and concerns of 15-minute neighbourhoods. After this, we performed coding by labelling the sub-categories within the themes. We then manually organized the codes and themes and described what we saw. As a final step, we used inductive reasoning to determine if there were additional themes in the data and if there were connections between these themes.

4.2.2.3. Integration and Development of the Community-Informed Map

We then used the feedback from the focus groups to update our preliminary map. Using the amenity rankings, we assessed whether participants' choice of essential amenities aligned with what we included in the preliminary map and drew on residents' thoughts regarding amenity definitions. We then repeated the mapping process (outlined in section 4.2.2.1.) and used this map for the subsequent social equity analysis.

4.2.2.4. Social Equity Analysis

For the social equity analysis, we used census data (2021) (Statistics Canada, 2023) and the community-informed 15-minute neighbourhood spatial data. Table 4.3 shows the equity indicators we used; we selected these indicators to capture equity-

deserving populations based on previous literature and reports (Keltie Craig Consulting et al., 2021; LevelUp Planning Collaborative & REACH-Cities, 2023; Linovski et al., 2021). For metrics, we calculated the average percentage of the population that was a part of each equity-deserving group in DAs considered 15-minute neighbourhoods, and we compared this to the average percentage of that population across all DAs in Surrey. We measured the percentage difference between these two to reflect potential inequities in who had access to 15-minute neighbourhoods.

Table 4.3: Equity indicators drawing on census data for Surrey.

Equity indicator	Census variables
Youth	0 to 14 years
Youth in single-parent households	Children - In a one-parent family
Older adults	65 years and over
Core housing need	Total – Households' spending 30% or more of income on shelter costs' or 'not suitable' or 'major repairs needed'
Low income	Prevalence of low income based on the Low-income measure, after tax (LIM-AT) (%)
Racialized population	Total visible minority population
Recent immigrants	Immigrant - last 5 years
Indigenous identity	Indigenous identity

*Source: 2021 Canadian Census (Statistics Canada, 2023).

4.3. Results

4.3.1. Preliminary Mapping

Within our amenity data set (Table 4.2), there were 10,652 amenities: 64 community centres (0.6% of total amenities), 193 educational facilities (1.8%), 301 grocery stores (2.8%), 476 health facilities (4.5%), 820 parks (7.7%), and 8798 public transit stops (82.6%). Our preliminary map (Figure 4.1) shows access to amenities when walking at an average speed (4.8 km/hr). Results show that 173 DAs (of 665 total or 26%) were 15-minute neighbourhoods. These areas were home to 149,594/568,322 Surrey residents (26.3%). We saw high access to amenities near town centres, which are the communities' commercial hubs. Access to amenities decreased as the distance from the town centres increased. In terms of access to specific amenities, 99% of residents had access to parks, 96% had access to public transit, 91% to educational facilities, 80% to grocery stores, 72% to health facilities, and 31% to community centres.

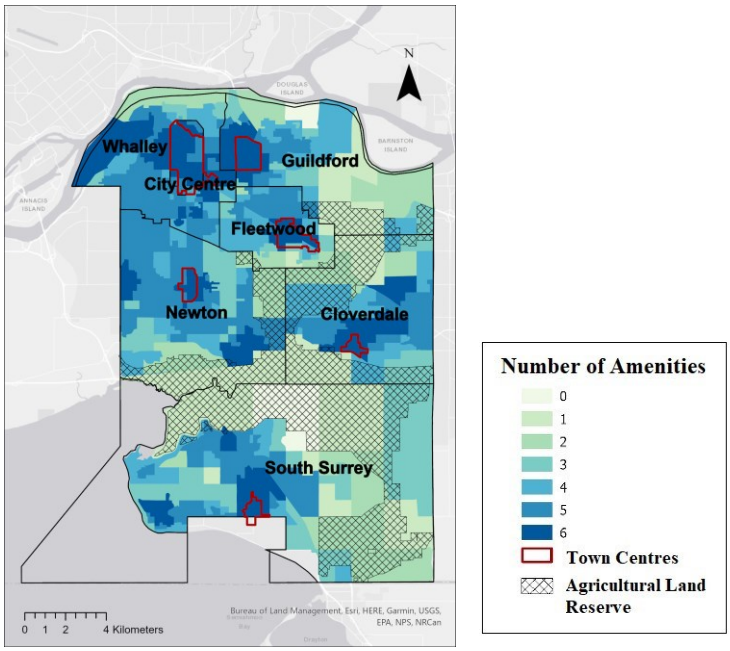


Figure 4.1: Preliminary 15-minute neighbourhood map depicting access to amenities (0-6) at the dissemination area level in Surrey, B.C.
Based on a walking speed of 4.8 km/hr. Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

We also examined access depending on different travel modes (walking, cycling) and speeds (Figure 4.2 a-c). At lower walking speeds, only 83 DAs (home to 13.4% of the population) were considered 15-minute neighbourhoods. Considering cycling as the travel mode, at lower cycling speeds, 436 DAs (65.5% of the population) were in 15-minute neighbourhoods; at faster cycling speeds, 497 DAs (74.8% of the population) met the definition. Adding cycling, with its faster speeds, dramatically increased access.

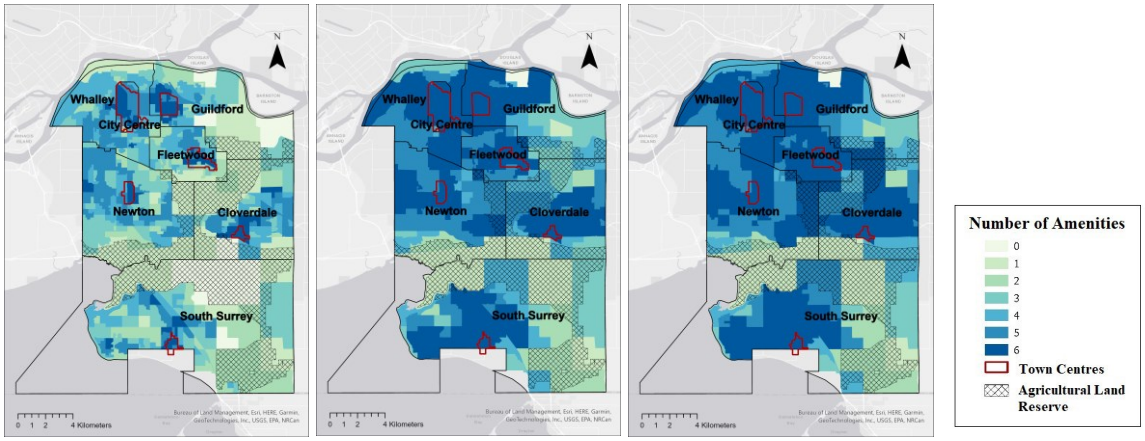


Figure 4.2: Auxiliary 15-minute neighbourhood maps depicting access to amenities (0-6) at the dissemination area level in Surrey, B.C.
Based on a walking speed of 3.6 km/hr (left) (a), cycling speed of 13.9 km/hr (middle) (b), and cycling speed of 16.2 km/hr (right) (c). Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

Table 4.4 summarizes the number of amenities residents could access using different transportation modes and speeds. Essentially, access to 6 amenities was 3-5 times greater with the cycling transportation mode; the largest shifts were in areas with access to 3-4 types of amenities, which had much more complete access (5-6 types) with the faster travel speeds.

