Aspirations and Reality of a Compact Walkable Neighbourhood: The Case of Surrey's East Clayton Neighbourhood

by

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Abstract

As cities and suburbs pursue narratives of sustainable, compact and walkable neighborhoods, ex-post evaluation and monitoring of plans have been largely neglected by policy makers. Such ex-post evaluation and monitoring of compact and walkable neighbourhood plans are critical to inform lessons learned, but little is known about the impacts of plan especially from the perspectives of local residents. This thesis aims to explore the impacts of compact and walkable suburban built environment on encouraging pedestrian activity for parents and children aged 10 to 12 years old. Employing a mixed method approach, an unobtrusive observational study is conducted on the design of the built environment, supplemented by semi-structured interviews with parents and children living in the area. Through the case study of East Clayton neighbourhood, this empirical study demonstrates a gap between planning aspirations and reality for local residents. The findings also underscored the importance of contextualizing general best practices from principles of compact and walkable neighbourhood to grounding them in local values and needs of residents.

Keywords: Ex-post evaluation; compact cities; walkability; built environment; sustainable urban design; parents and children

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Table of Contents

Declaration of Committee ii
Ethics Statement iii
Abstract iv
Acknowledgements v
Table of Contents vi
List of Tables viii
List of Figures viii
List of Acronyms ix

Chapter 1. Introduction 1
1.1. Research Questions 1
1.2. Significance of Research 2
1.3. Context and Case Study Selection 6
1.3.1. Case Study Context and Demographic Profile 6
1.3.2. East Clayton Neighbourhood Concept Plan 9
1.3.3. Sustainable Principle One and its Implementation 10

Chapter 2. Literature Review 12
2.1. Gaps in New Urbanist and Smart Growth Inspired Theory and Practice in Suburban Development 12
2.2. Relationships between the Design of Built Environment and Physical Activity for Parents and Children 16
2.3. Parents and Children's Perception towards Built Environment in Influencing Physical Activity 18

Chapter 3. Research Design, Methodology, Data Collection and Analysis 21
3.1. Research Design 21
3.2. Methodology 22
3.2.1. Irvine Minnesota Inventory Observational Study 22
Data Collection 22
Data Analysis 25
3.2.2. Qualitative Interviews 26
Data Collection 26
Data Analysis 28
Data Limitation 31

Chapter 4. Data Findings 32
4.1. Introduction 32
4.2. Irvine Minnesota Inventory 33
4.2.1. Findings 33
Accessibility 33
Pleasurability 36
Perceived Safety from Traffic 38
Perceived Safety from Crime 41

Summary 41
4.3. Qualitative Interview 43
4.3.1. Findings 43
Social and Physical Attributes as Perceived Safety 45
Sidewalk, Road Condition and Traffic Infrastructure as Perceived Safety and Comfort Concern 47
Crime as Perceived Safety and non-Safety Concern 52
Parental Attitudes on Children's Independent Mobility as Physical Activity Barrier 53
Adequate Training as Perceived Parental Comfort on Children's Independent Mobility 55
Children Attitudes on Independent Mobility and Physical Activity Motivators 56
Accessibility to Destinations as Conditional Walking Motivator 58
Neighbourhood Pleasurability as Perceived "Fortunate to have" 60
4.3.2. Summary 61

Chapter 5. Discussion 63
5.1. Intentional Sustainable Built Environmental Designs for Nuanced needs of Residents to Facilitate PA 63
5.2. Subjectivity in Walkability 65
5.3. Social Connectedness 66
5.4. Aspirations and Reality 67
5.5. Strengths and Limitations 69

Chapter 6. Conclusion 70
6.1. Summary of Findings 70

References 74

Appendix A. Moderate Scale of Irvine Minnesota Inventory Checklist 79

Appendix B. Semi-Structured Interview Guide 85

Appendix C. East Clayton Neighbourhood Concept Plan Seven Sustainable Principles 89

List of Tables

Table 1 East Clayton Neighborhood and City of Surrey Demographic Profile, Per 2021 Census Data 9
Table 2 Irvine Minnesota Inventory Summary Findings 42
Table 3 Qualitative Interview Summary Findings 44

List of Figures

Figure 1 East Clayton Neighbourhood Concept Plan Land Use Plan 7
Figure 2 East Clayton Neighbourhood Concept Land Use Plan 8
Figure 3 Irvine Minnesota Inventory Sampled Segments 25
Figure 4 IMart Corner Store Along 188 St. And 71A Ave 34
Figure 5 Low-Rise Residential Building Typology 35
Figure 6 Discontinued Sidewalk On One Side of the Street, Along the Existing Development 35
Figure 7 Vandalized Bus Stop Shelter 36
Figure 8 Pedestrian Pathway Surrounding A Pond 37
Figure 9 Zebra Crossing and Stop Sign at Intersection 39
Figure 10 Parked Cars Along Both Sides of Street 39
Figure 11 White Solid Line as Demarcation Of Bicycle Lane 40
Figure 12 Map of Interviewee's Residence and Walking Route to School 45
Figure 13 Child #5 Drawing Illustrating The Walking Scene To School 46
Figure 14 Child #3 Drawing Illustrating Uneven Sidewalk (Curvy Line) as Walking Barrier 49
Figure 15 Child #2 Drawing Illustrating Fallen Tree as Walking Barrier 50
Figure 16 Child #4 Drawing Illustrating Parental Attitudes on Children's IM 54
Figure 17 Child #6’s Drawing Illustrating Narrow Path as Place for Ball Hockey 58

List of Acronyms

BE	Built Environment
IMI	Irvine Minnesota Inventory
NCP	Neighbourhood Concept Plan
NU	New Urbanist
PA	Physical Activity
SPO	Sustainable Principle One

Chapter 1.

Introduction

As urban design approaches of compact and walkable development have been increasingly adopted by cities and suburbs as a ubiquitous solution to confront the ills of sprawling suburbs, greenfield suburban developments like East Clayton in the City of Surrey epitomizes this phenomenon. Despite the momentum to adopt principles of compact and walkable development, ex-post evaluation of their impacts has remained largely neglected and vague. This is especially problematic when aspiring compact and walkable suburban neighborhoods claim to have created sustainable environments, without empirical proof of their outcomes and impacts on local residents. I became interested in investigating whether these aspiring compact and walkable suburban neighborhoods actually lived up to their claims after visiting a family member who lives in East Clayton. I noticed there were an overwhelming number of parked cars and fast traffic on the streets, which was in stark contrast to the theoretical intentions of a compact and walkable neighborhood. By examining East Clayton as a case study of compact and walkable design, I hope to uncover lessons to help raise awareness among policymakers and planning practitioners to reconsider the significant role of evaluation in planning.

1.1. Research Questions

My research aims to explore the impact of a compact and walkable suburban built environment on encouraging physical activity for parents and children aged 10 to 12 years old. This is done through a case study of East Clayton in the City of Surrey, a neighbourhood that was designed to be a compact and walkable through application of the City's Sustainable Principle One (City of Surrey, 2003, p. 2). According to the NCP for East Clayton, the City of Surrey defined the goal of Sustainable Principle One as:

> "To conserve land and energy by designing compact walkable neighborhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six-minute walk of [residents'] homes" (City of Surrey, 2003, p. 2).

To answer the research aim, I will also address the following three research questions:

1. What is a compact and walkable suburban built environment? How has Sustainable Principle One aspired to be an example of this?

2. How does the built environment in East Clayton conform to the goals of a compact and walkable neighbourhood?

3. How do parents and children aged 10 to 12 years old perceive the built environment of East Clayton to influence their physical activity?

Ultimately, my thesis aims to explain whether an intentional compact and walkable neighborhood has had any impact on promoting physical activity in the form of walking, biking, and rolling amongst a demographic slice of the population that is particularly prominent and well-served, namely: parents and children aged 10-12.

1.2. Significance of Research

This research is situated within the larger field of urban studies, as it intersects with the salient and emerging issues of rapid urbanization and population growth that many suburbs are facing today while reconciling land scarcity. By having sustainable redesign of suburbs into compact and walkable community, architect Ellen Dunham-Jones espoused the shift away from automobile centric built environment to be imperative for reduction in greenhouse gas emissions, better public health benefits and affordable transportation costs (Dunham-Jones, 2010). To remedy land scarcity and population growth towards sustainable development, the idea of people having access to mixed land uses and basic services within walking distance of home has already existed in several sustainable planning theories and movements, such as new urbanism (Congress for the New Urbanism, 2000) and smart growth (US EPA, 2023). In the 1990s, New Urbanism design principles were established by the Congress for the New Urbanism to articulate physical designs that promote mixed-use, mixed income, compact developments that integrated a variety of housing and diverse modes of transportation at various scale (Garde, 2020). The Charter of the New Urbanism specifically outlines that neighbourhoods should be compact, pedestrian, and mixed use where many activities of daily living should occur within walking distance and the design of networks should

reduce the number and length of automobile trips (The Charter of the New Urbanism, n.d.). Similarly, Smart Growth also became ubiquitous to address urban sprawl and enhance conservation of environmental resources since the mid-1990s (Sharifi, 2015). Smart Growth supports mix land uses, compact building design, diverse housing options to facilitate the development of walkable communities where multiple destinations are within close proximity, and street network supports multiple forms of transportation (US EPA, n.d.). Since the 1990s, many Canadian cities have adopted principles of New Urbanism and Smart Growth in their planning principles to promote mix land uses, transit oriented development, diverse housing mix, and connected street grids (Graham et al., 2019; Grant, 2009). Consistent with the broader sustainable planning movements, the City of Surrey sought similar urban forms and narratives for the planning and development of a greenfield suburban neighbourhood of East Clayton in the late 1990s. Specifically, the East Clayton Neighbourhood Concept Plan articulated sustainable principle one to create a compact and walkable neighbourhood where services are in close walking distance from residents' homes. Such pursuit of compact and walkable design in the East Clayton Neighbourhood Concept Plan are inspired or derived from the central domains of new Urbanism and Smart Growth, albeit not explicitly stated in the plan. In other words, the city of Surrey's East Clayton neighbourhood is a manifestation of the broader and significant discourse about cities pursuing sustainable planning movements.

Greenfield suburban neighbourhoods like East Clayton are among many places that pursued principles of sustainable urban design and planning in hopes of righting the wrongs of sprawling and car-dominated suburbs (Grant, 2009). However, a lot of research questions whether sustainable planning movements like compact and walkable neighbourhood in the similar veins of New Urbanism and Smart Growth have achieved their aims of encouraging pedestrian activity through the built environment by influencing the perception of safety and shifting dependency on automobile-centric habits (Falconer et al., 2010; Ghorbi & Mohammadi, 2017; Grant, 2006 & Grant, 2009). Studies have demonstrated significant challenges in implementing the ideals of New Urbanism and Smart Growth where there is a disjuncture between design theory and practice in terms of development outcomes (Falconer Al-Hindi & Till, 2013; Grant, 2009).

To bridge the gaps between planning theory and practice, the evaluation of plan implementation is important for continuous process improvement against the intended

objective, but such evaluations have been rare (Guyadeen & Seasons, 2018). Specifically, this study focused on ex-post evaluation, which occurs after the plan is implemented to determine if the plan has achieved its intended outcomes. Ex-post evaluations have largely been neglected by municipal planners (Guyadeen & Seasons, 2018). In response, this research seeks to understand whether the East Clayton neighbourhood lives up to the goal of encouraging physical activity by examining the design of built environment and interviewing residents on their perspective on the design of built environment in influencing their physical activity. While physical attributes of the built environment have explicit influences on one's physical activity within the environment, a large body of scholarship suggests that individual's perception of safety and comfort of the physical environment also affects one's physical activity and behavior (Ewing & Handy, 2009). Hence, this research will include both objective measures and subjective perceptual measures of the built environment to understand the holistic impact of the built environment on physical activity. Specifically, this research focused on parents and children aged 10 to 12 years old because of the high concentration of this specific demographic group living in the area, which is further substantiated in Chapter 1.3.1. To supplement this point, I also have anecdotal experience of witnessing high presence of children aged 10 to 12 years old playing, walking and living in this neighbourhood. Additionally, the age group of 10 to 12 years old is a complex and peculiar stage in which children experience delineation between non-independent and independent mobility in their neighbourhood.

Emphasis on parents and children aged 10 to 12 years old is particularly important to academic researchers and planners because very little research has examined the impact of neighbourhood design on individuals' physical activity, especially in children (Loptson et al., 2012). Given the widespread adoption of compact and walkable neighbourhoods, Loptson et al. (2012) argue there are numerous questions regarding the impact and relevance of this concept to children. Research findings of this study will be valuable for policymakers and planners to better understand what facilitates or hinder physical activity for parents and children. Hence, this study is significant to encourage planners to pay more attention to the lived experiences and insights of local perspectives in creating more walkable neighbourhoods that benefits parents and children.

Ultimately, my thesis aims to explain whether an intentional sustainable neighborhood has had any impact in promoting physical activity in the form of walking, biking, and rolling. On a broader scale, this research seeks to explain the potential gap between theory and practice between what compact and walkable designs intend to achieve relative to their consequences as perceived by those who inhabit the landscapes they create.

The research aims and questions are both important and relevant in providing a meaningful contribution to the literature because evaluation in planning remains under-explored, albeit being an important mechanism to demonstrate the significance and merit of the efforts made by planning professionals (Guyadeen & Seasons, 2018). While planners are inherently responsible for serving the public interests in establishing walkable and healthy communities, a study by Bucher (2008) found that sustainable planning principles were compromised in the amendments made to East Clayton NCP by developers to build more 'marketable' projects. Whether the original intent of the sustainable principles have been altered or followed through, it remains a complex and obscure process for local governments as they may have inadequate resources and time to study the impacts of design of the built environment (Seasons, 2003). This is especially the case for the East Clayton study area where there remains ambiguity and vagueness on the implementation outcome of compact and walkable urban design, especially in terms of its impacts on parents and children.

By examining the implementation of New Urbanism and Smart Growth inspired principles through the case study of East Clayton, the findings will be critical for other municipalities as lessons learned for their local context. Beyond the case study of East Clayton, the findings will help achieve the larger aim of raising awareness for policymakers and planning practitioners to reconsider the significant role of evaluation. The evaluation of planning implementation can inform evidence-based decision-making process to ensure the impacts of sustainable planning policies benefit the public interest by achieving their intended objectives. The lessons learned from this study are in turn significant in informing other municipalities that are considering the adoption or have adopted principles of sustainable development to tailor their planning approaches and implementation that are specific to the social and environmental contexts.

1.3. Context and Case Study Selection

1.3.1. Case Study Context and Demographic Profile

To explore the larger aim of this research, the East Clayton neighbourhood in the City of Surrey was selected as a case study. East Clayton is located north of Fraser Highway along the border of the Township of Langley. It comprises of 562 acres of land, as part of the larger Clayton area in City of Surrey (City of Surrey, 2003a, p. 5). The boundary of the East Clayton neighbourhood is defined by the City's 2003 East Clayton Neighbourhood Concept Plan (NCP), which is bordered by 72 Avenue to the north, 188 Street to the west, 196 Street (Township of Langley) to the east, and Fraser Highway and 64th Avenue to the south, as shown in Figure 1.