Table 4.4: Count of dissemination areas with access to amenity types comparing preliminary and auxiliary maps.

Number of amenity types	Preliminary map (walking 4.8 km/hr) n dissemination areas (%)	Auxiliary map a (walking 3.6 km/hr) n dissemination areas (%)	Auxiliary map b (cycling 13.9 km/hr) n dissemination areas (%)	Auxiliary map c (cycling 16.2 km/hr) n dissemination areas (%)
0	2 (0.3)	6 (0.9)	1 (0.2)	1 (0.2)
1	12 (1.8)	21 (3.2)	4 (0.6)	3 (0.5)
2	19 (2.9)	62 (9.3)	7 (1.1)	6 (0.9)
3	73 (11.0)	138 (20.8)	16 (2.4)	12 (1.8)
4	112 (16.8)	148 (22.3)	37 (5.6)	22 (3.3)
5	274 (41.2)	207 (31.1)	164 (24.7)	124 (18.6)
6	173 (26.0)	83 (12.5)	436 (65.6)	497 (74.7)

*Access is defined as having at least one of that type of amenity within 15 minutes.
Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

4.3.2. Focus Groups

The focus groups aimed to hear from Surrey residents whose voices are not typically engaged in civic issues. The 8 focus groups included: racialized youth recent immigrants and refugees (n=12 participants), racialized adult recent immigrants and refugees (n=14), racialized older adults (n=11), Indigenous peoples (n=8), low income single mothers (n=11), older adults (n=22), racialized queer participants (n=5), and English-speaking adult recent immigrants (n=11). Collectively, there were 102 participants; 94 (92%) provided demographic information (Table 4.5). Most participants

were of working age and women. The participants were diverse racially, with many South Asian, White, Middle Eastern, and Black participants. The majority did not have youth in the home. Participants tended to describe their income as meeting their needs “Not so well” (29.8%) or “Well” (43.6%). Most of the participants used sustainable transportation, reporting transit (47.9%), walking (1.1%), or cycling (1.1%) as their primary transportation mode.

Table 4.5: Demographic characteristics of focus group participants.

Variables		Percentage (%)
Number of participants	94	100
Age (missing n=2)		
	16-19	10.6
	20-64	53.2
	65+	34.0
Gender (missing n=1)		
	Woman	62.8
	Man	33.0
	Non-binary	2.1
	Transgender	1.1
Race (missing n=3)		
	South Asian	23.4
	White	20.2
	Middle Eastern	16.0
	Black	14.9
	East Asian	7.4
	Indigenous	6.4
	Southeast Asian	6.4
	North African	1.1
	East African	1.1
Relationship status		
	Partnered	50.0
	Single	48.9
	Separated	1.1
Youth in the home (missing n=1)		
	No	57.4
	Yes	41.5
Household income meets needs (missing n=9)		
	Not at all	6.4
	Not so well	29.8
	Well	43.6
	Very well	10.6
Primary transportation mode (missing n=1)		
	Car/truck	48.9
	Transit	47.9
	Walk	1.1
	Bicycle	1.1

*For 94/102 who completed the questionnaire.

4.3.2.1. Benefits and Concerns

Most participants had positive feelings about 15-minute neighbourhoods. Participants mentioned benefits like reduced congestion and improved health and were excited about the prospects of improved accessibility. The older adult and racialized youth participants with limited car access were particularly excited. They commented on improved access, which could make it easier for them to see the doctor or go to a park. For example, a participant stated, "*Everything we need is near; we do not need to drive*

anymore." Participants noted how these changes could improve their quality of life. They also described improved access as enhancing their independence by not having to rely on their family members or public transit for mobility.

Participants also had concerns. Some worried that improved access to amenities might make neighbourhoods unaffordable. One participant commented, "*I moved to Surrey for affordability*" and was now concerned as "*Rent is higher in a 15-minute neighbourhood because they are more in demand*." Safety was another critical issue, particularly with parks and public transit. One participant said, "*A 15-minute neighbourhood would work in the day, but not at night, as when it gets dark, I do not feel safe walking*." The terrain was also a concern with features such as hills and busy streets. A participant stated, "*Roads are very steep in places; so steep that my partner cannot take public transit because the stop near our home is up a big hill*."

4.3.2.2. Reflections on the Preliminary Map

The participants largely agreed with how the map represented their local communities, and this was consistent across people who lived in areas with high and low access. Participants noted that the town centres on the map seemed to have more amenities, reflecting their lived experiences. Some racialized older adults shared that the high access depicted in City Centre may not be culturally sensitive, as they could not find the cultural grocery stores they required. Participants also commented that some areas that seemed accessible on the map were not, in their view, for reasons related to infrastructure (such as a lack of sidewalks or lighting), hilly or gated areas, and safety concerns.

Importantly, participants said they did a lot of cross-community travel. In the discussion, participants shared their struggles to get anything done without making long commutes. They often sought out amenities that were further from their homes and shared that they may not actually use amenities that were close to them. For example, several participants made long commutes to Newton, whether from City Centre or South Surrey, for everything: settlement/support services, cultural grocery stores, or other needs. They shared that a lack of interpretation services and a lack of quality of services forced them to leave their community. Racialized youth were drawn to areas where their friends were, regardless of whether these areas were outside their communities. They explained that social connections were as essential to them as these amenities.

4.3.2.3. Amenity Selection and Definitions

Table 4.6 summarizes participants' reflections regarding amenities and relays the nuance behind their choices. The participants largely agreed with the preliminary amenity selection of community centres, educational facilities, grocery stores, health facilities, parks, and public transit. Grocery stores, health facilities, and public transit were typically ranked highly, although the specific order varied by the group. Nearly every participant ranked retail last, sharing that they saw it as a luxury rather than essential.

Several amenities were contentious. For example, there were differing views on childcare: many recent immigrants and single mothers thought it was vital, as, without it, mothers needed to be at home and could not take English classes or work to support their families. However, older adults and racialized youth thought childcare was less important. The ranking of parks was another place where there were marked differences. Numerous people felt that having a park close to their homes was not necessary, as they felt that the parks in their neighbourhoods were unsafe, sharing: "*If parks were safer, we would use them*" or "*Parks are filled with sketchy people*." Some older adults and racialized youth disagreed with this sentiment; they described parks as places to relax, play, and talk with their friends. There were also mixed feelings about public transit. Older adults and racialized youth participants noted that public transit was vital to mobility. Middle-aged participants tended to disagree with the sentiment; they did not rely on public transit and ranked it low. A participant stated, "*The bus is expensive, time-consuming, and takes as much time as it takes to walk!*" There were other common comments about public transit being unreliable, poor quality, and unsafe.

We also asked residents what amenities fit within these categories and if the options encompassed their daily needs. A common thread in the feedback was that community centres needed to be redefined to include places of worship. One participant noted, "*If community centres included the temple, it would be at the top of my list!*" Several groups also enquired about entertainment not being an amenity option. A participant asked, "*Where are the casinos, bingo, and fun stuff*?" while others asked for "*more plazas, cafes, and restaurants*" to socialize. However, not everyone shared this sentiment; others saw entertainment as not essential.

Table 4.6: Participants' reflections on amenity choices for 15-minute neighbourhoods.