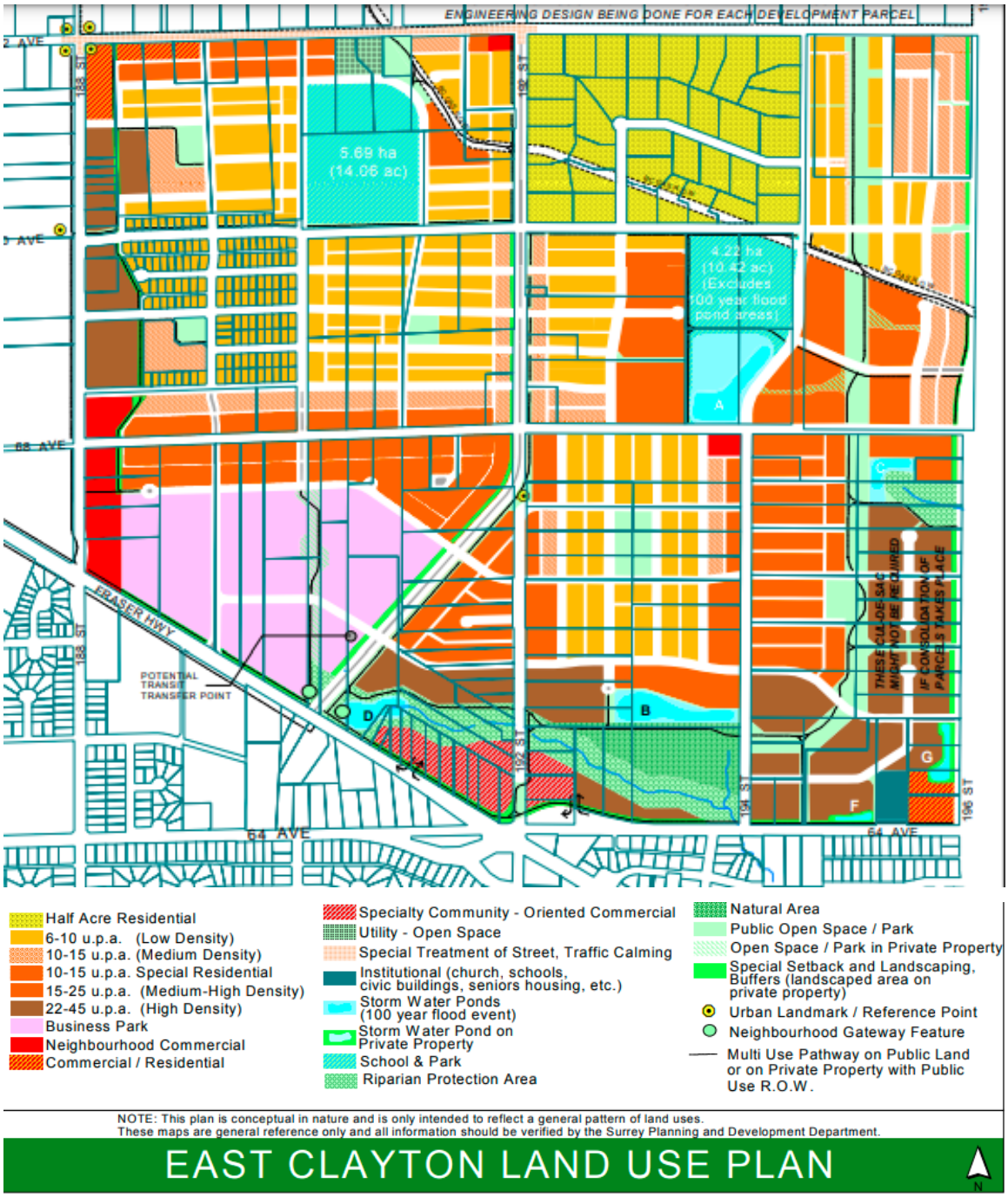

Figure 1 East Clayton Neighbourhood Concept Plan Land Use Plan
Source: City of Surrey 2003

Figure 2 East Clayton Neighbourhood Concept Land Use Plan
Source: City of Surrey (n.d.)

East Clayton has a slightly different demographic profile in comparison to the City of Surrey. The median household income in 2020 is $103,667, which is 6% higher than the City's average (Statistics Canada, 2021). The population percentage change from 2016 to 2021 for East Clayton NCP is 8.3% higher than the City of Surrey as shown in Table 1 (Statistics Canada, 2021). In comparison to the rest of the city, the population density per square kilometer is 308% or three times higher, which foregrounds the significant number of residents living in this area (Statistics Canada, 2021). This data also substantiates the original intent of the East Clayton NCP to achieve a compact and dense suburban neighborhood. Though the population of East Clayton NCP only accounts for 3% of the citywide population, it consists of 11% of the total 10- to 14-year-old age group living in the City of Surrey (Statistics Canada, 2021). The high percentage of 10- to 14-year-old age group living in this neighborhood supports my anecdotal evidence through site visits to my family and friends' homes and noting that there is high presence of children living in this neighbourhood.

Table 1 East Clayton Neighborhood and City of Surrey Demographic Profile, Per 2021 Census Data

	East Clayton Neighborhood Concept Plan (NCP)	Surrey	East Clayton NCP: All of Surrey	
Population Percentage Change, 2016 to 2021	18.0	9.7	8.3%	higher than citywide
Population	17,127	568,322	3%	of the citywide population
Population Density Per Square Kilometer	7341	1798	308%	higher than citywide
Total Number of 10 to 14 Years Old Age Groups	3,840	34,330	11%	of the citywide age group
Median Household Income in 2020	$103,667	$98,000	6%	higher than citywide

Source: Statistics Canada 2021

1.3.2. East Clayton Neighbourhood Concept Plan

Surrey's 1998 official community plan identified East Clayton as an "urban infill area and the remaining suburban land within Clayton as an area with potential long-term development subject to land use planning with local residents" (City of Surrey, 1998, pg. 2). Projected to accommodate urban growth, East Clayton presented an opportunity for the City to reconcile growth and sustainability through implementing NU principles of a complete community that are ubiquitously characterized by compact land use and a walkable built environment.

On January 25, 1999, City Council approved the General Land Use Concept Plan for the entire Clayton area that served as the basis for the comprehensive Neighborhood Concept Plan (NCP) for East Clayton (City of Surrey, 2003a). The General Land Use Concept Plan was developed in partnership with Patrick Condon, University of British Columbia James Taylor Chair in Landscape and Livable Environments, who conducted extensive design charrettes, and public consultation processes with a citizen advisory committee, multiple stakeholders from Royal Canadian Mounted Police, environmental agencies, transportation and utility agencies, and other community groups (City of Surrey, 2003b). Through the design charrettes' outcome,

seven principles of sustainable development were identified to serve as the premise for the development of the East Clayton (City of Surrey, 2003b).

Following public consultation in 2003, City Council approved the boundary and land uses of the East Clayton NCP for implementation as shown in Figure 1. Due to public interest, the plan had an extension west of 188th Street and a second extension north of 72nd Avenue in 2005 (City of Surrey, n.d.). Subsequently, the East Clayton NCP had an additional Council approved East Clayton Transit Oriented Area (TOA) Plan to guide the development around future sky train along the Fraser Highway in 2014 (City of Surrey, n.d.) as shown in Figure 2.

The scope of this case study is confined within the boundary of the East Clayton NCP that was approved in 2003 to ensure specific focus on the site of interest that adhered to the compact and walkable urban design through Sustainable Principle One.

1.3.3. Sustainable Principle One and its Implementation

The East Clayton NCP is a planning document that guided the detailed planning process and provided design guidelines and practices for the neighbourhood with intentional emphasis on sustainability. The NCP was premised on seven foundational principles of sustainable development as outlined in Appendix C, which were identified through the design charettes with public consultation (City of Surrey, 2003a). Of importance, Sustainable Principle One of this planning process was one of the underpinning guidance for development practices and built environment to achieve the ideal objective of a complete, mixed-use community that reduced dependency on the automobile (City of Surrey, 2003a). According to the NCP for East Clayton, the City of Surrey defined the goal of Sustainable Principle One as:

> "To conserve land and energy by designing compact walkable neighborhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six-minute walk of [residents'] homes" (City of Surrey, 2003, p. 2).

Through achieving Sustainable Principle One, East Clayton aspires to become a NU suburban neighbourhood that promotes walkability through the design of a compact and walkable built environment. According to the Congress for the New Urbanism

(2002), NU advocates for pedestrian oriented design with proximity to shopping, mixed used development, and human-scale urban design that minimize car dependence. The goal of Sustainable Principle One prioritizes compact walkable design that pedestrians can walk to services within proximity, which closely resembles one of the central domains of New Urbanism and Smart Growth principles. Due to the limitations of a graduate student research, this study primarily focused on ex-post evaluation of Sustainable Principle One, even though all seven sustainable principles are equally important in determining the design of East Clayton neighbourhood. The rationale to focus on Sustainable Principle One was to ensure feasibility of this research by narrowing down on specific aspect of the plan.

Although the City considered establishing a project team and monitoring program to implement and evaluate Sustainable Principle One, there is no information available on the implementation outcomes. At the outset of the NCP, City staff were instructed by Council to establish a project team that comprised of cross-departmental staff to “ensure consistency and to evaluate and monitor progress toward achieving the various objectives of the NCP” (City of Surrey, 2003a, p.16). Additionally, the document outlines a multitude of recommended follow-up programs and monitoring initiatives. For instance, to evaluate the role of building form in achieving overall neighbourhood character; evaluating the use of multi-use paths as routes for local trips and recreational purposes; monitoring the pedestrian and automobile circulation patterns; evaluating pedestrians and drivers’ response to road pattern and traffic calming measures (City of Surrey, 2003a, p.44). Despite these recommendations that emphasize the important role of evaluation and monitoring as part of continuous process improvement towards achieving the sustainable principles, there is no information available on city webpages that document the outcomes or progress of the monitoring initiatives. Such ambiguity in the evaluation and monitoring of the plan outcome raised significant issues that mean it is worthwhile for this study to investigate whether the design of compact and walkable neighborhood through the application of Sustainable Principle One was effective for their intended purpose and its impact on the local residents.

Chapter 2.

Literature Review

To contextualize and justify my research, the first body of literature is crucial in drawing upon other scholarship to understand the existing gaps in New Urbanist and Smart Growth inspired theory and practice in suburban development. It is important to highlight the gaps in ex post evaluation in planning as this is crucial to understand whether the objectives of compact and walkable design are achieved as intended in the planning document. The literature review in policy implementation establishes that ex post evaluation remains largely neglected by forward-looking planners, and that there is an unmet need for such evaluations, such as in the East Clayton neighbourhood to study the impact of its implementation of "walkability" for residents. To evaluate the impacts of compact and walkable built environment on residents, the second body of literature provides essential definitions, concepts, and objective assessment of built environment that urban planning professionals believe to have a prominent role in promoting walkability and physical activities. This section also provides rationale for the research to focus primarily on parents and children aged 10 to 12 years old. Despite what the urban planning professionals perceive as best practice for the design of built environment, there may be a gap between theory and practice, especially when it comes to parents and children. The third body of literature complements the objective measures of assessing built environment by establishing the stance that parents and children's perceptions of the built environment also play a significant role in shaping their physical activities and walkability. Together, this literature review provides the context, justification and key concepts that are foundational to the research.

2.1. Gaps in New Urbanist and Smart Growth Inspired Theory and Practice in Suburban Development

Since the 1990s, Canadian planners have almost ubiquitously adopted principles of New Urbanist and Smart Growth into their zoning regulations and planning practices (Grant, 2005, 2009) for its solution to auto-centric transportation in the suburban development. New Urbanist advocates for pedestrian-oriented design, walkable neighborhoods with proximity to shopping, mixed used development, accessible public

spaces and human-scale urban design that minimize car dependence (Congress for the New Urbanism, 2000). The proponents of New Urbanist design espouse that compact urban form with pedestrian-oriented design will foster walkability for the residents and thereby advance environmental sustainability by reducing energy use and CO2 emissions (Trudeau, 2013). On the similar note, Smart Growth advocates for mix land uses, compact building design and diverse housing options to facilitate the development of walkable communities where multiple destinations are within close proximity and street network supports multiple forms of transportation (US EPA, n.d.). While Sustainable Principle One is not identical to New Urbanism and Smart Growth, it strives to achieve very similar outcomes and development patterns that are more sustainable. Hence, the body of scholarship used in Chapter 2.1 are ex-post evaluation and implement outcomes of New Urbanism and Smart Growth inspired plans to substantiate the missing link between theory and practice in suburban development.

Although many cities have adopted the rhetoric of New Urbanism and Smart Growth to confront the ailment of suburban sprawl in their policies and plans, development patterns in North American suburbs often remain single-use and car-dependent (Grant, 2009, as cited in Al-Hindi et al., 2001). Specifically, the implementation of NU design in greenfield suburban development has been contentious (Xu, 2017); in particular, scholars have criticized NU design as contributing to building suburban enclaves (Ghorbi & Mohammadi, 2017; Grant, 2006); and others have criticized New Urbanism and Smart Growth for falling short of its promises to reduce car dependence by integrating mixed land use (Falconer et al., 2010; Hess & Sorensen, 2015). Many research findings have demonstrated significant challenges in implementing the ideals of New Urbanism and Smart Growth suburbs where there is a disjuncture between design theory and real-life practices in terms of development outcomes (Al-Hindi & Till, 2001; Grant, 2009).

To understand the gaps between planning theory and practice, evaluation of planning implementation is important in improving the legitimacy and application in planning to determine if there are discrepancies between the intended objectives and reality. However, community planners are notoriously forward looking and usually focus on long term strategic plan and processes rather than on evaluation of planning implementation outcomes. Placing emphasis on evaluation and monitoring help improve the legitimacy of planning by improving the citizens' understanding of the impacts of

planning (Guyadeen & Seasons, 2018, as cited in Oliveira & Pinho, 2010a, 2011). There are typically three phases of implementation evaluation of planning processes, but this study narrows down specifically on the ex-post evaluation which occurs after the plan is implemented to determine if the plan has achieved its intended outcomes. Ex-post evaluation is often largely neglected by municipal planners (Guyadeen & Seasons, 2018). This is especially problematic for New Urbanism and Smart Growth inspired suburban development like East Clayton in Surrey that claimed to achieve idealistic values of compact walkable environment on paper without planners empirically understand the extent of outcomes and impacts against their intended objectives. Laurian et al. (2010) argues the lack of ex post evaluation of the outcomes of land-use plans undermines the planners' ability to understand the impacts of their plans. Despite the importance of ex post evaluation, planners do not perform these best practices as they are often constrained by resources such as time, money, and skills (Seasons, 2003). While New Urbanism and Smart Growth inspired suburban development are heralded as the epitome of sustainable alternative to sprawling suburbs, there needs to be robust ex post evaluation to assess whether they live up to their claims in reality.

In response to the gap in ex post evaluation on NU suburban development, a multitude of scholars have found that one of the primary NU goals to achieve a pedestrian friendly or walkable environment to have considerable variations in walking outcomes in terms of pedestrian activity, purpose, and preferences. Through objective assessment and detailed comparison of design features and urban form of ten NU suburban neighborhoods in the Toronto region in Canada, a study found that while these selected NU neighborhoods had higher percentages of walking trips to nearest parks, schools and amenities than conventional suburban development, the built form of some failed to provide destinations for local residents to walk to and generate opportunities for higher pedestrian volumes to access local businesses (Xu, 2017). Xu (2017) argues that many of the NU design strategies create self-contained neighborhoods equipped with pedestrian infrastructure (i.e., complete sidewalk) without a variety of destinations for walking activities. This is particularly the case for those greenfield NU neighborhoods that are developed after regional infrastructure (i.e., arterial roads and transit stations) are built, which sometimes result in access disjuncture to regional connectivity.

An ex-post evaluation on the City of Calgary's Smart Growth and New Urbanist-inspired community plans found that the transportation infrastructure and the commercial

and form of density did not support an extensive shift to active transportation (Tsenkova & Damiani, 2009). Another research findings on greenfield neighborhoods that are premised on New Urbanist principles in Perth, Australia found that they facilitated a small gain in local walking (Falconer et al., 2010). However, the purpose of local walking trips was primarily for recreational purposes without any local utilitarian destinations and access to public transit options. Even though New Urbansim developments create more walking, Falconer et al. (2010) argued that there is significant gap between principles and practice as car dependency in these suburban New Urbanism neighborhoods is no different than conventional suburban development. On the other hand, Stanislav & Chin (2019) demonstrate that the New Town in St. Louis, a New Urbanism suburban development, was implemented adequately in accordance to the design principles set forth by the Congress for New Urbanism through conducting a qualitative survey of residents' perceptions of design features. Validated by the perceptions and user experience of the residents, New Town provides an increased sense of safety and walkability due to less traffic, aesthetics in architecture, and access to various destinations (Stanislav & Chin, 2019). Together, the scholarship in ex post evaluation in New Urbanism and Smart Growth suburban development highlights the opportunity for further research to bridge the gaps between planning theory and practice, especially on the challenging goal of creating a walkable and pedestrian friendly greenfield suburb.

This literature review reveals the significant gaps between New Urbanism and Smart Growth inspired theory and practice while establishing the normative stance that ex post facto evaluation in planning, especially in compact and walkable greenfield suburban development, needs to be undertaken. This provides a strong rationale to research the case of East Clayton, since the established gaps in planning evaluation undermine planning from making sound and evidence-based decisions, increases legitimacy and fosters continuous learning (Guyadeen & Seasons, 2018). Bridging the gaps between theory and practice and building upon critiques of these sustainable planning movements provide strong justification to scrutinize whether East Clayton has been implemented as its intended primary objective of creating a compact walkable neighborhood.

2.2. Relationships between the Design of Built Environment and Physical Activity for Parents and Children

Physical activities help children and adolescents improve cardiorespiratory fitness, strength, flexibility and reduces health risk of childhood obesity and chronic diseases. However, many children in Canada do not get the recommended amount of physical activity (PA) (Goon et al., 2020). The term physical activity used in this study encompasses all pedestrian activity relates to walking activities and other active modes of transportation such as cycling. There is growing evidence that demonstrates the explicit relationships between the design features of built environment and physical activity for adults in a neighborhood where denser urban environments with proximity to services by means of active transportation contribute to higher levels of physical activity (Rakhimova et al., 2022; Smith et al., 2017). As for children, one study finds that physical characteristics of neighbourhoods that facilitate inactive forms of leisure and transportation are linked to low levels of physical activity in children (Dunton et al., 2012). Although New Urbanist planners claim that design principles of the suburban built environment (e.g., sidewalk requirement, reduced lot size) encourage active modes of transportation and reduce car dependency, scholars have questioned whether these features translate into higher physical activity, especially in children (Curtis et al., 2015; Dunton et al., 2012).

The term ‘built environment’ (BE) has been defined in various ways by different researchers. It is a multidimensional concept that is comprised of macro-scale (e.g. block length, number of intersections) and micro-scale features (e.g. presence of street trees, sidewalk width) of the physical environment (Alfonzo et al., 2008; Handy et al., 2002). As previous scholarship has been mostly focused on macro-scale features of the built environment, this research design and methodology focused on a composite approach, including both micro and macro-scale features to provide a composite synthesis and assessment of the built environment. Specifically, the observational study component of the research methodology is centred on assessing the micro-scale features that influence individuals’ experience and use of walking (Alfonzo et al., 2008). The emphasis on micro-scale built environment features refer to the elements and features that pedestrians can directly perceive on the streets which are important factors that affect the lived experience, and perceptions for parents and children towards physical activity (Boarnet et al., 2011). As for the qualitative interviews, the was

emphasis on the macro-scale features of the built environment from the perspectives of parents and children. This was pertinent in answering the third sub-question of the research question: how do parents and children aged 10 to 12 years old perceive the built environment of East Clayton to influence their physical activity.

As both micro and macro-scale elements of built environment have different influences on adults and children's physical activity, it is essential to understand specific elements of built environment that are determinants of physical activity among both children and adults. An emerging literature has found that elements of built environment shape the modes of travel among adults in terms of proximity between places; street design and geometry, street connectivity; safety, mix of land uses, aesthetic qualities and path infrastructure (Curtis et al., 2015). However, for children research suggests only certain elements of built environment influence their physical activity, which are primarily restricted to distance to school, quality of pedestrian infrastructure and traffic safety (Saelens & Handy, 2008). This is especially important for children aged 10 to 12 years old, the age group experiencing the transition between dependent and independent mobility in their neighbourhood environment (Curtis et al., 2015). Additionally, it is appropriate to engage the targeted audience on children aged 10 to 12 years old because there is a large proportion of children aged 10 to 12 years old living in the East Clayton neighbourhood as mentioned in in Table 1 in Section 1.1.1. Hence the focus of this research project is on the association between BE and physical activity for this specific age group.

As the objective of this research study is to understand the impact of NU design of compact walkable built environment in encouraging physical activity, I engage with numerous objective assessments and tools related to built environment and PA. Objective walkability audit tools are often used in combination with subjective, perceptual measures of the built environment and walkability. For instance, Goon et al. (2020) used multiple built environment audit tools: neighbourhood active living potential (NALP) and Irvine Minnesota Inventory (IMI) then surveyed children aged 9 to 14 years old on their perception of built environment and their physical activity outcomes. This composite approach contributes to understanding both how the perceptions of children and parents and the objective-built environment affect their physical activity behaviors, which will be used as a similar guide for my research design and methodology.

This literature review serves to provide the design concepts of built environment that urban planning professionals believed to have an impact on walkability, especially for families with children. This body also provides one approach of ex post facto evaluation on NU neighborhood that has been done by others to test the principles using robust objective assessment tools. It also outlines important definitions of built environment, walkability that will be used to inform one component of the research methodology, which is the observational study.

2.3. Parents and Children's Perception towards Built Environment in Influencing Physical Activity

Physical design features of the built environment have explicit influence on physical activity, but a large body of scholarship suggests physical features (e.g., sidewalk width, building height) of the built environment influences the walking environment both directly and indirectly through the perception and sensitivity of the individuals (Ewing & Handy, 2009). Ewing & Handy (2009) define perception as how an individual reacts to a place given their own attitudes and preference which include their sense of safety, comfort, and interest. According to Ewing & Handy (2009)'s conceptual framework, all three factors of urban design qualities, physical features and individual reactions influence the overall walking environment for individuals. Although this conceptual framework will not be used to guide the analysis framework in this paper, it is used to demonstrate the interconnectedness between objective features of built environment and the subjective perception of built environment in influencing walking environment and physical activity. The relationships between objective features of BE and subjective perception of the built environment are both fundamental components in conducting a comprehensive ex post evaluation on the compact and walkable design in East Clayton.

While much research has previously conducted evaluations of New Urbanism and Smart Growth inspired neighbourhoods involving the perceptions and observations of planning professionals (Filion et al., 2015; Grant, 2009), the perception of residents on perceiving the impact of the New Urbanism and Smart Growth inspired built environment on their physical activity is underexplored (Stanislav & Chin, 2019). Additionally, very little research has examined and evaluated the impact of neighbourhood design on individuals' physical activity, especially children (Loptson et al., 2012). Hence, the focus

of this research topic is primarily on the parents and children' perception of the built environment in influencing their physical activity. As school aged children are still under the care and authorities of parents, they are restricted in terms of their independent mobility inside or outside of the neighborhood. Curtis et al. (2015) argue for the importance of 'licenses' children required from parents to travel independently, and this is connected to parental perceptions and attitudes towards the built environments, which play a significant role in influencing children's level of PA. For instance, a study on 10 to 12 year old children in Belgium reported to have more active transport when parents perceived more land use mix diversity, shorter distance to school and availability of walking or cycling infrastructure (De Meester et al., 2014). Other research in New Zealand reveals that parents choose to drive their children rather than accompany them walking to school due to the perceived notion of convenience despite living in close proximity to school (Lang et al., 2011).

As much as parental perception has strong influence in children's physical activity, it is important to consider the children's perception and experiences of the built environment as they differ from adults. A study in Saskatchewan provided each child in grade 5 to 8 with a camera to take pictures of aspects of built environment that encouraged or discouraged their physical activity and then semi-structured interviews were conducted separately with the child and one of the parents (Loptson et al., 2012). By doing so, the study found adults' physical activity were influenced by environmental factors (e.g., proximity to commercial destinations, walking trails and beautiful scenery) whereas children's physical activity were influenced by social factors such as parents' behavior and perceived sense of safety (Loptson et al., 2012). This study foregrounds the fundamental difference and nuances on what makes a built environment walkable for adults is not the same as for children, which is a crucial distinction to identify when evaluating NU's general claims of promoting walkable environments for all. Another study in Scotland invited 10 to 12 years old children to participate in visual (e.g., disposable cameras and sketchbooks) and verbal representation (e.g., focus group discussion) of their perceived environment to analyzed environmental determinants of physical activity (Hayball et al., 2018). The study highlights the importance of taking a creative approach in involving children in the research, which will be used as inspiration to guide my approach in conducting semi-structured interviews with parents and children.

The purpose of this literature review is to establish the significant role of perception towards built environment in influencing parents and children's physical activity levels. It provides an understanding that a comprehensive ex post evaluation of built environment requires both objective and subjective perceptual measures of the built environment.

Chapter 3.

Research Design, Methodology, Data Collection and Analysis

3.1. Research Design

The research aim is to explore the impact of New Urbanism and Smart Growth inspired suburban built environment on encouraging pedestrian activity for parents and children aged 10 to 12 through a case study of East Clayton neighbourhood in City of Surrey. As mentioned in Section 1.1.3, East Clayton aspires to be a compact and walkable suburban built environment through the implementation of Sustainable Principle One. The research design utilizes a case study approach to focus on a specific detailed investigation of a single instance of social phenomenon, in this case the East Clayton neighbourhood (Babbie & Benaquisto, 2014). This project assesses the study area in its present state (Spring 2023) in accordance with one of the central goals of New Urbanism and Smart Growth (i.e., walkable blocks with mixed used and diverse development) to determine the impact of a compact and walkable built environment on the physical activity.

Drawing upon Goon et al. (2020)'s study on relationships between the built environment and physical activity on parents and children f the composite methodologies of objective walkability audit tools used in combination with subjective, perceptual measures of the built environment will help serve as guidance to my research approach. Following precedent study, this case study will employ mixed methods of both objective structured observational study and semi-structured interviews to help answer the research question.

As mentioned in Section 1.2, there are three research questions: 1) What is a compact and walkable suburban built environment? How has Sustainable Principle One aspired to be an example of this? 2) How does the built environment in East Clayton conform to the goals of a compact and walkable neighbourhood 3) How do parents and children aged 10 to 12 years old perceive the built environment in influencing their physical activity? The first question was initially answered in Section 1.3 Context and

Case Study Selection and 2.1 Gaps in New Urbanist and Smart Growth Inspired Theory and Practice in Suburban Development. Research questions 1 and 2 will be answered through an unobtrusive structured observational study on the design of the built environment. The purpose of this observational study is to evaluate whether the design features of the built environment have been implemented as intended for a compact walkable neighborhood. In response to research question 3, I conducted semi-structured qualitative interviews with parents and children aged 10 to 12 years old. The semi-structured interview plays an important role in understanding the impacts of compact and walkable neighbourhood on the residents according to their lived experience and perceptions.

3.2. Methodology

3.2.1. Irvine Minnesota Inventory Observational Study

Data Collection

To evaluate whether the design of the built environment supports a compact and walkable neighborhood, I will conduct structured and unobtrusive observations based on the Irvine Minnesota Inventory (IMI). The purpose of this walkability audit is to provide quantitative and objective measures of the design of the built environment in relation to physical activity. The IMI is designed for observing settings that are roughly the size of neighbourhoods and is appropriate for suburban or urban settings that contain primarily residential or a mix of land uses (Boarnet et al., 2006). As discussed in the literature review, the IMI instrument has also been used in previous research (Goon et al., 2020) as a composite methodology with subjective, perceptual measures of the built environment and walkability.

The IMI is an instrument that is designed for field observation of macro- and micro-scale features of the physical environment that relate to physical activity such as walking and biking (Day et al., 2006). As discussed in literature review, the focus of this study will be on the micro-scale features (segment-level observation) of the built environment as they have direct impact on the perceptions and experienced of the individuals, which is the central to the research aim. Thereby, the IMI instrument checklist is adapted to focus on the segment level questions that are related to the

micro-scale features of each block face. Additionally, a condensed and shorter version of the IMI instrument will be appropriate for this study given the limitations of time and resources available for a graduate thesis project. The moderate scale of IMI has been tested and used previously by (Boarnet et al., 2011) research that included only the necessary and relevant thematic questions that have strong association with physical activity and walking.

The moderate scale of IMI contains approximately 25 checklist questions (yes or no), organized into various categories (i.e., street crossing and characteristics) under four domains: (1) accessibility, (2) pleasurability, (3) human needs and comfort, and (4) perceived safety from crime (Day et al., 2006). To adapt to the purpose of this research study, the 25 checklist questions and options for answers have been curated and modified in pertinent to the factors in built environment that shape the pedestrian activity for adults and children. For instance, I have added question 12a under the section of diversity of destinations to the moderate scale of IMI as it is an important factor in influencing adults' pedestrian activity as indicated in Table A.1 in Appendix A. Other options of answers such as the presence of freeway overpass and electrical wiring overhead are eliminated for irrelevance in the context of the East Clayton neighbourhood. The moderate IMI scoring scale has also been simplified in this research study to allow easy comparison between the scales across the observed segments. The primary change includes the use of only two rating categories in the scoring scale, which means combining "some", "a lot" and "few" into a category of "present" that contrast with "not present". Depending on the segment questions, "present" or "not present" is assigned with either the score of 1 or 0 as shown in Table A.1 in Appendix A. The higher the score number would indicate the better the performance of the categories and domain under each segment.

The unit of analysis in IMI is the segment, which is defined as a block face, including *both* facing sides of the street as one unit (Boarnet et al., 2006). The segment boundaries should be defined by intersections and when boundaries are unclear, the segment will extend to the near edge of the next building after the open space (Boarnet et al., 2006). Following the IMI's definition of segment, only public roads and streets are considered as segments, not back lanes, alleys, pathways and trails through forested areas. When walking along each segment, I will be answering the 25 structured checklist

questionnaire that include “present or not present” questions regarding the quantification of occurrences of built environment features within a segment (Boarnet et al., 2006).

The boundary of the study areas will be limited to 500 meters surrounding the two public elementary schools – Hazelgrove and Katzie, which is equivalent to a 5 to 6-minute walk. This study area is deliberately chosen around the public elementary schools to examine the built environment features in close proximity to where parents and children aged 10 to 12 years old reside. Within the boundary area, only a suggested 25% random sample of the total segments in the study area will be observed in accordance to IMI codebook to ensure a sufficient number of segments are observed to characterize the overall physical features of the setting (Boarnet et al., 2006). There are a total of 46 identifiable segments in the study areas and a sample of 7 segments will be observed at Hazelgrove Elementary School and 5 segments at Katzie Elementary that are within 5-minute walking radius, as demonstrated in Figure 3.

Each segment takes approximately 20 minute and up to a total of 4 hours field observation were conducted for a total of 12 segments in the study areas. The field observations were conducted on a weekday at school pick up time between 2 to 3 p.m., and on a weekend day during 5 to 7 p.m. The purpose of two field observations on a separate day is to determine whether the indicators and categories performed differently during a weekday versus the weekend. Additionally, while the observational study focus primarily on the physical features and design of the built environment, the weather will not be a factor in hindering my unobtrusive structured observations of presence of elements such as pedestrian crosswalk, and curb cuts.

While the IMI recommends conducting an inter-rater reliability test after data collection, but this reliability test will be excluded for this study due to the limited time and resource constraints associated with a graduate thesis project.