Amenities	Summary of reflections	Nuance
Childcare	Opinions were divisive depending on the population. Older adults and racialized youth ranked it lower, whereas recent immigrants and single mothers ranked it higher.	"Childcare and education are ranked high as children are the main priority." "The city I would like to live in prioritizes childcare, but for me personally, I do not need childcare right now."
Community centres	There were very mixed feelings between groups. If the definition of community centres included places of worship, participants were more likely to rank it higher.	"The community centre should be included as it is a time to relax, like in the gym or swimming. It is a good place to have alone time and get government support."
Educational facilities	It was seen as a key amenity by most.	"My son takes two buses to get to high school." "More people are coming here, so we need bigger schools."
Grocery stores	It was seen as a key amenity by most.	"I am a mom of three, so I need the grocery store nearby." "There are some grocery stores nearby, but they are expensive."
Health facilities	It was seen as a key amenity by most.	"Family doctor is not near us, not even a pharmacy." "Doctors, in general, are very inaccessible."
Parks	Older adults and racialized youth saw it as a key amenity, mainly to gather with friends. Other groups thought there were too many parks or safety concerns.	"I go to Bear Creek Park to hang out with friends and socialize." "I felt like passing out when I went for a walk. There were no benches or water fountains."
Public transit	Participants saw it as a key amenity for older adults and racialized youth mobility. Participants of working age were split; concerns surrounded safety and unreliability.	"Taking the bus is a terrible experience for me; buses do not come, and they are always crowded. I cannot do that with two young kids." "I do not feel safe in transit. The news always emphasizes the bad, and I only use transit in an emergency."
Retail	Most participants ranked it low. Older adults and single mothers ranked it higher than other populations, sharing that retail gave them something to do.	"If you want to go shopping, you have to drive." "Going to Guildford Mall takes me longer than going to Vancouver or Metrotown."

4.3.3. Community-Informed 15-Minute Neighbourhood Map

To create a community-informed 15-minute neighbourhood map (Figure 4.3), we built off our preliminary map to incorporate insights from the focus groups. In particular, we looked at alignment around which amenities were important and how residents defined the amenities and then made changes informed by the nuances of the conversation (e.g. Table 4.6).

First, participants suggested no changes to the overall set of amenities included. In their ranking of the 8 amenities, the same 6 amenities we had selected (Table 4.2) were also ranked highest by our participants: community centres, educational facilities, grocery stores, health facilities, parks, and public transit were the most important, childcare and retail were mixed and, on average, less essential. Second, participants suggested alterations to amenity definitions. Specifically, we heard that most participants considered places of worship to be community centres (Table 4.6). We incorporated this feedback into our maps by adding data for places of worship (such as Buddhist temples, Churches, Gurdwaras, and Mandirs sourced from Open Street Map).

In the community-informed 15-minute neighbourhood map (Figure 4.3), there were 295,308 (52.0%) residents with access to 15-minute neighbourhoods (351 DAs), nearly double the percentage from the preliminary maps (where 173 DAs and 149,594 (26.3%) residents lived in 15-minute neighbourhoods). In the community-informed map, numerous DAs with access to 3, 4, and 5 amenities shifted to having access to 6 amenities and were now classified as 15-minute neighbourhoods (Table 4.7). The change was driven by the addition of places of worship to the community centre definition, an addition of 208 locations, which meant that 468 DAs (73%) had access to community centres (compared to 206 (31%) in the preliminary map). However, community centres remained the least accessible amenity. Access to the remaining amenities did not change.

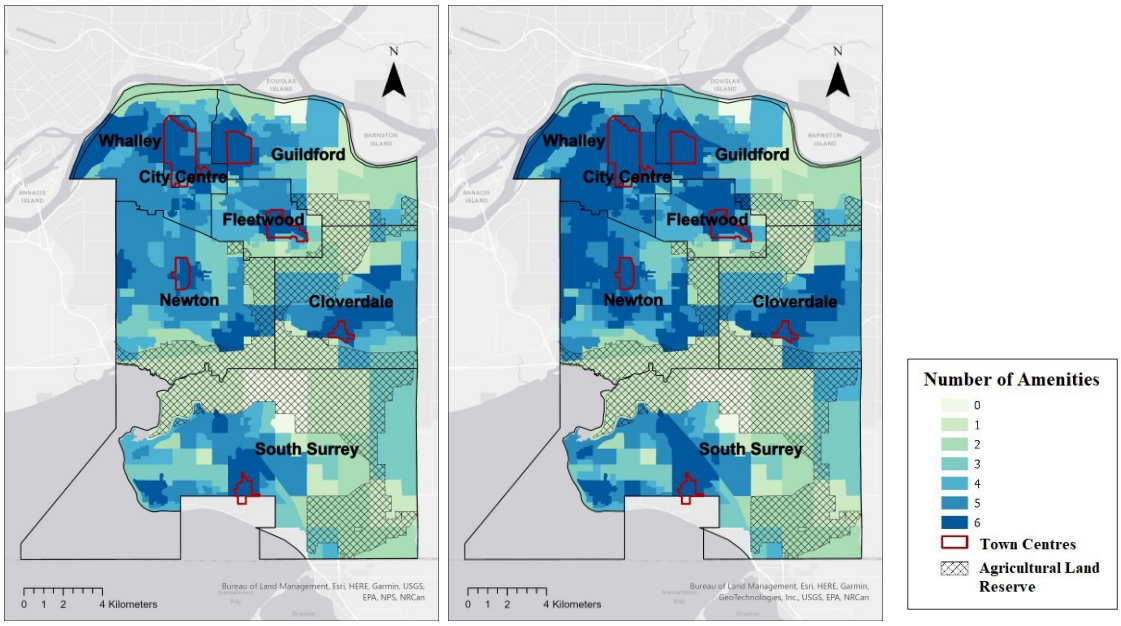


Figure 4.3: Preliminary 15-minute neighbourhood map (left) and community-informed 15-minute neighbourhood map (right) depicting access to amenities (0-6) at the dissemination area level in Surrey, B.C.
Based on a walking speed of 4.8 km/hr. Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

Table 4.7: Count of dissemination areas with access to amenity types, comparing the preliminary 15-minute neighbourhood and community-informed maps.

Number of amenities	Preliminary map n dissemination areas (%)	Community-informed map n dissemination areas (%)
0	2 (0.3)	2 (0.3)
1	12 (1.8)	11 (1.7)
2	19 (2.9)	15 (2.3)
3	73 (11.0)	51 (7.7)
4	112 (16.8)	88 (13.2)
5	274 (41.2)	147 (22.1)
6	173 (26.0)	351 (52.8)

*Based on a walking speed of 4.8 km/hr.
Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

4.3.4. Social Equity Analysis

To determine whether there were inequities in who had access to 15-minute neighbourhoods, we conducted a social equity analysis by overlaying the community-informed map and equity indicators (Table 4.3). Table 4.8 compares sociodemographic characteristics in DAs considered 15-minute neighbourhoods with all DAs in Surrey. A positive value for percent change meant that the equity-deserving population was overrepresented in 15-minute neighbourhoods, compared to all DAs in Surrey (not an equity concern, geographically at least); a negative value meant that the equity-deserving population had less access to 15-minute neighbourhoods (spatial equity concern). The results show that youth living in one-parent households, low income populations, recent immigrants, and Indigenous peoples were more likely to live in 15-minute neighbourhoods. Youth and those in core housing need had less access to 15-minute neighbourhoods, but the percent change was not meaningfully different (<5%). Otherwise, the sociodemographic characteristics in 15-minute neighbourhoods were comparable to all DAs in Surrey.