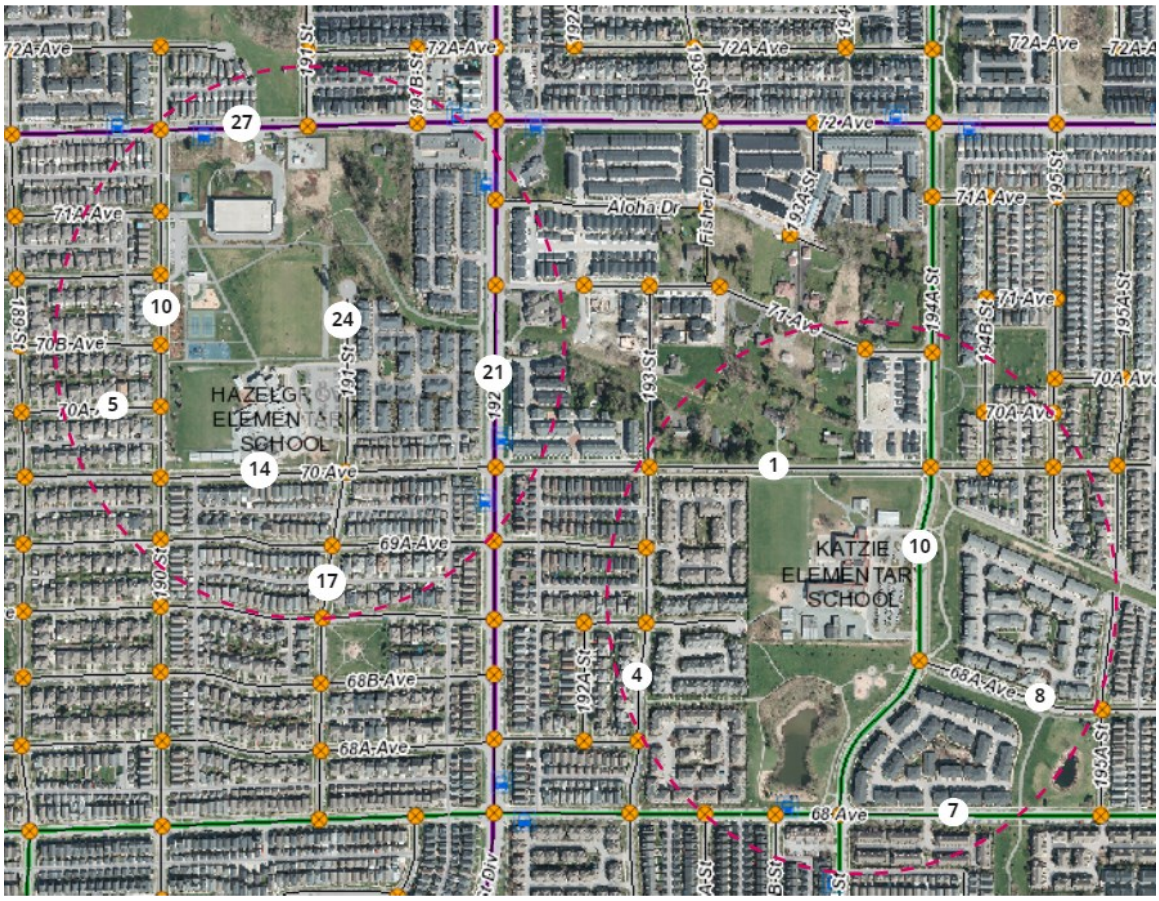

Figure 3 Irvine Minnesota Inventory Sampled Segments
Source: City of Surrey Cosmos

Data Analysis

Data collected through the modified IMI instrument allows for structured approach towards quantifying the data for analysis. The instrument comprises of questions that are related to categories (e.g., land use mix and diversity of destinations) under each of the four domains (e.g., Accessibility). As the answers to each question are associated with a scoring number of “0” or “1” under each observed segment as indicated in Table A.1 in Appendix A, they are then summed up to a total score under each domain. The higher the score indicates the better the built environment performs under each domain. To get a better understanding of how each area performed, I organized the data gathered in an Excel spreadsheet and compared the total score obtained against the total score available for Katzie and Hazelgrove Elementary School under each category. The outcome of the comparison was then organized into percentage scoring to provide a succinct and brief overview of compare and contrast

between the two study areas. Beside each study area column, I also included a columns of field notes that documented additional qualitative findings related to the categories during the site visits. The field notes are useful to supplement the data findings with descriptions and explanations of how the study areas performed relative to each other.

Upon completion of the data collection and analysis, the structured observation allows for quantifiable and objective measures of the built environment that is crucial in informing whether the built environment is implemented as a pedestrian friendly and walkable environment. The data collected and analyzed is the preliminary step in assessing the performance of the physical features of the built environment, which will be further corroborated or uncorroborated by the lived experiences and perspectives of the residents through qualitative interviews.

3.2.2. Qualitative Interviews

Data Collection

To supplement the objective measures of the built environment with subjective perceptual measures as a composite approach used in previous research (Goon et al., 2020), semi-structured qualitative interviews will be conducted after the observational study. Qualitative interviews is used as the primary means of data gathering for this study as it allows researcher to use guiding questions and pursue topics in depth while providing freedom for the residents to direct flow of the conversation (Babbie & Benaquisto, 2014). This methodology is appropriate to use for uncovering lived experiences and local perspectives of the built environment in influencing their physical activity. As data collected on micro-scale features of the built environment informs only one part of the narrative on the overall walking experience, qualitative semi-structured interviews is important in daylighting individuals' walking experience, and perception in terms of safety and comfort.

Semi-structured interviews were conducted simultaneously with parents and their child or children aged 10 to 12 years old. Each semi-structured interview took approximately 20 to 30-minutes to complete in person or on an online platform via Zoom. The interviews were audio recorded through Otter AI for transcription purpose only and raw data collected was stored and further refined on an Excel spreadsheet. Physical drawings were scanned and stored as electronic version for further data analysis. When

data analysis is completed, audio recording of the interview will be destroyed for confidentiality purpose.

Recruitment for semi-structured interviews comprised of a diverse set of outreach strategies in reaching the targeted aim of families. The target number of interviews was aimed at nine to twelve families (parents and children aged 10 to 12 years old) because empirical-based studies have confirmed qualitative studies can reach saturation at relatively small sample sizes between nine to seventeen interviews (Hennink & Kaiser, 2022). The recruitment was primarily conducted in person by setting up table with posters and candy and approaching members of public at Clayton Community Centre on Friday or Saturday on a weekly basis from end of January to mid-March. The secondary recruitment method involved asking friends who live in the area and participants to promote this study through community groups in social media platform and ask the residents through a brief online screening survey questionnaire for qualifications and provide contact for the researcher to schedule an in person/online interview. The online screening survey questionnaire was designed to be an effortless and simple survey that screened the interested participants based on three selection criteria: 1) Residents of East Clayton NCP; 2) Parent/Guardian who has a child aged 10 to 12 years old who are willing to participate; 3) Willing to be audio-recorded for the interview. If the interested participants meet all of the qualifying criteria, they will be asked to provide their contact information for scheduling an interview. Other tertiary recruitment methods include putting up posters in local neighbourhood parks, and coffee shop to recruit residents.

The interview guide for qualitative interviews was constructed to be semi-structured with guiding questions organized into specific categories based on the categories from structured observational study findings and literature review. Due to the semi-structured nature of the qualitative interview, the guide only serves as guiding questions with the flexibility to adapt according to the response of the participants. The interview guide is separated into two primary sections, as shown in Appendix B, the interview guide is divided into two sections, as shown in Appendix B, with questions catered to parents and a drawing exercise and follow-up questions geared towards the child. In the first section of the interview, children first participated in a drawing exercise in response to a given drawing prompt (i.e., What features of the environment do you see when walking to school or in and around your neighbourhood?). The purpose of employing the drawing exercise is to draw upon creative approach of using visual and

verbal representation that previous study in Section 2.3 had done in relation to physical activities. Upon drawing completion, children were followed up with clarifying questions on the content of the drawing and questions related to important categories such as distance to school, the quality of pedestrian infrastructure and their sense of comfort and safety towards the traffic and the built environment. The questions for the children were strategically focused on the important categories because previous studies have demonstrated the key criteria that shaped children's pedestrian activity, as mentioned in Section 2.3. For the second section of the interview, parents were questioned about their walking preferences, and behaviour and factors of BE features that influence their walking journey (e.g., proximity to destinations, land use mix and destinations, path infrastructure). Questions about the built environment features were derived from issues or questions that arose following the completion of the IMI observational study. Furthermore, other category of questions addressed parental attitudes toward children's independent mobility in relation to sense of comfort and safety. Previous research (Curtis et al., 2015) discovered that parental attitudes toward children's independent mobility have a significant influence in children's level of PA. Upon completing the interview, each family received a $10 Starbucks gift card and was entered a draw to win a $50 gift card at their local grocery store.

In terms of ethical approval, the semi-structured interview with parent and child/children was a low to minimal risk study as the interview guide comprised of non-intrusive and non-personal questions. To address ethical concerns, child/children aged 10 to 12 years old werenot interviewed alone, but under the supervision of their parent or guardian. Additionally, both assent form and consent form will need to be verbally agreed upon and tracked on Excel spreadsheet prior to commencing the interview.

Data Analysis

Using a hybrid of deductive and inductive approaches towards the qualitative data analysis, transcribed data are processed for coding and memoing. Transcribed data was organized on Excel spreadsheet using a deductive approach with a predefined set of categories (e.g., Accessibility – Land use Mix and Destination) from the interview guide to organize the response. The purpose of starting with a deductive approach is to gain insights into gaps and questions raised by observational study. Transcribed data related to the topic are organized under each category with a pseudonym identifier next

to each parent (e.g., P1 means Parent #1) or child's response (e.g., C1 means Child #1). To analyze the qualitative data gathered from interviews, I employed both methodologies of coding and memoing, which are integral in uncovering in-depth codes and overarching theme using an inductive approach.

According to Saldaña (2013)'s "The Coding Manual for Qualitative Researchers", theming the data is an extended phrase or sentence that is an outcome of coding, categorization, and analytic reflection (p. 175). Thematic analysis of qualitative data allows categories and sub-categories to emerge from data using inductive approach, which is strategic for analyzing interview transcripts and participant-generated drawings (Saldaña, 2013). To align with the research aim and methodology of exploring participant's perception of the built environment in influencing their physical activity, qualitative analysis involves analyzing data from codes and categories and subcategories to themes. There are a combination of coding methods used - initial coding, In Vivo coding and descriptive coding, which are appropriate in the order listed to generate substantive discoveries. At the preliminary stage of initial coding, the interview transcript is reviewed line-by-line and assigned a first impression phrase from an open-ended process (Saldaña, 2013). As coding is an iterative and cyclical process, the second round of coding employs In Vivo coding method which means using direct quotation from the participant to formulate codes (Saldaña, 2013). Both initial and In Vivo coding methods are compatible for analyzing interview transcripts and attuned researcher to the participant perception, and perspectives, which are key in answering the third sub-question of how do parents and children aged 10 to 12 years old perceive the built environment in influencing their physical activity (Saldaña, 2013, p. 64). As part of the first cycle coding, descriptive coding method is used as a one-word capitalized code that summarizes the primary topic of the excerpt (Saldaña, 2013). Descriptive coding method is essential to examine in detailed on the interview transcripts, field notes, and drawings by comparing them for patterns and potential themes. The second cycle coding involves revisiting the previous coding methods and re-coding with the aim of identifying patterns in the varying form of similarity, difference, frequency, sequence, correspondence, and causation. This analytic stage considers creating sub-codes under categories and synthesizing how they can be knit together and relate to the utility of themes (Babbie & Benaquisto, 2014, p. 381).

During the analytic coding process, two types of memos – initial and integrative memo – are developed in parallel as they are central to processing and analyzing data. The first type of initial memos will help elaborate the codes by providing definitions and descriptions (Babbie & Benaquisto, 2014). Under each coding category, I plan to create initial memo that summarizes the rationale behind each code application and potential emerging relationship among codes or subject relevant to this study (Babbie & Benaquisto, 2014). Moving on to the progressive stage of integrative memo, I will be articulating relationships among codes and connect analytic themes and coding categories together (Babbie & Benaquisto, 2014). This is especially important step in refining the data and connect them to dominant and overarching motifs that could provide valuable and meaningful insights on the impact of built environment on parents and children. In addition to documenting the researcher's thought process about the codes and categories, "memo writing also serves as a code- and category-generating method" which are significant in theming the data (Saldaña, 2013, p. 216).

To enhance reliability and validity of thematic analysis in keeping consistency for data interpretation, codes, sub-categories, categories, and themes are documented with definition, clear label, description of any exclusions or inclusion of data related to theme and description of positive or negative sentiment associated with the same theme (Babbie & Benaquisto, 2014). This systematic approach towards data organization, definition and description is essential for analyzing a large bulk of data compiled from nine 30-minute interviews with parents and children. Additionally, the data organization approach helps reduce personal bias when it comes to data interpretation.

Data collected and analysis are important primary means of data gathering in answering the third sub-question of the research aim of how parents and children perceive the built environment in influencing their physical activity. The purpose of this qualitative data analysis is to understand whether the residents are indeed walking or not in this intentionally designed compact and walkable neighbourhood. Data gathered and analysis through interviews are used to draw insightful and meaningful connections between the observational study and local perspectives that further inform the conclusion of this study.

Data Limitation

Although a multitude of recruitment strategies were employed, the research study experienced challenges with recruitment due a number of factors. Factors that contributed to the challenges with recruitment were the specific and limiting criteria on demographic, age group and location within the boundary of East Clayton NCP. Additionally, as children aged 10 to 12 years old are becoming more independent in their mobility, they tend to spend more time with their friends and seldomly visit the Clayton Community Centre with their parents together when they are dropped off or picked up from program and classes. Given the significant challenges in recruiting specific demographic, age group, and location within the boundary of East Clayton NCP, I have also broadened the subsequent recruitment methods to contacting the principals of Katzie Elementary School and Hazelgrove Elementary School and Girl Guides of Canada to distribute the recruitment poster in their newsletter to interested members[1]. Additionally, families who live close and spend time within the boundary of the study area were also recruited in the interviews study. Due to challenges with recruitment, only nine interviews were completed.

For those parents and children who volunteered to participate in the study, it is important to note there may be selection bias from the participants as they tend to possess similar characteristics of being more physically active than others who do not participate in the study. With the challenges that come with recruitment and potential selection bias, it is important to note the sample data size of nine interviews may not be representative of the target population of parents and children living in the East Clayton neighbourhood.

[1] Principal at Katzie Elementary School distributed the recruitment poster prior to researcher had a chance to apply for separate ethics application to Surrey School District.

Chapter 4.

Data Findings

4.1. Introduction

As mentioned in Section 3.1, the second and third sub-questions of 2) How does the built environment in East Clayton conform to the goals of a compact and walkable neighbourhood? 3) How do parents and children aged 10 to 12 years old perceive the built environment of East Clayton to influence their physical activity? are imperative to answer to achieve the aim of the research: to explore the impact of a compact and walkable built environment on encouraging pedestrian activity for parents and children aged 10 to 12 years old. Therefore, the purpose of this chapter is to present the objective findings based on quantitative and qualitative data collection and analysis in informing the answers to the second and third sub-questions.

Section 4.2 of this chapter will present the findings from Irvine Minnesota Inventory (IMI) observational study to inform the answer to the second sub-question of how the built environment has conform to the goal of Sustainable Principle One. The purpose of this moderate scale IMI instrument is to provide quantitative and objective measures of the built environment in relation to physical activity. As discussed in Section 3.2.2, the focus of this study will be on the micro-scale features (segment-level observation) of the built environment as they have direct impact on the perceptions and experiences of the individuals, which is the central to the research aim. As per the IMI Codebook, findings are organized under the four domains that are linked to physical activity, which includes (1) accessibility, (2) pleasurability, (3) human needs and comfort, and (4) perceived safety from crime. The domains are characteristics of the built environment that may have influence on physical activity (Day et al., 2006). Two field observations were conducted at two locations, one near Katzie Elementary Schools and one near Hazelgrove Elementary Schools (see Figure 3 – map). The field observations were conducted on a weekday at school pick up time between 2 to 3 p.m., and on a weekend day during 5 to 7 p.m. The purpose of two field observations on separate days was to determine whether the indicators and categories performed differently during a weekday versus the weekend. The findings from this IMI structured checklist are useful

for determining whether the built environment has conformed to the goal of Sustainable Principle One – to encourage pedestrian activity through achieving compact urban design.

In Section 4.3 of this chapter, findings from semi-structured interviews with parents and children will help inform the answers to the third sub-question of how parents and children perceive the built environment in influencing their physical activity. Additionally, insights from the qualitative analysis and findings are useful to validate and enhance the findings from IMI observational study.

Together, the findings from both mixed methodologies are significant in contributing to the overall research aim of whether the new urbanist (compact and walkable) suburban built environment has had any impact on encouraging pedestrian activity for parents and children.