Table 4.8: Sociodemographic characteristics of dissemination areas with access to 6 amenities within a 15-minute walk in the community-informed map, compared to demographics of all dissemination areas in Surrey, B.C.

Sociodemographic characteristics	DAs with access to 6 amenities mean (SD) n=351 [A]	All DAs in Surrey mean (SD) n=665 [B]	Absolute difference [A-B]	Percent (%) difference [(A-B)/B)]
Youth (%)	15.9 (4.2)	16.3 (4.1)	-0.4	-2.5
Youth living in single-parent households (%)	8.0 (3.1)	7.5 (2.7)	0.5	6.7
Older adults (%)	16.4 (10.2)	16.1 (8.8)	0.3	1.9
Core housing need (%)	24.8 (8.3)	24.9 (8.7)	-0.1	-0.4
Low income (%)	9.2 (4.9)	8.6 (4.4)	0.6	7.0
Racialized population (%)	67.4 (21.8)	65.3 (22.7)	2.1	3.2
Recent immigrants (%)	7.2 (5.1)	6.5 (4.7)	0.7	10.8
Indigenous identity (%)	2.1 (2.7)	1.9 (2.5)	0.2	10.5

*Based on a walking speed of 4.8 km/hr.
DA = dissemination area; SD = standard deviation
Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

4.3.5. Going Beyond Amenities: Mapping Microscale Design Features

A major theme from the focus groups was that participants repeatedly mentioned features other than amenities that they felt were important in 15-minute neighbourhoods;

specifically, they underscored that safety, infrastructure, and terrain were major considerations influencing whether they would choose to walk. To capture this feedback on maps, we worked to build in microscale urban design. We accessed data for benches, lighting, public washrooms, shelters, tables, and water fountains (source: City of Surrey, 2023d, 2023e). We combined these layers (point files) and calculated an aggregate number of microscale design features in each DA (range 0-663 features/DA), normalized this by land area, and mapped by deciles (Figure 4.4). Microscale design features were more common near town centres, particularly in City Centre; areas further away from town centres had the fewest supports, particularly in Cloverdale and South Surrey.

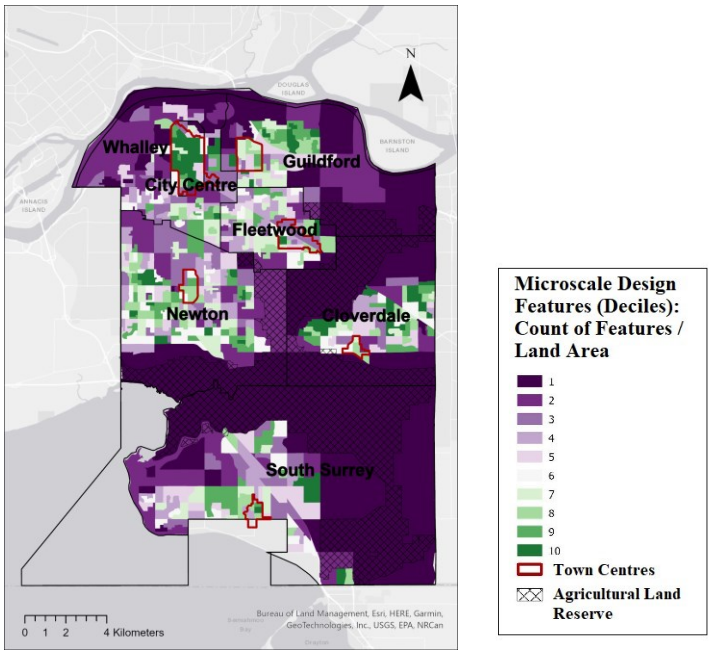


Figure 4.4: Access to microscale design features in Surrey, B.C.
Microscale design features are: benches, lighting, public washrooms, shelters, tables, and water fountains; total features/land area – Source: Surrey's Open Data – City of Surrey, 2023d, 2023e.

To see if areas considered 15-minute neighbourhoods also had good microscale design, we created a bivariate map (Figure 4.5). Areas in the light green had poor access to microscale design features and fewer essential amenities; areas in the purple had good access to microscale design features and more essential amenities. The areas that may warrant attention are those in darker blue, which had poor access to microscale design features but good access to essential amenities. Although some residents had

good amenity access in these areas, the lack of microscale design features may dissuade them from walking. Such areas were prominent in every community but particularly noticeable in Newton and Whalley.

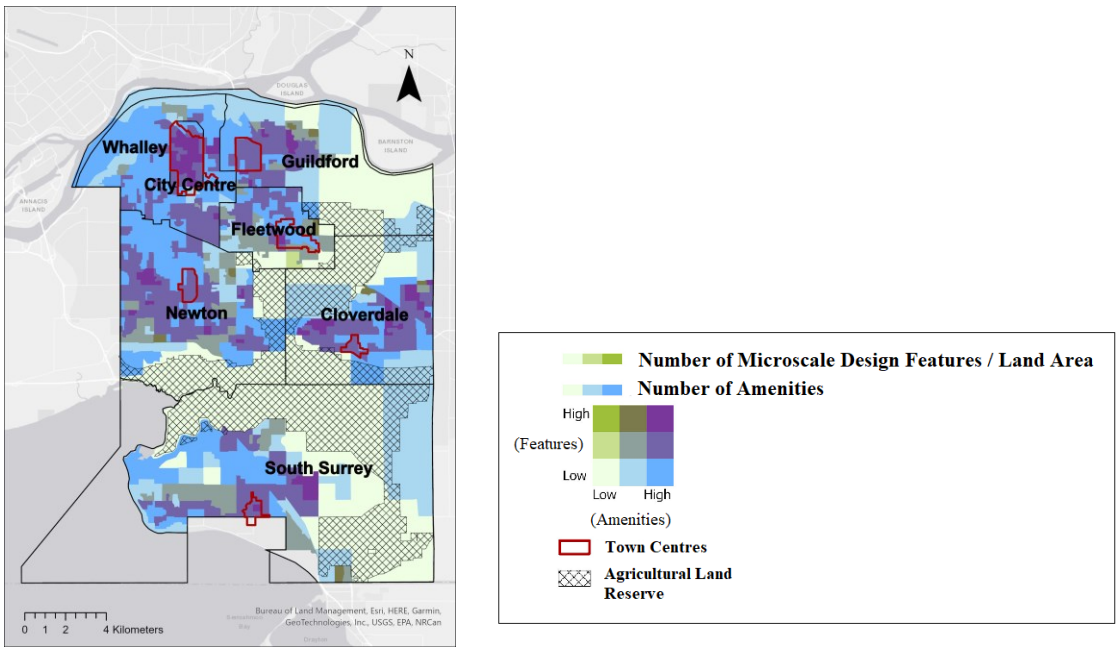


Figure 4.5: Access to microscale design features vs the community-informed 15-minute neighbourhood definition in Surrey, B.C.
Count of microscale design features normalized by land area at the dissemination area level. Microscale design features are: benches, lighting, public washrooms, shelters, tables, and water fountains – Source: Surrey's Open Data – City of Surrey, 2023d, 2023e. Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

4.4. Discussion

Building community views into the process, this study identified 15-minute neighbourhoods and assessed geographic patterns of social equity. Our findings contribute to the literature on 15-minute neighbourhoods in the North American context. Surrey faces rapid population growth and a car-dependent population; with these pressures, Surrey and many other cities are working toward proximity-based planning. We found that over half of the population of Surrey (52.0%) lives in areas that could be considered a 15-minute neighbourhood. However, residents shared that factors beyond just amenities – such as infrastructure and safety – were key to supporting walking.

Our study found that half of Surrey's residents currently lived in 15-minute neighbourhoods. At slower, more inclusive walking speeds, only one-eighth of residents would be considered as living in 15-minute neighbourhoods. When cycling was considered as the travel option, about three-quarters of the population had access to all essential amenities within 15 minutes. These findings highlight the importance of considering different age profiles (older adults and youth) and abilities in developing more accessible cities and the potential that can be unlocked if cycling is a feasible option for more people. To showcase whether cycling is actually accessible for residents, we overlaid our cycling access to amenities map with cycling infrastructure data in Surrey (Appendix D and Appendix E). Both maps show that areas with good access to amenities often also had more cycling infrastructure relative to areas with poor access to amenities. Similar maps could be created by overlaying other features, such as sidewalks. Surrey covers a large land area, including 6 town centres, suburban areas, and large rural areas. Our maps highlight the city's emphasis on developing access to amenities near town centres. Our maps draw attention to several areas that lacked access to amenities. A notable feature in Surrey is the agricultural land reserve (ALR), which covers large portions of South Surrey and is sparsely populated (Provincial Agricultural Land Commission, 2022). Established in 1973, the ALR promotes and protects agricultural lands for now and the future, bringing economic and social benefits. These protected areas are crucial to health and livability. However, great political debate continues in municipalities like Surrey, which face population growth pressure and housing affordability crises, where development meets farmland. As the ALR is reserved for agricultural uses, we overlaid our maps with the ALR to showcase access to amenities and microscale design features in areas where development is permitted. These maps show that many areas with low access to amenities and microscale design features are in the ALR. Thus, access to amenities and microscale design features are quite strong in areas where development and densification are allowed, with some exceptions in Guildford and South Surrey.

The input we received from the community prompted us to make two major changes to our mapping approach: first, to amend our definition of community centres, and second, to reflect the importance of microscale design features. Amenity-wise, the critical change was broadening the definition of community centres to include places of worship. With this revised definition, double the number of DAs met the definition of 15-

minute neighbourhoods. On urban design, a recurring theme from our focus groups was that features other than amenities (e.g., macroscale or land use) were vital in residents' decision to walk; for example, we heard participants discuss the importance of benches and lighting (e.g., microscale or urban design). Research shows these design features make walking more appealing and pleasant, supporting walking as a transportation mode (Adkins et al., 2012; Brown et al., 2007; Hamidi & Moazzeni, 2019; Jun & Hur, 2015). People with mobility challenges also rely on these features to support them being out in the community, with the physical and social health benefits that they bring (Ottoni et al., 2016). In response, we created a map of microscale features and overlaid this with the 15-minute neighbourhood map. This map highlighted gaps where amenities may be available, but the urban design did not support walking.

Our social equity analysis did not raise concerns about inequities in terms of spatial access to 15-minute neighbourhoods in Surrey. We found that areas considered to be 15-minute neighbourhoods actually had more youth living in one-parent households, Indigenous peoples, low income residents, and recent immigrants than the rest of Surrey. Studies in North American and Asian cities have shown that equity-deserving groups often had worse access to amenities, including healthcare (Vadrevu & Kanjilal, 2016), grocery stores (Smiley et al., 2010), and recreation (Gordon-Larsen et al., 2006). However, in our focus groups, we heard concerns about displacement. Many of the participants were low income (36% reported their income did not meet their needs well), and a common concern that surfaced was the fear that they would have to move from high-access areas due to rising rent costs. Research has shown that development can precede rent increases (Bereitschaft, 2017) and may lead to the displacement of populations to more affordable areas with worse access to services (Marquet et al., 2024). These gentrification processes could lead to high-access areas becoming hubs for elites or investors rather than the equity-deserving residents who used to live there, exacerbating inequities.

4.4.1. Implications for Future Research and Practice

We add to the scholarly research on 15-minute neighbourhoods by adding empirical research from the North American context. We share an approach that future researchers may want to consider in building community perspectives into GIS mapping approaches. In recent years, there has been wariness in engaging communities around

15-minute neighbourhoods, given the controversy and public pushback (Butterfield, 2023; Canadian Institute of Planners, 2023). However, the residents we spoke to were not inflammatory but supportive. They felt that ensuring equitable access to amenities was not just a convenience; it was a necessity. They did raise concerns about affordability, crowding, and cultural displacement. In our conversations, they also raised the idea that more than just amenities mattered, prompting us to add urban design features to the map. Future GIS-based 15-minute neighbourhood research may want to reflect both urban design and amenities. Maps like these can illustrate to city planners where they might invest in walking and cycling infrastructure or take measures to improve safety and comfort.

4.4.2. Limitations

There are limitations regarding the data and approaches used in this study. We used a combination of open-source datasets and ground-truthing (based on our local knowledge) to identify the best amenity datasets, but every spatial database brings issues of completeness. We used binary measures (at least one of the amenity types accessible within 15 minutes); completeness may be more of an issue if total counts were used. The amenity datasets also cannot capture nuanced data, such as quality, pricing, or opening hours. The cumulative opportunity measure use also brings limitations, as such measures count all opportunities equally, meaning they do not consider distance (Merlin et al., 2019). Studies can use gravity-based measures, where closer amenities are weighted heavier to account for this weakness.

4.5. Conclusions

15-minute neighbourhoods are a proximity-based planning concept where all essential amenities are within a short walk, cycle, or transit ride of residents' homes (Moreno et al., 2021). The concept may be vital in helping tackle health and environmental issues caused by auto-centric urban design. Policymakers and researchers must seek input from equity-deserving residents as they may be more strongly affected by urban design choices and are often not consulted (Linovski et al., 2021; Meerow et al., 2019). Our study shows that 15-minute neighbourhoods are possible in Surrey, B.C. and would largely be welcomed by equity-deserving residents.

Residents were interested in more than just amenities; microscale design features were key to many. However, there were concerns with the concept that policymakers must consider, including rising costs and safety. Researchers and policymakers should seek and incorporate residents' diverse viewpoints to support healthy, equitable, and sustainable cities.

Chapter 5. Conclusions

5.1. Summary

This thesis aimed to examine access to amenities using a community-informed definition of a 15-minute neighbourhood and how this concept relates to social equity in accessibility. I identified areas that were 15-minute neighbourhoods and saw how this corresponded with geographic patterns of social equity. My research team and I also explored how 15-minute neighbourhoods resonated with residents, specifically equity-deserving groups. Using a PHIR approach that aimed to research the determinants of health outside the health sector (Hawe & Potvin, 2009) (in this case, the built environment), I produced findings for a rapidly developing city in Metro Vancouver and discussed whether there is an equitable distribution of amenities. I highlighted how policymakers and fellow researchers can use these findings to advance policy and practice toward developing more sustainable, equitable, and healthy cities.