4.2. Irvine Minnesota Inventory

4.2.1. Findings

Accessibility

Accessibility is the perceived ease with which a destination can be reached, and terrain can be traveled across. The built environment features that are connected to accessibility include land-use mix, including density of origins and destinations (Day et al., 2006). Both the areas near Katzie and Hazelgrove Elementary Schools performed very poorly on land use mix and diversity of destinations. The area is predominantly consisted of residential use, elementary school, playground, and pocket parks, except for a small concentration of low-rise and small-scale retail stores and medical clinic available along the arterial roads of 188 St and 71A Ave, towards the south of Katzie Elementary school as shown in Figure 4. The residential use is comprised of one to three storey townhouses and detached homes as shown in Figure 5. There are no distinct variety in terms of vertical mixed use or retail types. The lack of spectrum and diversity in land use mix and diversity of destinations does not support the goal of Sustainable Principle One, where pedestrian activities are encouraged by having access to basic services and amenities.

Figure 4 IMart Corner Store Along 188 St. And 71A Ave
Source: Taken by Winnie Lee

In terms of sidewalk accessibility, both study areas perform excellent for having complete sidewalk on both sides of the street, with the exception of certain sections where the existing development intersects with the new development. Consistent throughout both study areas, the sidewalk becomes discontinued on one side of the street or becomes narrow when the existing development meets the new development as shown in Figure 6. It is interesting to note that the street lighting also follows the same pattern as the discontinuity of sidewalk. While complete sidewalks on both sides of the street is present on majority of the observed segments, the disjuncture of certain sidewalk sections may cause inconvenience and hindrance to pedestrian access, especially for parents with young children in strollers.

Figure 5 Low-Rise Residential Building Typology
Source: Taken by Winnie Lee

Figure 6 Discontinued Sidewalk On One Side of the Street, Along the Existing Development
Source: Taken by Winnie Lee

Pleasurability

Pleasurability is the perceived attractiveness of the setting for physical activity for travel and/or recreation (Day et al., 2006). This attractiveness includes a considerable wide range of pleasurable qualities that comprise of aesthetic appeal of architectural characters, presence of destinations, presence of users on the streets, and condition of sidewalk and amenities (Day et al., 2006). Both study areas performed poorly in the category of pleasurability, which is comprised of sub-categories of sidewalk amenities and condition and attractiveness of the public street. The condition of sidewalks is generally found to be even and well-maintained without any cracks, however there are no amenities such as benches for resting or and bike racks on the public street, they are available at Hazelgrove Park. Bus stops with seating are typically located along arterial roads, and one of the bus stops in the study area with weather cover was vandalized with shattered glass as shown in Figure 7.

Figure 7 Vandalized Bus Stop Shelter
Source: Taken by Winnie Lee

Both study areas performed poorly on the attractiveness of public street as the aesthetic appeal of architecture and the character of the neighbourhood is relatively monotonous. Along the observed segment, the architectural characters of low-rise residential homes have similar building typology, human-scale building heights and aesthetics with most garages tucked in the rear laneway. Pedestrians and cyclist can benefit from the relatively flat terrain and have access to natural features in the form of a greenway with pedestrian path, pond, and pocket parks with a playground as shown in Figure 8. Other than that, there is a lack of diversity in destinations and gathering places, such as local coffee shops or restaurants, except outside the boundary of the study areas, along arterial roads. There is also no unique neighbourhood identification or characters in terms of banners except for a conglomerate of compact low rise residential homes. Together, the lack of wide range pleasurable qualities does not promote pedestrian activity, especially for adults and parents.

Figure 8 Pedestrian Pathway Surrounding A Pond
Source: Taken by Winnie Lee

Two field observations were conducted to account for variations in use and conditions. The weekend observation took place on a Sunday afternoon. It was cloudy and rainy, the study areas were both generally quiet, with little presence of users on the streets. There were many adults walking their dogs; one adult with two kids walking

along the streets; and a few adults outside of their own garages or front porches. The weekday observation took place on a Friday afternoon during Hazelgrove elementary school pick up hour around 2:15 p.m. to 3:00 p.m. There was not much difference between the two days for the larger study areas, however, the presence of users on the streets became more prominent and concentrated closer to the school grounds and Hazelgrove Park, as parents were waiting to pick up their children. About half of the parents walked there with their dogs, strollers, or younger children, the other half parked their idling cars on the side streets or in the school parking lot. There were no adults who commuted to the school by bicycle. Majority of the older children, around 10 to 12 years old, walked home alone with friends or by themselves. Whereas the younger children walked together in twos or fours, accompanied by an adult. After the school pick up rush, the study area returned to its original state of quietness with little presence of users on the streets.

Perceived Safety from Traffic

Perceived Safety from traffic is not the same as actual traffic safety, but the individual's beliefs that limited opportunities exist in the setting for injury from automobile (Day et al., 2006). The built environment features that increase perceived safety from traffic are those that create physical and/or psychological barriers to high traffic speeds (e.g., cul de sacs, stop and yield signs, bike lanes, and sidewalks) (Day et al., 2006). To analyze the perceived safety from traffic, the domain is further aggregated into sub-categories of both safe street connections and crossing, and traffic safety. The indicators are both critical to understand whether the built environment supports the goal of Sustainable Principle One for parents and children aged 10 to 12 years old.

For perceived traffic safety, the study areas performed well for having posted speed limits and various measures to slow down traffic. Measures to slow down traffic included having posted play zone signs, school zone signs, stop signs, and crosswalk signs with zebra striping at road intersection as shown in Figure 9. Pedestrian activated signals with flashing lights are only located at the arterial roads. The flashing lights is especially important for safe street crossing during rainy winter as it gets dark early in late afternoon. On-street parking along both sides of the street also provide additional sense of safety to the pedestrians on the sidewalk as shown in Figure 10. Although traffic slow down measures are evident in the segments, the car traffic speed next to

sidewalk felt quite fast as they do not have to conform to the school zone speed limit during the weekends, while others ignore the residential speed limit.

Figure 9 Zebra Crossing and Stop Sign at Intersection
Source: Taken by Winnie Lee

Figure 10 Parked Cars Along Both Sides of Street
Source: Taken by Winnie Lee

For safe street connections and crossing, both areas performed fair on the rating scale, as the IMI quantifies the types of signage, crosswalk markings, count of curb cuts, pedestrian sign systems, bicycle lanes, and vehicle lanes. While crossing the street intersection with a crosswalk sign and zebra striping on ground, the traffic speed from the vehicle lanes felt quite fast; most cars do not slow down unless the pedestrian is already on the crossing in the middle of the crosswalk. Despite the multiple posted school and playground zone speed limit signs, some drivers did not conform to the speed limit during the weekends. While there is consistent demarcation of bicycle lanes throughout the study areas, there were no cyclists on the streets during the observed weekend afternoon. The demarcation of bicycle lanes is typically painted in white solid lines on the streets in between the parked cars along the streets and the vehicle lanes as shown in Figure 10.

Figure 11 White Solid Line as Demarcation Of Bicycle Lane
Source: Taken by Winnie Lee

During the school pick up hour, the traffic speed was significantly slower with more pedestrians walking on the sidewalk and street crossing. There was also a traffic controller near the school entrance and road intersection that aided with signage to slow the cars to full stop for children to cross the intersection. As drivers coming out of the school parking lot and nearby streets were mostly parents, they appeared to be quite cautious with their driving speed. It is interesting to note the disparity in the traffic speeds

between a weekday or weekend afternoon, as this plays an important role in influencing the levels of pedestrian activities for parents and children aged 10 to 12 years old.

Perceived Safety from Crime

Perceived safety from crime is the individual's beliefs that limited opportunities exist in the setting for crime victimization or harassment during physical activity (Day et al., 2006). Some examples of built environment features that have influence on perceived crime safety include maintenance (e.g., absence of graffiti) and street lighting (Day et al., 2006). Both study areas performed excellent in having well-maintained buildings and presence of outdoor lighting distributed throughout the site. Most of the study areas are fully developed with predominantly residential buildings and elementary schools, which appeared to be well-maintained and occupied without any signs of dilapidation or graffiti. As discussed earlier, the outdoor lighting has been consistently distributed throughout the observed segments, except when the new development meets the existing development. Overall, well maintained buildings and presence of outdoor lighting provides a sense of safety for pedestrians from crime.

Summary

The findings from IMI instrument reveals that the built environment of East Clayton NCP area falls short of meeting the goal of Sustainable Principle One – to foster active pedestrian activity through achieving compact urban design. While the built environment performed well in the domains of perceived safety from crime and traffic, it performed poorly in the domains that are linked to physical activity, such as accessibility and pleasurability, as shown in Table 2. The summary findings from Table 3 demonstrate how certain micro-scale categories of the built environment contribute to the performance of each domain. Ultimately, the absence of built environment features and categories that contribute to accessibility and pleasurability illuminate the need for improvement before reaching the lofty goal of Sustainable Principle One.

Data collection and analysis for the IMI instrument is based on the quantitative scoring scheme with a numeric rating that can be summed up to a total score under each segment that relates to each category, as shown in Table A.1 in Appendix A. The higher the rating score indicates how well each category performs. However, the numeric scoring scheme does not have meaningful attributes that can be easily

understandable by readers. To present the summary findings in a succinct and concise manner, I have organized the numeric scoring into a percentage point rating scale that is calculated based on the total number scored out of the total possible rating scores under each category. The percentage point rating scale is then further aggregated with an assigned rating of very poor, poor, fair, good and excellent. The percentage rating scale in turn helps provide valuable information in how each domain and categories perform and differ from one another.

It is essential to know how the built environment performs under each domain as the findings from this observational study help formulate potential questions that could further enrich dialogue with the residents. The semi-structured interview in later Section 3.2.2 builds on the evaluation from this data analysis by deepening the researcher's understanding on topics and questions that been uncovered during the field observation.

Table 2 Irvine Minnesota Inventory Summary Findings

Domain	Categories*	Rating Score**	Findings
Perceived Safety from Crime	Building Maintenance and Outdoor Lighting	Excellent	Majority of buildings are well-maintained and occupied without any signs of dilapidation. Outdoor lighting is consistently distributed throughout the areas except for a few sections where it is discontinued at the intersection between the new and existing development. The lighting in the evening is observed to be quite dim with yellow lighting.
Perceived Safety from Traffic	Safe Street Connections and Crossing	Fair	Traffic slow down measures are predominantly implemented through posted school or play zone signage, and yield sign with zebra stripping at street crossing. Other types of crosswalk markings and pedestrian activated signal system for safe street connections are not prominent throughout. Generally, bicycle lanes are demarcated clearly in white painted lines on roads but there are no buffer to provide an additional sense of safety.
	Traffic Safety	Good	Consistent throughout the school and park areas, there are posted speed limits with play and school zone signage to slow down the traffic. Additionally, on-street parking along both sides of the street provides additional safety to pedestrians on the adjacent sidewalk.

Domain	Categories*	Rating Score**	Findings
Accessibility	Land use Mix and Diversity of Destinations	Very Poor	The land use mix is dominated by monotonous low-rise residential homes, pocket parks/playground and elementary schools. There are no other distinct uses such as vertical mixed use and retail types along the observed segments except for a conglomerate of low-rise small-scale retail and commercial use near the Katzie Elementary School.
	Complete Sidewalk	Excellent	Sidewalks are mostly complete on both sides of the street except at certain sections where it becomes discontinued or narrowed when the new and existing development intersects.
Pleasurability	Sidewalk Amenities and Condition	Poor	Sidewalks are generally even and well-maintained without any cracks. However, there is no access to other amenities such as seating, bike racks or bus stops along the street except at the premise of a park or along arterial roads.
	Attractiveness of Public Street	Poor	The aesthetic appeal of architecture and the character of the neighbourhood is relatively monotonous without any unique identification. There are no gathering places such as coffee shops within the residential streets except at arterial roads. Access to greenway and pocket parks are abundant throughout the area.

Notes:
*Categories adapted from Day, K., Boarnet, M., Alfonzo, M., & Forsyth, A. (2006). The Irvine-Minnesota inventory to measure built environments: Development. *American Journal of Preventive Medicine*, *30*(2), 144–152. https://doi.org/10.1016/j.amepre.2005.09.017

**Rating score is a scale assigned with a rating of very poor, poor, fair, good and excellent that is based on aggregated percentage points.

4.3. Qualitative Interview

4.3.1. Findings

While the observational study provides an objective measure of the built environment features that influence physical activity, there are other perceptual qualities of urban design that may affect physical activity (Ewing & Handy, 2009). The purpose of the semi-structured interviews is to provide insights into residents' lived experiences and perception of the built environment in influencing their physical activity. As discussed in Chapter 3.2.2, a total of 9 interviews were completed with parents and children aged 10 to 12 years old who reside near and within the boundary of the East Clayton NCP. Due

to the challenges with recruitment, 3 out of the total 9 interviews conducted include families who reside outside of the study area but were recruited based on their experience and frequent visits to the study area in red boundary line as shown in Figure 12. To gain a better understanding on the interviewees, the white circle in Figure 12 illustrates the approximate area of the interviewees' residence and the arrow points to the direction of the schools that children attend. While most of the children who reside within the boundary attend Hazelgrove and Katzie elementary schools, there are two other children who attend schools outside of their catchment area, as shown in Figure 12 with arrow pointing outside of the red boundary.

Through qualitative analysis, there are a total of eight dominant overarching themes in Table 3 that connects coding categories together to provide valuable and meaningful insights on how parents and children perceive the built environment in influencing their physical activity.

Table 3 Qualitative Interview Summary Findings

Eight Dominant Themes
Social and Physical Attributes as Perceived Safety
Sidewalk, Road Condition and Traffic Infrastructure as Perceived Safety and Comfort Concern
Crime as Perceived Safety and non-Safety Concern
Parental Attitudes on Children's Independent Mobility as Physical Activity Barrier
Adequate Training as Perceived Parental Comfort on Children's Independent Mobility
Children Attitudes on Independent Mobility and Physical Activity Motivators
Accessibility to Destinations as Conditional Walking Motivator
Neighbourhood Pleasurability as Perceived "Fortunate to have"

A wide spectrum of similarities and differences toward the same coding categories are described under one or two dominant themes with supporting quotes and visual representations from children's drawings.

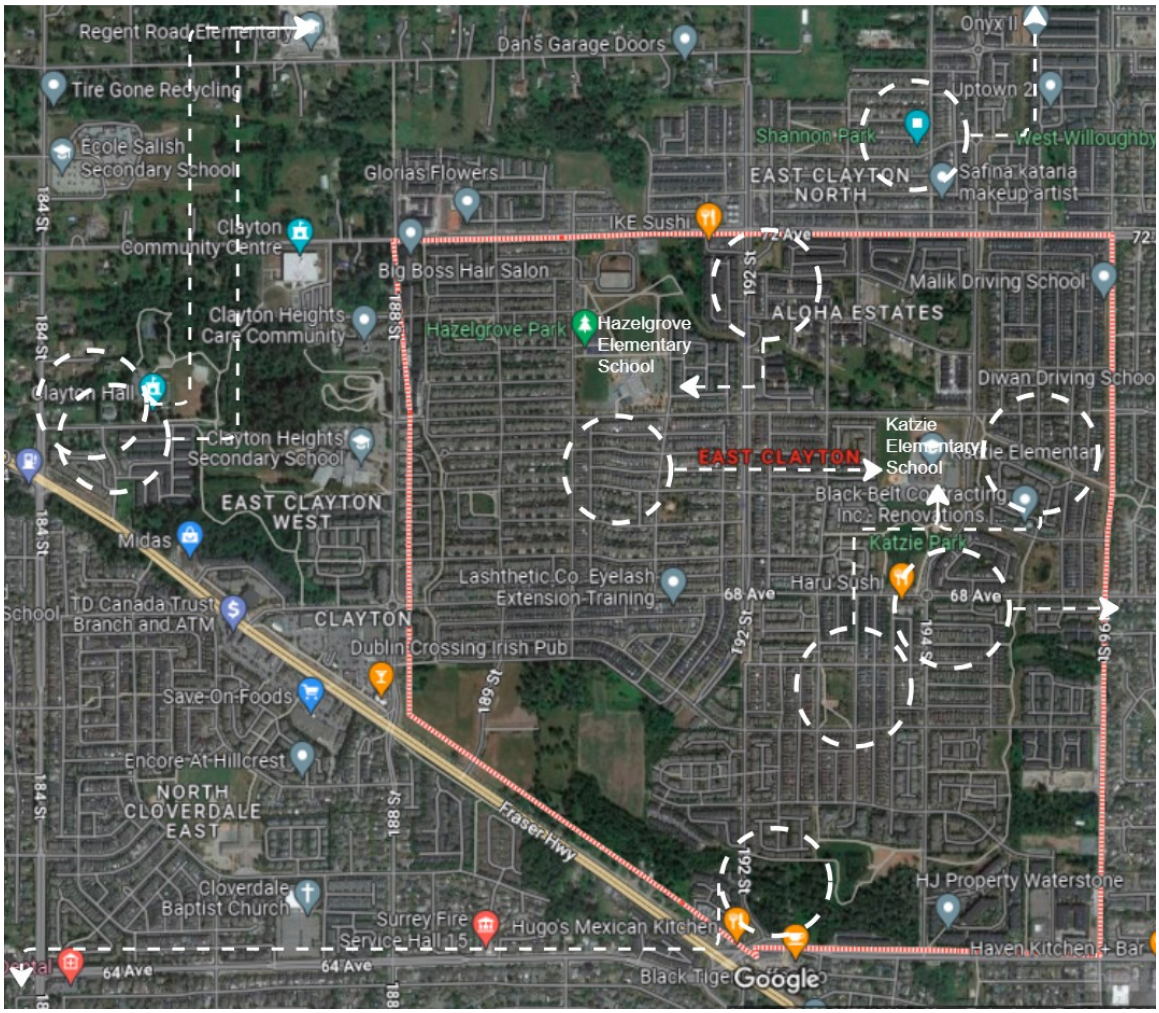

Figure 12 Map of Interviewee's Residence and Walking Route to School
Source: Google Map

Social and Physical Attributes as Perceived Safety

An emerging theme related to the perceived sense of safety, for both parents and children, was due to social attributes. This was the presence of pedestrians on the streets. Other indicators included the presence of known people, such as school cross guards, friends, siblings, and neighbours walking on the pathway to school. These social indicators made the participants feel safe and comfortable with the built environment, as shown in Figure 13.

> *"…I would say all of our neighbors all walk and you know that your kids know most of the people that they see walking to school... they know all their friends all walk the same way at least recognize them from the path."- Parent #6*

"Everyone knows everyone though. across the street and then they'll be a few people at least know one person…" – Children #5

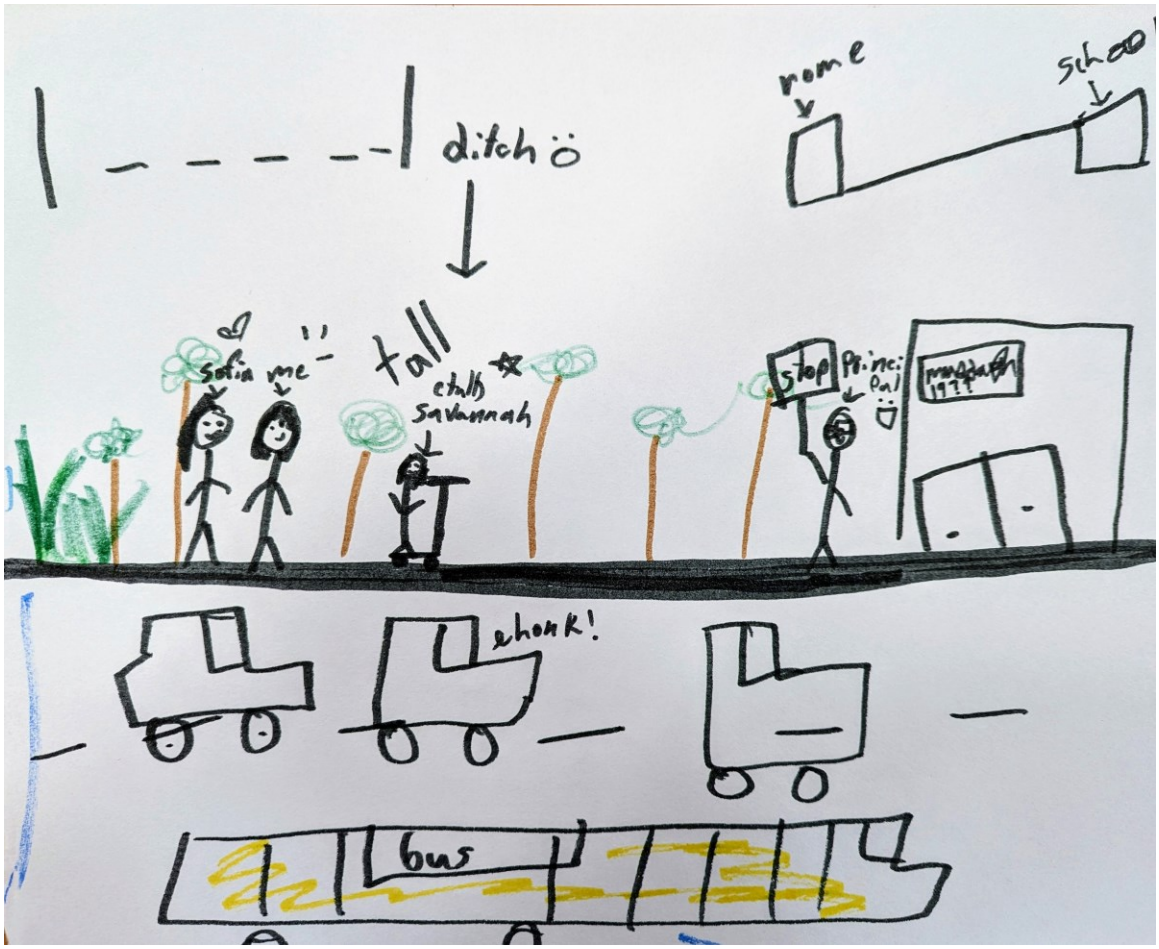

Figure 13 Child #5 Drawing Illustrating The Walking Scene To School
Source: Drawing from Interview

Another factor that contributed to the perceived sense of safety was the sense of a close-knit community in the neighborhood. Not only did parents and children recognize neighbours on the street, but some also reported that the compact and dense housing design helped facilitate the feeling of closeness with one another. This perceived safety of the neighbourhood is due to having more 'eyes on the street'.

"I think for townhouse complexes, our units are so close together and there's so many people around that we feel pretty safe in there because you're right. attached to your neighbors… – Parent #6

“The times that they're walking there's so many other parents, their kids yeah. It that gives me comfort.”- Parent #9

On the other hand, physical attributes of the built environment also contribute to families’ perceived sense of safety when walking in the neighbourhood. Where physical barriers such as parked cars or other barriers that separate the sidewalk from traffic or school cross guard that direct traffic, parents and children recognized that these physical features helped them feel a sense of safety and comfort. As shown in Figure 13, child #5 illustrated their daily walking scene to school where there is presence of pedestrians, ongoing traffic, and the school principal as the cross guard directing the traffic for students to safely cross the street.

“...there is like a road shoulder there's the yellow stuff to block the cars that is too close to the road” – Parent #8

“[the person is a] principal. There is a crosswalk and he tells the cars to stop so the kids can come to [school]” - Child #5

“I feel pretty safe in our neighborhood. The sidewalk are really really wide. Because there's parked cars between the road and the sidewalk. I really don't feel like there's a whole lot of risk the kids getting hit by a car.” – Parent #9

Sidewalk, Road Condition and Traffic Infrastructure as Perceived Safety and Comfort Concern

Another emerging and dominant theme from the interviews was that parents and children perceive the absence of complete, even sidewalk, and lack of road infrastructure and fast traffic condition as factors of safety and comfort concern that inhibit their physical activity.

Regarding the sidewalks, many reported them to be too narrow for a parent and multiple kids to walk together side by side without getting off the sidewalk to let pedestrians pass by. The narrow sidewalk deterred Parent #2 to walk on the sidewalk with three kids as she needs to constantly hold the rambunctious kids’ hands for safety reasons.

“I have three kids and four of us can’t walk together. Only two people can. If there is somebody behind us who wants to walk faster, then you have to just stand at the side and let them pass… Oh yeah. I hold the kids' hands all the time.” – Parent #2

There's a sidewalk [but] it is just very narrow. And the cars are really just…- Parent #4

On the other hand, many reported the sidewalk to be uneven, with occasional physical barriers, as a safety and comfort concern. For example, child #3 depicted the uneven sidewalk in his daily walking journey to school in the form of a curvy line in Figure 14, and child #2 illustrated fallen trees as a walking barrier to him during his daily walk to school as shown in Figure #15.

“[the curvy line on drawing is like]..sometimes it is like [the sidewalk] is not very smooth. [There are] like little bumps on sidewalk.” – Child #3

“Sometimes the trees fall down and block the road. [It happens] sometimes after a stormy weather or sometimes it is like it is too weak enough to stand up now and just fall.” – Child #2

Additionally, participants found incomplete or absent sidewalks. This was an inconvenience to pedestrians that resulted in crowding on one side of the sidewalk when walking to school and posed a danger to parents and children who must walk on the edge of the roads where sidewalks are absent. Child #5 illustrated and explained that pedestrians only walk on one side of the road when walking to school next to the traffic Figure 13.

“So there's one sidewalk on this side and then you have like the road and then there's like no sidewalk on that side. Oh, yeah…So you had the whole school basically taking one sidewalk, right?”– Parent #5

“Yeah, there isn't a sidewalk on this side of 192st. It's dark and is not well lit.” – Parent #1

“…there is no pedestrian walk at our side. So when we walk.... we kind of like walking in dangerous side without pedestrian walk.” – Parent #8

"…the sidewalks are not really there…So then it's really tight." – Parent #4

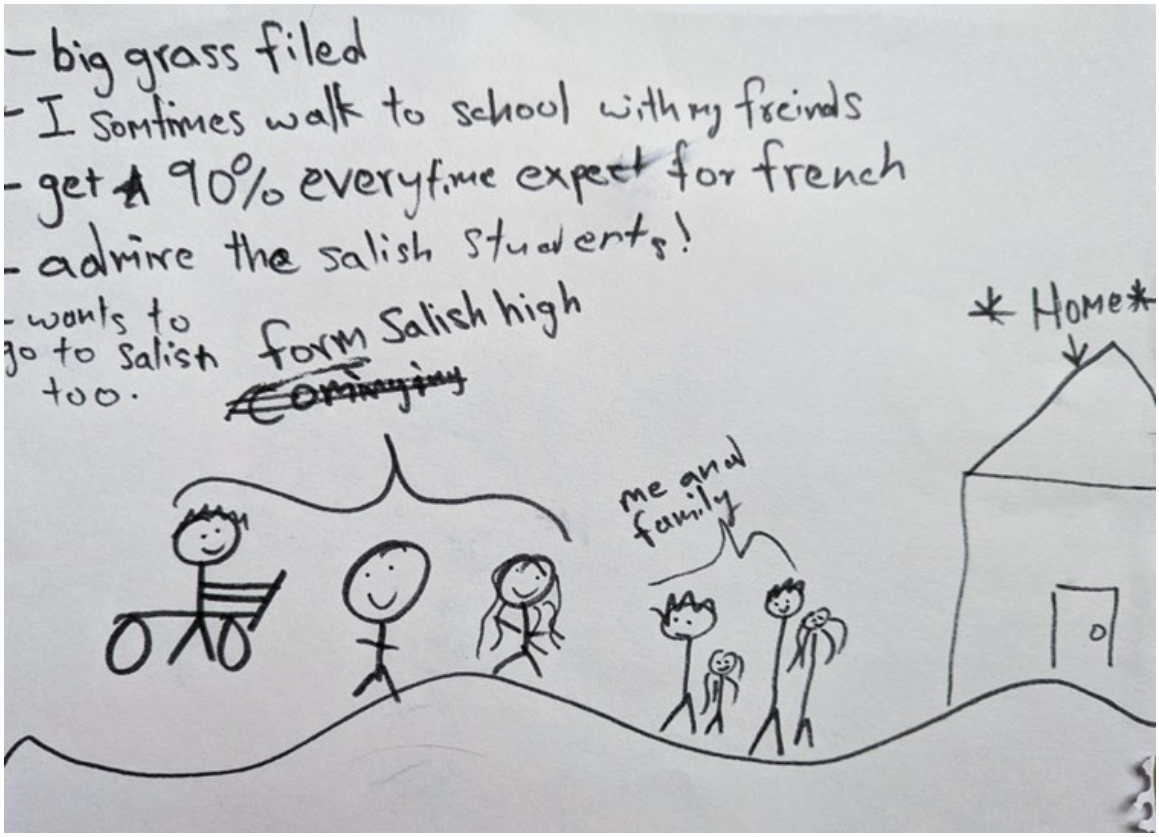

Figure 14 Child #3 Drawing Illustrating Uneven Sidewalk (Curvy Line) as Walking Barrier
Source: Drawing From Interview

Narrow road conditions are another factor contributing to safety and comfort concerns for parents and children. Participants noted that they do not feel safe when biking on bike lanes or sidewalks next to ongoing traffic.

"We don't feel really safe because the road is so narrow. If he actually fall down from the bike, it might not so safe…[and] cars are coming in. We don't bike on the sidewalk. We usually go to the school and park then we bike... not on the road. And we are not really sure if he can control his speed when he bikes.". – Parent #2

Figure 15 Child #2 Drawing Illustrating Fallen Tree as Walking Barrier
Source: Drawing from Interview

In addition to narrow roads, parked cars on both sides of the roads pose visibility issues to pedestrians when crossing the street. Participants shared that visibility is further compromised when large cars are not parked properly and can block a short young child on the sidewalk, especially during poor weather conditions.

> *"…There are so many cars parked on the street. If they are not parked properly, sometimes it can be challenging to see if a car is coming…a lot of cars don't stop. Like [cars] don't look." – Parent #7*

> *"Something that they could work on is when they are parking cars…I am worried sometimes that if a kid is short like me...the driver can't really see [me]." - Child #9*

In terms of traffic infrastructure, parents and children predominantly expressed safety and comfort concerns with fast traffic and cars that do not provide clear signal of stopping at intersections without crosswalks. Based on the parents and children's illustrative quotes below, cars are reluctant to come down to a full stop and appear to take precedence over pedestrian safety, especially in places where there is an absence of stop signs or crosswalks.

> *"[it is because there are many cars here that are fast]. Oh yeah. Sometimes they go fast. I can even hear them first before I see them."*
> *- Parent #2*

> *"…traffic is really bad, unfortunately…It's just hard because people don't respect the sign [with] 30 km/hr. They drive faster than that. – Parent #4*

> *"…if you walk too slow, whatever they decide to speed pass you right – Parent #4*

> *"…[cars] go like really fast. Yeah, it's scary because it's like are they gonna stop or not?" – Children #7*

> *"There's a crosswalk already. Oh, but the car just doesn't seem to want to stop…it is in a roundabout between 194 St. to 68th Avenue. Near Katzie Park – P8*

When asked about what kind of improvements in the built environment would help make parents and children feel safer and more comfortable when walking on sidewalks, they suggested the need for more traffic stop lights, school cross guards, traffic speed signs, street lighting, and leashed dogs to enable a comfortable walking journey.

> *"I'll probably say if there's a once in a while a slow down sign...I wish there was a slowdown sign because whenever I'm walking there I usually see cars driving by fast" – Child #9*

> *"there is a stop sign for one of the directions, not all directions. For those that do not have a stop sign…[they] go quite quickly…and don't look for pedestrians – Parent #7*

"Also, there is a lack of street lighting during winter time that my husband always complaints that it doesnt feel safe outside." – Parent #2

"The other threatening thing is dogs…many people who own the big dogs here…they keep the dogs unleashed." – Parent #8

"Maybe they need more…traffic light…even like a cross guard" - Parent #4

Crime as Perceived Safety and non-Safety Concern

To supplement the IMI structured checklist, parents and children were asked about how crime in the neighbourhood influenced their perceived sense of safety towards physical activity. The responses received are split in half where some parents feel indifferent towards minor or targeted crime (e.g., car break in other targeted crime) in influencing their mobility or children's independent mobility. Despite these minor crimes and occasional targeted incidents, some parents generally feel safe living in the neighbourhood.