In Chapter 4, I reported the results of a mixed methods study examining access to amenities in Surrey, B.C. Based on the literature, I developed a preliminary definition and operationalized it to create preliminary maps using open-source data from various levels (municipal to federal), r5r routing software, and ArcGIS. Next, my research team and I conducted community focus groups where we gathered residents' insights. I used this to develop a community-informed definition of 15-minute neighbourhoods in Surrey and operationalized it to create community-informed maps. I also created microscale design feature maps based on community feedback and a bivariate map showing the patterning of access to amenities and microscale design features.

In my analysis, I calculated accessibility estimates for various transportation modes and speeds; then, I repeated this process using the community-informed definition. I also assessed social equity by comparing the sociodemographic characteristics of those who lived in 15-minute neighbourhoods to all of Surrey. Additionally, I analyzed qualitative data from the focus groups to determine recurring themes. This study’s results show that over half of Surrey is classified as a 15-minute neighbourhood using a community-informed definition. I also found that there were currently no social equity concerns with spatial access to amenities. However, residents were concerned about safety, infrastructure, and cost.

5.2. Knowledge Mobilization

I shared these findings at two conferences: the Western Division of the Canadian Association of Geographers (March 2023) and the Emerging Mobility Scholars Conference (June 2023). My research team and I also shared findings at several community workshops and presentations, including CityHive's Surrey Shapers program (December 2022), the Burnaby Festival of Learning (May 2023), the City of Surrey Age Friendly Strategy session (September 2023), City of Surrey staff (January 2024), United Way British Columbia staff (February 2024), the Surrey Libraries Climate Conversation (February 2024), and the Surrey Local Immigration Partnership Community Stakeholder Forum (February 2024).

5.3. Contributions

5.3.1. Exploring Mixed Methods

This study used a combination of methods often not seen in 15-minute neighbourhood literature. I used r5r routing tools and ArcGIS to map access to amenities. However, this study's unique contribution was that I explored community perspectives on 15-minute neighbourhoods to add lived context to the 15-minute neighbourhood maps. Most 15-minute neighbourhood research studies do not include this qualitative component. Because of the qualitative data my research team and I obtained from the focus groups, I was able to identify the amenities residents wanted in their neighbourhoods, identify other features (microscale design features) that were key in residents walking or not, and also identify aspects that would not arise in a standard 15-minute neighbourhood map (safety, cost, infrastructure). Therefore, this thesis underscores the importance of meaningfully involving the community in city planning to ensure that study findings and future policies align with community needs.

5.3.2. Community-Informed Definition

Developing a community-informed definition fills a key policy gap regarding 15-minute neighbourhoods in Surrey. The city has explored the 15-minute neighbourhood concept with several policies, including the Resilient Zero-Carbon Neighbourhood Plan (City of Surrey, 2022h), Surrey Transportation Plan Phase 3 (City of Surrey, 2022g) and

4 (City of Surrey, 2023f), the Climate Change Action Strategy (City of Surrey, 2023c), and the City of Surrey Economic Strategy (City of Surrey, 2024). However, there were shortcomings in these plans: the documents lacked clear methods regarding the operationalization of the 15-minute neighbourhood concept and measures of progress; the amenity data was lacking; the amenity rankings may not represent the views of equity-deserving groups; and there was no detail regarding concerns raised by the public. I aimed to tackle some of these shortcomings by developing a community-informed definition of 15-minute neighbourhoods with equity-deserving groups in Surrey. This study's demographic data comes from the 2021 census (Statistics Canada, 2023), and the amenity data comes from municipal, provincial, and federal data sources. Additionally, this study's methodology is detailed. This study purposefully recruited equity-deserving populations in Surrey to hear their perspectives, which provided unique perspectives. For example, Punjabi-speaking older adult participants shared the importance of cultural grocery stores in their daily lives. These perspectives may otherwise be missing from 15-minute neighbourhood literature and add richness to this work. The concerns raised by Surrey residents in the Surrey Transportation Plan Phase 3 aligned with the issues the participants raised in this study's focus groups (City of Surrey, 2022g).

Section 1.3.4. of this thesis discusses the Continuum of Community Engagement (Key et al., 2019), with this study comprising community-informed and community consultation methodologies. The maps played an essential role in being a conversation starter and getting participants to consider their neighbourhoods regarding accessibility and land use. As a lifelong Surrey resident, I connected with the participants through our shared experiences of living in the city. With community input, I changed the preliminary map in key ways. Although the overall types of amenities ultimately did not change, my research team and I found that participants considered places of worship to be community centres, and I included these within the community centre category. We also learned that participants considered features outside of amenities, including safety, terrain, and infrastructure, when considering accessibility. These findings led me to develop a microscale design features map and a bivariate map. This thesis offers evidence to policymakers in the City of Surrey about what equity-deserving populations within Surrey want from their communities, both in the form of amenities and beyond.

5.3.3. Unique Context

This study explored a setting that differs from others within 15-minute neighbourhood research, as Surrey is unlike other sites where research on this concept has occurred. Researchers largely conduct 15-minute neighbourhood research in European cores (Birkenfeld et al., 2023). European cities were largely designed prior to the invention of the automobile and, thus, may be more amenable to proximity-based planning (O'Sullivan & Bliss, 2020). Within North America, research has taken place in cities like Vancouver, B.C. (Hosford et al., 2022), and Tempe, Arizona (Capasso Da Silva et al., 2020). Surrey is nearly three times as large as both cities in terms of land mass and has one-third of the population density of Vancouver (Statistics Canada, 2022a, 2022b; U.S. Census Bureau, 2023). Surrey is a rapidly developing, diverse city that faces many differences from most other cities where this work occurred. Thus, this study provides findings in a unique context that policymakers in the City of Surrey or similarly large and not densely populated cities can use to create healthier cities.

5.3.4. Social Equity Analysis

I also conducted a social equity analysis, which is currently lacking in 15-minute neighbourhood research. In completing this analysis, this study looked beyond amenities and statistical boundaries and examined the people who lived in these neighbourhoods. Future studies could implement similar processes to examine spatial equity. Additionally, social equity mapping tools are becoming more common and can be useful for academics. For example, Curbcut – now available for Metro Vancouver (https://vancouver.curbcut.ca/?) – offers mapping tools to examine various social equity indicators, including demographics, housing, and transport (Curbcut, 2023). Another example is the Mobilizing Justice project, which is an SSHRC Partnership grant that aims to address transportation equity by compiling transportation equity research and providing tools/guidelines for transportation and spatial equity researchers, such as the Transportation Equity Dashboard (https://edumaps.esri.ca/mj/) (Mobilizing Justice, 2021). Tools like these can allow researchers to perform exploratory analyses of the literature and identify potential spatial inequities before beginning a social equity-centred research project.

5.4. Strengths, Limitations and Future Work

My positionality influences my research. As a lifelong Surrey resident who is a South Asian cis-gender male, my experiences of Surrey may not reflect that of other lived realities. My experience as a Surrey resident made me familiar with the content matter and helped build rapport with the participants. Future studies could also use go-along or walk-along methods to better capture participants' interactions with built environmental features and destinations. Previous studies have used the Irvine Minnesota Inventory (IMI) Observational Study to measure the quality of the built environment regarding how well it is suited to physical activity (Goon et al., 2020), while others have also corroborated these measures with qualitative data (Lee, 2023).