"We feel pretty safe. We have been here [for] 11 years. Generally, it's the same sort of small crime stuff that you see in other places. They're checking door handles and things like that if your cars are parked outside…" – Parent #6

"So that was not…something that concerns me so much, because that was a targeted incident." – Parent #7

"Our car was broken into a couple of weeks ago. That's the main thing that we see. We don't see a lot of violence in our neighborhood."- Parent #9

On the other hand, some parents gravitate towards fearmongering after hearing news or stories about crime, which further impedes their physical activity and their children's independent mobility.

"Because you hear about all those [crime] stuffs. That's why I don't feel safe...that's why I don't let her go to like Clayton Park even because

there's so many people having gang fights and like getting abducted and then all that incidents..."- Parent #4

"You always hear about…people have come up and exposed themselves while they're playing at the…There are some...creepers." - Parent #7

Parental Attitudes on Children's Independent Mobility as Physical Activity Barrier

One of the dominant themes that hinder children's independent mobility and physical activity is parental attitudes. Throughout the interview, parents reported there are a multitude of factors, physical conditions, and parameters that influence their approval for their children to travel independently.

Parental attitudes on children's age and lack of trust are factors that impede parents from providing license to their children to travel independently. Reaching a certain age is critical for some parents, however other parents think otherwise.

"[we feel more comfortable letting my kid travel independently] when he is like 12 or 13." – Parent #7

"I always felt it was better to teach my kids than to shelter them…because like at what age do you teach them?"– Parent #5

Additionally, some parents were concerned with 'daring and rambunctious' preteens, with assumption that this age group are often high energy, talkative, and easily distracted by the environment. The lack of trust and safety concern from the parents acts as a primary barrier to children's physical activity, as illustrated in child #6's drawing with big bold words depicting "My Mom Doesn't Trust Me" in Figure 16.

"I am just worried that she'll be distracted and focus on the conditions around her. Like for example, sometimes they would joke and then they might push each other by accident…sometimes a half an hour walk can become an hour walk because they're looking at everything around them like the trees and flowers." – Parent #4

"[they are] not walking. They are usually running. So that is one of the reasons I prefer driving" - Parent #2"

"I don't walk because she doesn't think I can." - Child #4

Figure 16 Child #4 Drawing Illustrating Parental Attitudes on Children's IM
Source: Drawing from Interview

Additionally, parental attitudes on the physical conditions such as raining and icy cold weather, COVID impacts, distance to school, and busy intersections are other contributing factors towards the deterrence and delay of training children for independent mobility. A combination of these factors causes family concern and affect parents' decision-making process in allowing their children the autonomy to train for independent mobility.

> *"...We did not want them to quite practice [walking independently by themselves] now with the weather conditions, to it being like dark in the mornings or dark earlier on after school. And the raining right? Yeah, we will first start in late spring or summer right when the weather's nicer then we'll let them start learning" – Parent #4*

"You have to actually go like towards the.... And then you walk across the high school and then walk up again. So yeah, we'll take half an hour to an hour" – Parent #4

"We were just kind of preparing her to learn how to go to parks, you know, walk and stuff independently and then COVID came and that just impacted that a bit."- Parent #1

"...If he didn't have to cross the busy intersection, we would have let him start [walking] a lot earlier. - Parent #9

Adequate Training as Perceived Parental Comfort on Children's Independent Mobility

While parental attitudes may act as a barrier to children's independent mobility and physical activity, parents find comfort in having adequate training and parameters in place prior to allowing children's independent mobility. Another recurring theme across the interviews was that adequate training is perceived by parents as a mandatory pre-requisite for children's independent mobility. Many parents demonstrated trust and confidence in their children's sense of traffic safety awareness after being equipped with electronic devices and having adequate training through repetition and practice. For some parents, adequate training involves having parents following and watching the children to practice independent mobility and providing children with technological access to Apple Watches or cell phones for emergency and tracking purposes.

"We did lots [of training]. We made sure you had the Apple phone or Watch first...then we had a couple of times where we just followed behind yeah. We made sure that he knew to look both ways." - Parent #9

He is allowed to go across the street to Hazel grove. Yeah, there. And we've let him go to his seven. We've let them walk to 711 but not alone. There is no like streets to cross or anything else. It's we're kind of they can walk through the park to get to it. Oh, see. So it's it's an easy walk. - Parent #9

In addition to preparing children with adequate training and electronic devices, many parents reported to feel comfortable and safe for their children to travel independently within parents' limitations and parameters. Such limitations and parameters are set in place for additional safety measures in the form of geographical boundary (I.e., fenced yard, rear lane and park grounds) and having walking companions when travelling independently.

> *"They're allowed to play in the alley but they need to watch out the cars and that's only when the weather is fair. And I have the door open so I can hear and see them." - Parent #7*

> *"He is allowed to go across the street to Hazelgrove [Elementary School]...We have let them walk to 711 but not alone [and] there is no like streets to cross..." - Parent #7*

Children Attitudes on Independent Mobility and Physical Activity Motivators

Children's attitudes on independent mobility and physical activity motivators have emerged as reoccurring themes throughout the interviews. When asked about their feelings of safety and comfort towards independent mobility and crossing intersections, most of the children responded with confidence in their own ability to navigate safely.

> *"[I would] take a different route.... which we never do. Because my mom she doesn't like taking new routes." - Child #4*

> *"Yeah [I have to cross the road by myself]. The first time I did it. It was a bit scary. And then it slowly got easier and easier." - Child #6*

> *"Yes [I feel safe walking to school and crossing the street]..Sometimes we'll walk to school by myself and I will make sure I am comfortable [doing that]." - Child #7*

> *"Yup I feel safe. I'm able to cross the street by myself." - Child #3*

> *"Well, I'm already comfortable [walking by myself]. She's not. I'm very comfortable."- Child #4*

“I do [feel] safe crossing the street by myself and on the sidewalk...” - Child #9

In terms of physical activity motivators for children, many had creative and bold ideas and suggestions for improving the built environment by having road reductions, wider paths, underground parking, reduced litter, and safety measures around bikes. Children perceived these measures would motivate them to spend more time outdoors. As shown in Figure 17, child #6’s drawing illustrated the narrow path in between the fence next to road and grass field as places where he spends time playing ball hockey while sharing it with pedestrians. As for safety measures in place for bicycles, one child indicated that she would prefer to bike to school if it was not because of the fear of her bike being stolen.

“[What would help me feel more safe walking is] people picking up their dog litter.” - Child #3

“We need cut the road in half. Because like the road is very, very big... [Here] is the road. Right there is the biking lane right there's bike lane. And then over here is the sidewalk and over here is the sidewalk...” - Child #4

“Wouldn't it be nice if there was underground parking in our neighborhood? Get rid of all the street parking in our neighborhoods” - Child #9

“More room on the path [because] during ball hockey sometimes gets complicated because some of us wants to move it to the side for more room for people to walk by.” - Child #6

“[I do not bike to school] normally because I don't want anyone steal my bike” - Child #7

“I don't like there's litter everywhere.”- Child #7

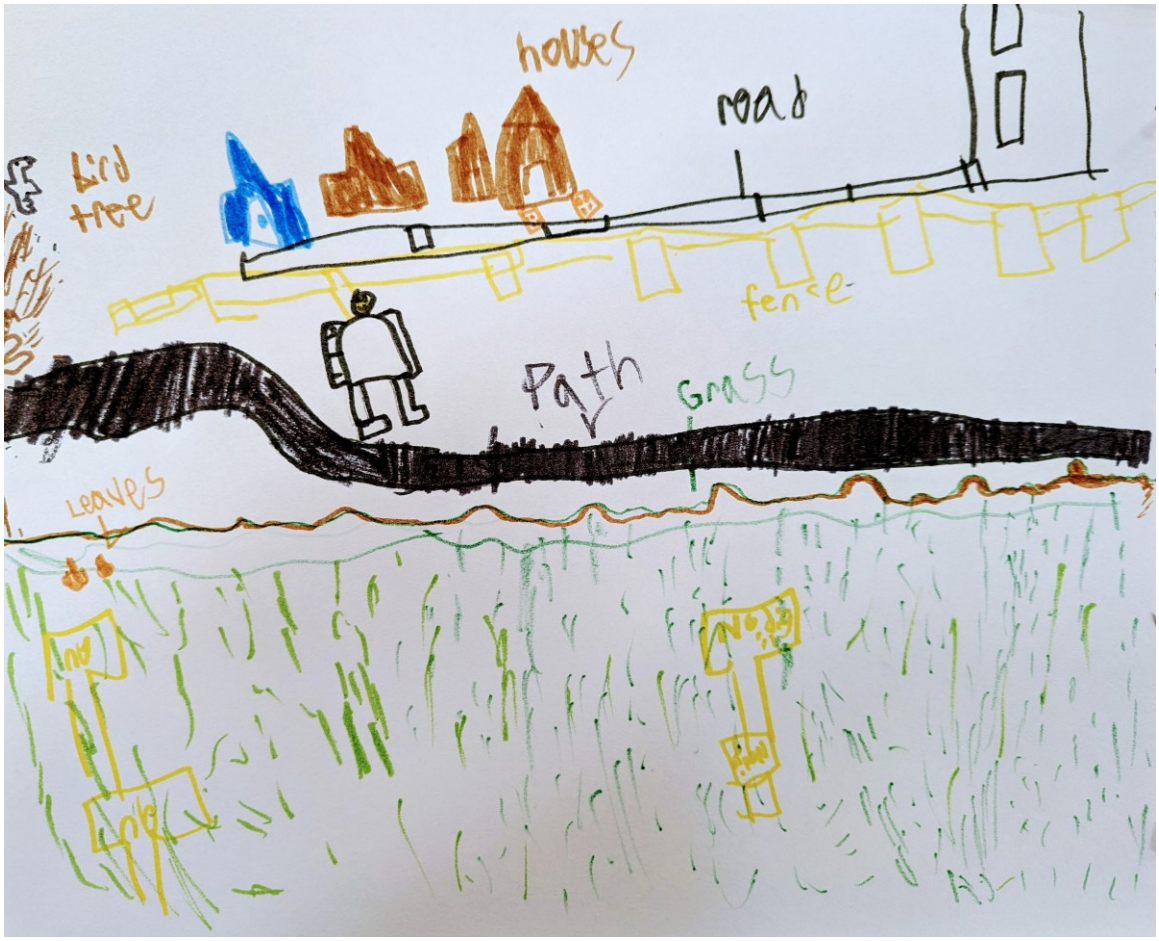

Figure 17 Child #6's Drawing Illustrating Narrow Path as Place for Ball Hockey
Source: Drawing from Interview

Accessibility to Destinations as Conditional Walking Motivator

A recurring theme across the interviews was that parents and children can access various destinations by walking, however it only serves as a conditional walking motivator. While most parents can access various small-scale destinations (e.g., corner store, convenience store, grocery and retail shops) within 10 to 15-minute walk from their homes, the majority typically prefer driving instead. Throughout the interviews, some parents perceived anything within 10 to 15-minute walk as accessible and close, while others perceived 45-minute walk to be accessible and close. Some parents foreground that accessibility to destinations is dependent on where you live, especially close to arterial roads, where clusters of large-scale commercial and retail shop are concentrated.

“We don't walk here either. It's a bit.. it's so far. It's about 30-minute walk." – Parent #6
“Anything within five kilometers (equivalent to 45-minute walk) is doable for me" – Parent #8

“There are small little things that we can walk to but anything like where [the] Independent Grocer is, which is where we grocery shop often, you can’t just walk to pick up a few things….it depends where you live. If you live here [along 188 St. and Fraser Highway], we'd have much better walking stuff – Parent #1

Despite parents expressing that “everything” is accessible by walking, they would only walk under certain conditions, such as close distance to school, weather, and younger children/siblings’ ability to walk. Most of the children living within the school catchment area typically walk to school with a companion and the close distance to school motivates walking behaviour and physical activity instead of driving to school.

“It takes me longer to drive than it does for them to walk” – Parent #6

While warm and sunny weather facilitate walking, the types of destinations also influence the decision of parents to walk. For instance, some parents and children would walk to ice cream shop and coffee shops, but not grocery stores.

“We drive, but we can walk too. Yeah, especially when the weather's nicer” – Parent #4

"I don’t usually do big grocery shop on foot" – Parent #7

Another scenario that facilitates conditional walking is destinations within 10 to 15-minute walking distance for parents with younger children. They recognize the physical constraints of young children to be able to walk within limited distances, which further influences their choice for walking and physical activity.

“… the five-year-old she's now reached an age where that's not too tiring for her. Up until I would say about six months ago [my daughter was] like ‘This is too far. Carry me’.” – Parent #9

While most parents reported having access to some destinations by walking from homes, the majority of them typically drive because of preference, convenience, distance, and necessity. Some parents feel compelled to drive to other places, except for nearby school and playground. However, there were also a few parents who choose active transportation options by transiting, walking, and biking due to their preference or inability to drive.

> *"We have cars so of course we use them…I will walk and not carry grocery…We typically drive if we are going except for school, we drive to most other places" - Parent #6*

> *"We usually drive. Actually, there are a few places I guess for grocery like Fruiticana and 711 that I can walk to, but we don't really walk. Only the playground we walk to and school as well… I don't recommend people without a car to live here. It takes longer time to get things without cars. – Parent #2*

While most of the parents have access to various small-scale destinations within 10 to 15-minute walk from their homes, the findings demonstrate that destinations only foster conditional walking behaviour. There are other factors and nuances that influence the parents' acclimated preference for driving.

Neighbourhood Pleasurability as Perceived "Fortunate to have"

To enrich the IMI structured checklist with qualitative data, questions were asked about how parents and children feel about their neighbourhood in terms of pleasurability and uniqueness. Generally, many parents noted they were fortunate to have access to pocket parks, library stands, community events, schools, greenspace, daycare, and other essential services to families. One parent indicated that the pocket parks and playgrounds foster places of gathering for meeting new neighbours and exchanging toys. Others highlighted the cookie cutter home design of the neighbourhood with monotonous building colours throughout, as something that does not support uniqueness.

> *"We have a lot of beautiful walking trails and ponds. We have the little free library set up all around the neighborhood. I also think what's unique is that we have two schools right by each other." – Parent #9*

“So it is nice to have those parks...when the kids were younger, that's how we met a lot of the neighbors is we would go and they'd play at the park...and share their toys and get to know the neighbors. So I do like that.” - Parent #7

“Everything in here is cookie cutter...you know you look at our house it looks the same as our neighbors all the way.” - Parent #5

"...you look at the other similar neighborhood beside us and [the colour of the buildings are]…like white, white, white, white, white, white, white, white, white, white, white, white, white, white, white, white, white, white, white...- Child #5

4.3.2. Summary

The findings from the semi-structured interviews are important primary means of data gathering to answer the third research question of my research: How do parents and children aged 10 to 12 years old perceive the built environment in influencing their physical activity? The purpose of this qualitative data is to understand whether the residents are indeed walking or not in this intentionally designed compact and walkable neighbourhood. In short, parents and children are walking in the neighbourhood, but are subject to a list of physical and social conditions and factors.

Overall, the eight dominant and recurrent themes that emerged from the qualitative analysis demonstrate how the parents and children aged 10 to 12-year-old perceive the built environment in influencing their physical activity. While the physical aspect of the built environment played major role in influencing parents and children’s perceived sense of safety and comfort, it is evident that there are complex systems of social attributes and parental attitudes that influence children’s independent mobility and physical activity. Ultimately, the interview findings revealed that built environment features impact residents’ perceived sense of safety and comfort to a certain extent. This in turn foregrounds the importance to account for social factors and parental attitudes or beliefs.

Data gathered through interviews will be used to draw insightful and meaningful connections between the observational study and local perspectives that further inform the conclusion of this study.

Chapter 5.

Discussion

This research provides an example of an ex-post evaluation of the NU BE characteristics associated with the residents' (parents and children) level of physical activity. This research contributes to existing knowledge on a causal relationship between BE and people's physical activity behaviours (Smith et al., 2017), as well as research suggesting the environmental perceptions and sensitivity from individuals have direct and indirectly influence on their PA (Ewing & Handy, 2019). Previous scholarship in ex post evaluation on NU suburban development have focused either on the physical characteristics of BE (Xu, 2017; Falconer et al., 2010) or on the qualitative perceptions of residents (Stanislav & Chin, 2019) without holistically addressing the interconnected issues. To date, little research has been conducted on ex-post evaluation on NU suburban development from the composite approach of quantitative assessment of the BE with validation from residents' perception, specifically from parents and children. Thus, this study provides evidence from both objective researcher assessment of the BE and the residents' perceived measures of the BE. Ideally, future studies will incorporate this approach for a holistic ex-post evaluation of sustainable neighbourhoods. The following sections within this chapter will provide details of nuanced findings on sustainable neighbourhood design, walkability, and social connectedness, which are the main contributions of this research. Two additional sections discuss the aspirations and reality, and the strengths and limitations of this research.