This research builds upon past 15-minute neighbourhood literature, which primarily focused on amenities. This study's qualitative work found that participants considered other features, including infrastructure, comfort, and safety, as key parts of the built and social environment that influenced their mobility; these features were not captured on the amenity map. Thus, this study highlights the need to incorporate these other aspects into 15-minute neighbourhood research. Although I attempted to include microscale design features using what my research team and I heard from the focus groups (based on readily available data), there is still space to advance this work. For example, in the spirit of community-engaged research, the microscale design feature and bivariate maps can be taken back to the community for another round of review. With community feedback, we could improve the maps to include missing features and aspects and better reflect the factors that impact residents' mobility patterns.

Additionally, there are some broader considerations. For example, the depth of discussion in focus groups was limited by the time of the sessions, the complex concepts, and the limited English proficiency in some sessions. The presence of translators or community staff leaders in several sessions may also have affected participants' comfort in discussing their ideal neighbourhoods. My research team and I tried to make participants comfortable by creating an open environment and offering food and refreshments. However, we noticed that some participants seemed hesitant to respond or seemed to be seeking the 'correct' answer. We also do not know if the translators were sufficiently knowledgeable about civic issues to convey the discussion and presentation to the participants accurately. While we did manage to speak to people

who may typically not participate in research, there were, of course, communities we did not talk to, and future research could delve more into these other communities. For example, this study did not include youth under 15 who could have unique perspectives of accessible neighbourhoods.

5.5. Conclusion and Policy Implications

Cities must rethink their design to tackle the health and equity concerns of auto-centric living. Planners and researchers are touting 15-minute neighbourhoods and other proximity-based urban designs as a solution (Moreno et al., 2021); others argue that these concepts will simply lead to larger inequities and gentrification (Marchigiani & Bonfantini, 2022; Markley, 2018). Researchers must test different settings and methods to determine the suitability of this concept to various lived contexts. As a lifelong resident of Surrey, I am confident that my research will help inform policymakers in this fast-growing city. This research aimed to demonstrate accessibility in a growing Canadian city and collect resident feedback so planners and policymakers can reduce inequities. My paper created preliminary 15-minute neighbourhood maps based on previous literature and policy documents. I also worked with Surrey residents to develop a community-informed definition of 15-minute neighbourhoods, which I used to remake my preliminary maps. This thesis offered various valuable contributions, including exploring mixed methods, creating a community-informed definition of 15-minute neighbourhoods for Surrey, and studying a unique context in Surrey. Policymakers can use the community's input and the reworked maps to highlight areas lacking access to amenities and microscale design features and discuss how these findings relate to social equity. My work responds to needs expressed by City of Surrey staff, who wonder how to plan for healthy, equitable, and sustainable cities with rapid population growth and unaffordable housing.

I hope this study’s findings encourage researchers and policymakers to work collaboratively with residents to build more equitable cities that suit the needs of all residents.

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Appendix A. Chapter 4 Manuscript Abstract

Abstract

Introduction: Auto-centric urban design drives health and environmental issues. Proximity-based concepts like "15-minute neighbourhoods" can reduce these harms. Most studies on 15-minute neighbourhoods have been in European centres, and few have incorporated community views. Set in a fast-growing city, this study developed a community-informed definition of 15-minute neighbourhoods and explored social equity in accessibility to amenities.

Methods: Based in Surrey, British Columbia, Canada (population 580,000), this mixed-methods study involved mapping and community engagement. We created preliminary maps of 15-minute neighbourhoods by using open data for 6 amenity types (community centres, educational facilities, grocery stores, health facilities, parks, and public transit) and mapping spatial access by walking/cycling for every dissemination area using ArcGIS and r5r. We then hosted focus groups with equity-deserving residents (n=102) to understand if these preliminary maps aligned with their experiences and gather input on what was missing and what concerns they had. We drew on residents' input to create a community-informed definition and refined maps. With census data (2021), we conducted a social equity analysis by calculating the percentage of residents living in 15-minute neighbourhoods and assessing access for equity-deserving populations.

Results: Overall, 52% of Surrey residents lived in areas considered 15-minute neighbourhoods. Participants felt maps missed some amenities (e.g., places of worship) and that beyond amenities, supportive infrastructure, safety, and terrain were vital. We produced bivariate maps, including microscale design features, highlighting areas with many amenities but little supportive infrastructure. The social equity analysis did not highlight inequities in spatial access; rather, areas with more youth living in one-parent households, Indigenous peoples, low income residents, and recent immigrants were more likely to be 15-minute neighbourhoods.

Conclusions: Community voices added insights into factors beyond amenities that matter. As proximity-based planning proceeds, care is needed to ensure that future city design meets the needs of all residents.

Appendix B. Count of Dissemination Areas With Access to Amenity Types, Comparing Preliminary, Auxiliary, and Community-Informed Maps

Table B.1: Count of dissemination areas with access to amenity types, comparing preliminary, auxiliary, and community-informed maps.

Number of amenities	Preliminary map (walking 4.8 km/hr) n dissemination areas (%)	Auxiliary map a (walking 3.6 km/hr) n dissemination areas (%)	Auxiliary map b (cycling 13.9 km/hr) n dissemination areas (%)	Auxiliary map c (cycling 16.2 km/hr) n dissemination areas (%)	Community-informed map (walking 4.8 km/hr) n dissemination areas (%)
0	2 (0.3)	6 (0.9)	1 (0.2)	1 (0.2)	2 (0.3)
1	12 (1.8)	21 (3.2)	4 (0.6)	3 (0.5)	11 (1.7)
2	19 (2.9)	62 (9.3)	7 (1.1)	6 (0.9)	15 (2.3)
3	73 (11.0)	138 (20.8)	16 (2.4)	12 (1.8)	51 (7.7)
4	112 (16.8)	148 (22.3)	37 (5.6)	22 (3.3)	88 (13.2)
5	274 (41.2)	207 (31.1)	164 (24.7)	124 (18.6)	147 (22.1)
6	173 (26.0)	83 (12.5)	436 (65.6)	497 (74.7)	351 (52.8)

Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit.

Appendix C. Count of Microscale Design Features That Facilitate Walking

Table C.1: Count of microscale design features that facilitate walking.

Microscale design feature	Count	Source
Park benches/bleachers	1448	Surrey's Open Data
Park lights/streetlights	35,248	Surrey's Open Data
		Surrey's Open Data
Park shelters/tables	506	Surrey's Open Data
Park water fountains	57	Surrey's Open Data
Public washrooms	95	Surrey's Open Data

Appendix D. Access to Amenities Overlaid With Cycling Infrastructure and Path Network

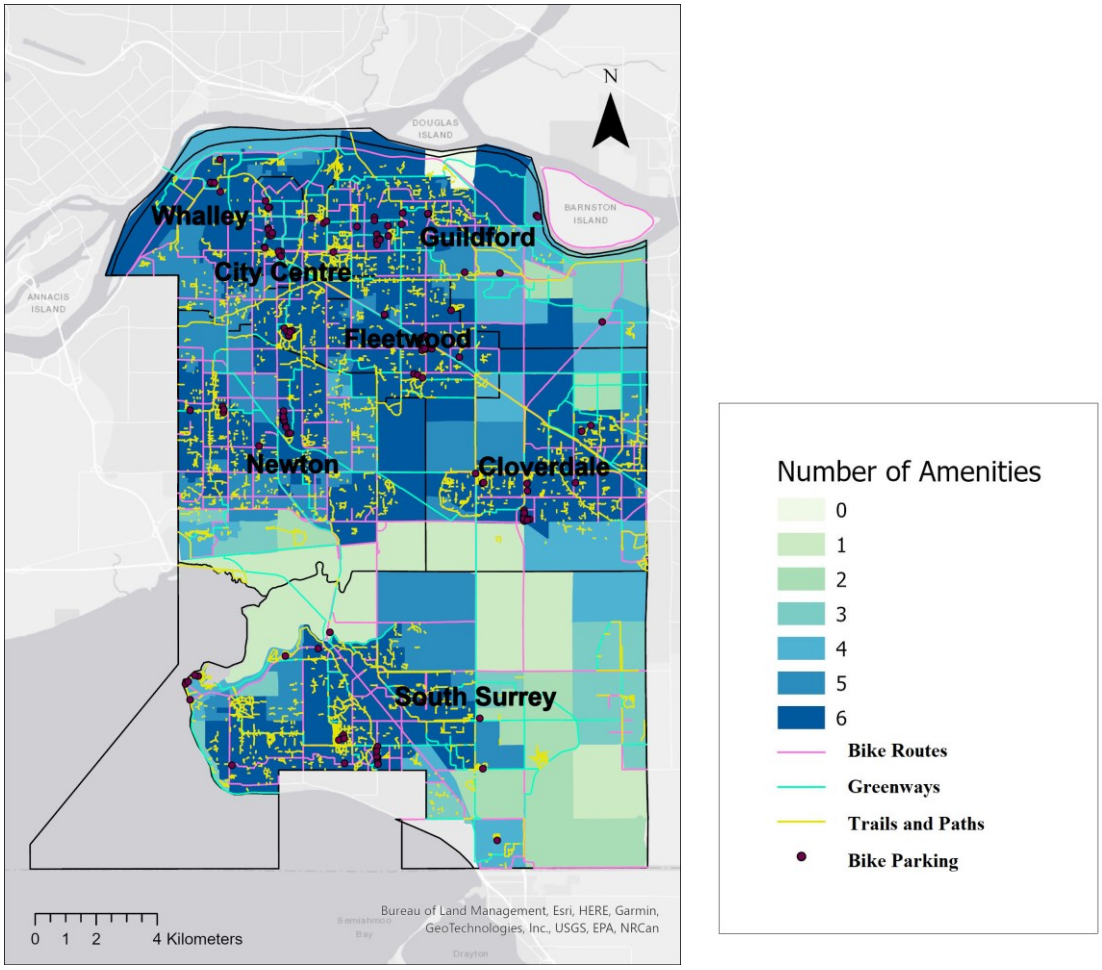

Figure D.1 Access to amenities map overlaid with cycling infrastructure and path network.
Based on a cycling speed of 16.2 km/hr. Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit. Features that support cycling include bike routes, greenways, trails and paths, and bike parking – Source: Surrey's Open Data – City of Surrey, 2020b, 2022b, 2022d, 2023b.

Appendix E. Access to Amenities Overlaid With Cycling Infrastructure

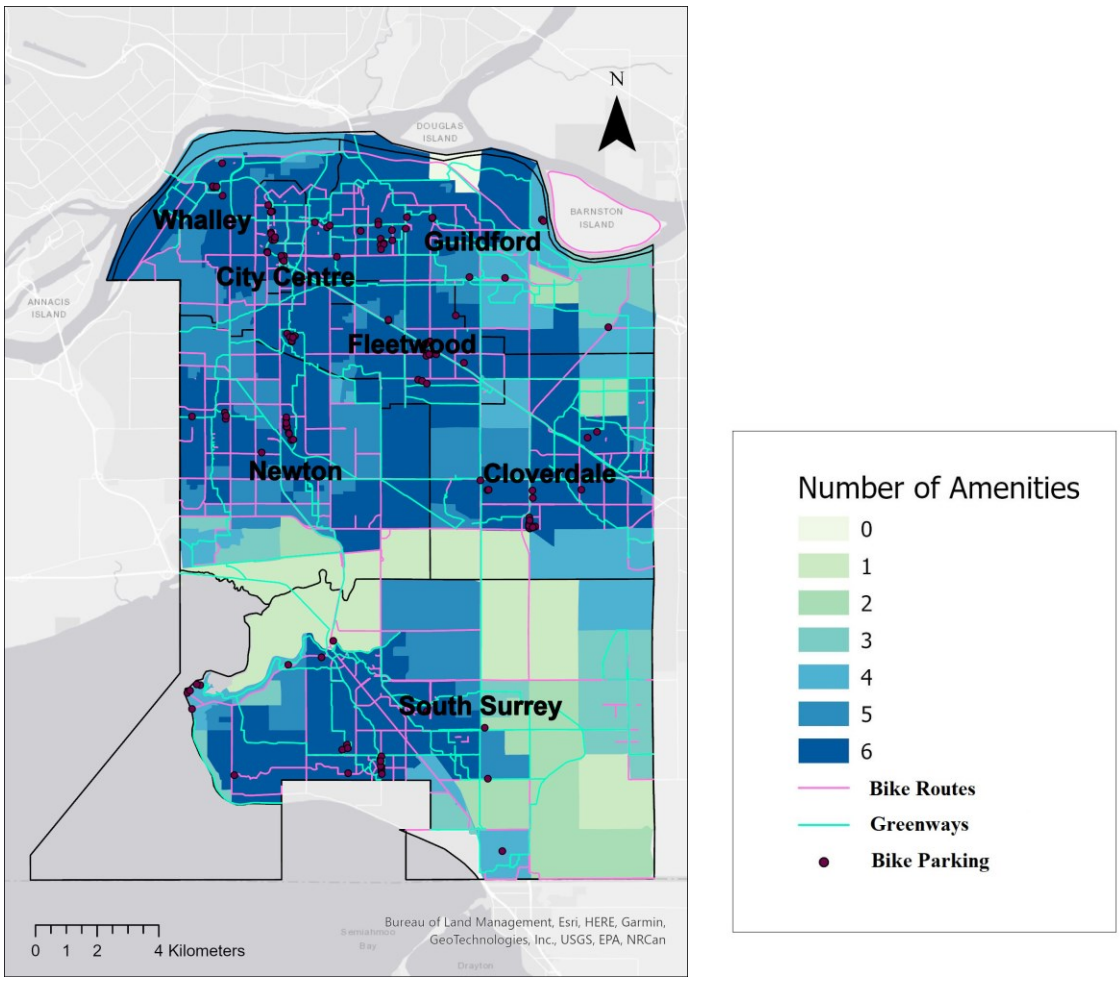

Figure E.1 **Access to amenities map overlaid with cycling infrastructure.** Based on a cycling speed of 16.2 km/hr. Amenities are (access to at least one each of): community centre, educational facility, grocery store, health facility, park, and public transit. Features that support cycling include bike routes, greenways, and bike parking – Source: Surrey's Open Data – City of Surrey, 2022b, 2022d, 2023b.