5.1. Intentional Sustainable Built Environmental Designs for Nuanced needs of Residents to Facilitate PA

This study finding contributes to the existing literature by advocating for intentional applications of New Urbanism and Smart Growth inspired built environment design to meet the nuanced needs of residents to facilitate PA. Congruent to Curtis et al. (2015) and Saelens & Handy (2008)'s studies, my research corroborates with existing literature, which states that factors of BE design, such as proximity between places, mix of land uses, distance to school and quality of pedestrian infrastructure are primary determinants for physical activity for both parents and children. However, my findings

from both parents and children suggest expanding factors of BE design to meet the nuanced needs of the local residents. For instance, for children, the factor of distance to school can be expanded to non-school destinations, which include a spectrum of specific destinations (e.g., playground, parks, convenience stores, community centre) that are unique to the children's age group. This finding further builds on Curtis and colleagues' findings that while distance to school is critical for active travel in children, their results argue for policy makers to increase focus on travel to non-school destinations in the neighbourhood (Curtis et al., 2015). Another Canadian cross-sectional study of 435 children aged 9 to 12-year-old also found that close distance and greater access to park space and multi-use path space facilitates moderate-to-vigorous physical activity for children (Mitchell et al., 2016). Aside from expanding the determinants for PA for residents, these findings also call for policy makers and researchers to unpack granular details of each determinant on PA to suit the specific needs of the targeted neighbourhood. For instance, Curtis et al. (2015) argue that proximity between places are one of the determinants on PA for adults, but my findings demonstrated the perceived convenience and implications of proximity to places are more salient than the actual proximity and distance to places. Consistent with another Canadian study on 9 to 14-year-old, children's perceived BE characteristics were stronger predictors of children's PA outcomes compared to researcher-rated BE factors (Goon et al., 2020). The finding is unsurprising to me, as Ewing and Handy (2009) have emphasized the importance of individual perception in influencing one's physical activity.

Lessons learned from this finding echo calls for urban planners and policy makers to curate sustainable design principles and best practices to meet the specific needs communities. Differences and nuances in the way residents perceive the BE features and determinants can have significant impact on their PA. Further research should explore and expand the primary determinants of PA from researcher-rated measures to perceived BE factors based on local neighbourhoods. Relating this back to the impetus and motivator behind this research, the disjuncture between best practice design and nuanced needs of families with children reinforce the importance of ex-post evaluation like this empirical study to understand whether there are gaps between New Urbanism design theory and real-life practices (Al-Hindi & Till, 2001; Grant, 2009). Rather than follow a one-size-fits-all approach from New Urbanism/sustainable

neighbourhood, urban planners and policy makers should consider contextualizing practices and involve the residents in ex-post evaluation and change monitoring.

5.2. Subjectivity in Walkability

This research contributes to improved understanding of subjectivity of walkability in terms of residents' perceptions. The findings relate to definitions of walkability and pre-requisite age for children's independent mobility.

To date, there are a plethora of literature that have substantial variations on definitions of walkability (Hajna et al., 2017; Forsyth, 2015; Spoon, 2005 as cited in Tobin et al., 2022). However, much of the focus is based on researchers in the field, however, more attention is needed to define and operationalize walkability based on the lived experience of residents. Emphasis on including residents' perception of walkability in New Urbanism and Smart Growth inspired communities are one of the identified missing links in the existing literature (Stanislav & Chin,2019). Validated by perceptions and lived experience of the residents, the hegemony of car dependency and preference was evident despite living in close proximity to destinations. This aligns with Falconer et al.'s (2010) research on minimal differences in car dependency between suburban New Urbanism neighbourhoods and conventional suburban neighbourhoods. Consistent with Al-Hindi & Till (2001) and Grant's (2009) research findings, the difference between the definition of walkability from professionals and residents expands knowledge on the implementation challenges where there is a disjuncture between New Urbanism design theory and real-life practices in terms of development outcomes.

The substantial variations on pre-requisite age for children's independent mobility from parents is different from other study findings. The pre-requisite age for children's independent mobility was ranged between 10 to 12 years old. Although Curtis et al. (2015) study showed that children aged 10 to 12-year-old experience the most transition between dependent and independent mobility, findings from this research demonstrated a variation of age beyond the suggested 10 to 12-year-old for children's independent mobility according to the parents. However, this finding concurs with previous studies that increasing age is correlated with increasing independent mobility (Fyhri & Hjorthol, 2009; Riazi et al.,2022). It is also interesting to foreground the polarizing parents' and children's perspectives on permissible age for children's independent mobility, which

further reinforced by Loptson et al.'s (2012) who found that there exists a fundamental difference between parents and children's perception and experience of the built environment. Previous studies that showed an increase parental permission for independent mobility is related to increase in age and a decrease in distance to school (Fyhri & Hjorthol, 2009).

The findings of subjectivity in walkability from the lived experience of residents suggest that there is valuable local knowledge on the implementation outcomes of New Urbanism and Smart Growth inspired principles. As discussed in Chapter 2.1, there is a lack of ex post evaluation on sustainable development plans (Laurian et al., 2010), especially from the perceptions of residents rather than professionals (Stanislav and Chin, 2019). When applying New Urbanism and Smart Growth inspired principles to other suburban development, the finding suggests policy makers to engage with residents on their perceptions of walkability. This research challenges policy makers and design professionals on the critical question of *who* is the walkable neighbourhood designed for and *whose* values and worldview are being prioritized? Recognizing there exist substantial variations on what makes a neighbourhood "walkable"; theses are different for residents and policy makers. Future research is needed to examine the degree of subjective perception of built environment from residents, and how that influences their physical activity and children's independent mobility.

5.3. Social Connectedness

Social connectedness, in terms of trust and familiarity with the neighbourhood, was found to have a strong influence on adults' physical activity, and especially on children's independent mobility. Although the research aims and literature review emphasized on the importance of Ewing & Handy (2009)'s individual perceptions of the built environment and physical built environmental designs, social connectedness was the dominant factor in influencing parents and children's perceived sense of safety and physical activity than the built environment.

Previous studies on social and built-environmental factors related to children's independent mobility revealed that parents' perception of neighbourhood social cohesion and connections were significantly associated with independent mobility for 8 to 13 years old (Lin et al., 2017). As with the previous studies, familiarity with people they know was

found to promote children's physical activity and independent mobility (Loptson et al., 2012; Hayball et al., 2018). My finding corroborates with studies where parents' perceived sense of safety through social connectedness (familiarity and trust with neighbours) demonstrated heightened permission in children's physical activity and independent mobility to destinations, as discussed in Chapter 4.3.1. While the scope of this research was not focused on social factors, other studies revealed that ethnic differences have influence on parents' perceived sense of safety with regards to unknown people and traffic dangers (Lin et al., 2017). Future studies could explore the role of socio-demographic, geographical, cultural factors, and ethnicity in influencing parents' perceived sense of safety and children's independent mobility.

Social connectedness showed strong associations between parental perceptions of environmental safety and children's independent mobility. When redeveloping suburban developments or designing new planning policies, policy makers should focus on fostering social connectedness to facilitate physical activity beyond the practice of focusing only on physical characteristics of built environment. This finding may also underscore the significant role of social connectedness and factors for researchers to include to provide a holistic understanding on variables that influence physical activity for residents.

5.4. Aspirations and Reality

This research contributions by identifying a disjuncture between planning intention and reality for residents. This finding helps expand and extend the literature in evaluation of planning implementation, which is largely neglected by municipal planners and under-studied (Guyadeen & Seasons, 2018; Laurian et al., 2010). While the case study of East Clayton neighbourhood is part of the larger New Urbanism and Smart Growth planning movements to be mixed used and pedestrian oriented community, the reality for residents may prove to be otherwise, as discussed in Section 5.1 and 5.2.

It is not surprising that there are variations across New Urbanist suburban development outcomes as substantiated by (Xu, 2017) study. In contrast with this study's finding, Stanislav & Chin (2019) argue that residents perceived their New Urbanism inspired neighbourhoods in St. Louis, United States to have valuable access to civic and public spaces, and highly favourable and walkable streets, which differs from

typical suburban attributes. (Stanislav & Chin, 2019) This study's finding corroborates with existing evidence that there continues to be gaps between New Urbanism principles and practices, especially regarding aspirational pedestrian friendly built environment designs for the residents. Xu (2017) found that replacement of large-scale commercial land with small clusters of mixed-use retail may even decrease a neighbourhood's proximity to retail stores, thus ineffectively reduce car dependency for residents. My study's finding support Xu (2017)'s finding as the residents' preference and dependence on cars remain the norm, despite having small cluster of mixed-use retail stores. Additionally, Falconer et al.'s (2010) found that New Urbanism developments helped facilitate small gains in leisure walking but are no different than conventional suburban development in their regional car dependence. The reason being is that New Urbanist developments did not deliver any local utilitarian destinations, which is consistent with the lack of land use mix of retail and services found in this study finding. Future research should consider examining specific aspects of built environment indicators, such as the scale and types of mixed-use destinations that would help reduce car dependency and encourage pedestrian friendly environment for residents.

Achieving a New Urbanist neighbourhood requires extensive empirical evidence for evaluation and monitoring that includes a selection of indicators of success that link to plan goals, objectives, and outcomes (Laurian et al., 2010). While this ex-post facto study identified a gulf between New Urbanism principles and the reality for residents, policy makers and municipal planners should consider integrating continuous evaluation and monitoring as part of holistic neighbourhood plans. This finding also foregrounded the importance of developing consistent indicators and methodologies linked to the success of plan goals, objectives, and outcomes, which would be valuable for future researchers to build on. Recognizing that there are institutional challenges, such as limited resources and competing demands to evaluate and monitor plans (Seasons, 2003), researchers can develop monitoring and evaluation practices that can be contextualized for local communities. The result from ex-post evaluation is particularly significant to academic researchers and professional planners because it helps provide improved legitimacy in planning by improving the citizens' understanding of the impacts of planning (Guyadeen & Seasons, 2018, as cited in Oliveira & Pinho, 2010a, 2011).

5.5. Strengths and Limitations

Strengths of this study included the use of mixed methodologies – quantitative objective measures of the built environment and qualitative interviews with residents. These were validated by both parents and children's perceptions of the built environment in influencing physical activity. The goal was to understand the nuanced needs of both parents and children in terms of physical built environment and social factors to facilitate physical activity. This research has the potential to inform future interventions for policy makers to design beyond the physical designs of the built environment and foster social connectedness.

Limitations of this study included the cross-sectional nature of this study, which does not infer conclusion of causality with data collected at a single point in time (Wang & Cheng, 2020). Secondly, structured observation of the built environment was conducted within a 500 meters walking radius of the two elementary schools, whereas the semi-structured interviewees reside in a broader geographical area. As recruitment challenges of parents and children did not allow for other solutions to minimize the discrepancy, this limits the generalizability and applicability of this study to other neighbourhoods. Third, the design of the IMI checklist is statistical and quantitative in nature, which assumes the sum of higher design features would result in a better pedestrian-oriented environment. To overcome this shortcoming, qualitative interviews was deliberately chosen to validate and challenge the findings from IMI checklist. This has proven to be effective as the data results discussed in Section 5.1 illustrate more enriched data where there are similarities and differences between IMI checklist and interview data. Fourth, another limitation included relatively small sample size and selection bias of families who volunteered to participate in this study who may possess similar characteristics of being more physically active than others who did not participate in the study. As discussed in Section 3.2.2., expanding the study area to larger boundary for families who live or spend time within the area allowed this empirical-based study to achieve appropriate sample size, as substantiated by (Hennink & Kaiser, 2022). Additional limitations of the small sample size is the acknowledgement that these findings may not be an accurate representation of the general population of parents and children living in the area.

Chapter 6.

Conclusion

The aim of this research was to explore the impact of a New Urbanism and Smart Growth inspired suburban built environment on encouraging pedestrian activity for parents and children aged 10 to 12 through a case study of East Clayton neighbourhood in City of Surrey. As mentioned in Section 1.2, there are three research questions: 1) What is a compact and walkable suburban built environment? How has Sustainable Principle One aspired to be an example of this? 2) How does the built environment in East Clayton conform to the goals of a compact and walkable neighbourhood? 3) How do parents and children aged 10 to 12 years old perceive the built environment of East Clayton to influence their physical activity?

Question 1 was answered through the context and literature review (sections 1.3 and 2.1). A compact and walkable suburban built environment is pedestrian oriented with proximity to shopping, mixed used development, and human-scale urban design that minimizes car dependence.

Question 2 was answered by applying the IMI checklist to the built environment of East Clayton. The area falls short of meeting the goal of Sustainable Principle One – to foster active pedestrian activity through achieving compact urban design. While the built environment performed well in the domains of perceived safety from crime and traffic, it performed poorly in the domains that are linked to physical activity, such as accessibility and pleasurability, as shown in Table 3.

Question 3 was answered through semi-structured interviews, which illustrated the complex systems of social attributes and parental attitudes that act as strong factors in influencing children's independent mobility and physical activity.

6.1. Summary of Findings

Findings from IMI observational study demonstrated that the built environment of East Clayton area fell short of meeting the goal of Sustainable Principle One – to foster active pedestrian activity through compact urban design. While the built environment

performed well in the domains of perceived safety from crime and traffic, it performed poorly in the domains that are linked to physical activity, such as accessibility and pleasurability, as shown in Table 3. The poor performance in the domains of accessibility and pleasurability were not surprising given the low land use mix and diversity of destinations, and low pleasurable qualities relating to attractiveness of public streets and incomplete sidewalk conditions and amenities. In alignment with the IMI, the interview data corroborated the finding on poor accessibility and pleasurability. For instance, while most parents could access small-scale destinations (e.g., corner store, convenience store), the majority typically preferred driving instead. Consistent with other ex post studies of New Urbanist suburban developments, the built form failed to provide destinations for residents to walk to (Xu, 2017). While the IMI data demonstrated poor performance of pleasurability in terms of sidewalk amenities and condition and attractiveness of public streets, parents and children were generally appreciative of other qualities of pleasurability such as having access to parks, playgrounds, libraries, and schools that are essential services to families. Conversely, parents and children noted the monotonous aesthetic architecture and lack of diversity in destinations as elements that could be improved upon. Although both domains of perceived safety from crime and traffic performed excellent in the IMI checklist, these conditions were raised as safety and comfort concerns for parents and children during the interviews. Potential difference in data results may be due to the nature of the IMI instrument that is based on the quantification on the presence of categories (i.e., lighting, crosswalk markings, etc.), which design features alone do not provide holistic evaluation of a walkable built environment. While the IMI instrument was only able to assess the micro-scale design features of the built environment in a rudimentary way, the qualitative interview helped complement its shortcomings by enriching it with local values and lived experience.

The interviews results demonstrated that parents and children are conducting physical activity but are contingent to a list of physical and social factors or conditions. As discussed in Section 4.3.1, there are a total of eight dominant overarching themes that connect coding categories together to provide valuable and meaningful insights on how parents and children perceive the built environment in influencing their physical activity (see Table 4). While the physical aspect of the built environment played a major role in influencing parents and children's perceived sense of safety and comfort, it is evident that beyond the physical built environment, there are complex systems of social

factors and parental attitudes that influence children's independent mobility and physical activity. While the eight dominant themes were not specified in order of significance, they represented how the parents and children perceive the physical built environment and other social factors affect their physical activity. As discussed in Section 5.1, some dominant themes from the qualitative data results help validate the excellent performance of "perceived safety from traffic and crime" in the IMI checklist, while others do not. Compared to the IMI checklist results, the qualitative data results cannot be categorized in a black-and-white boxes, but rather demonstrate how certain physical features can result in deeper understandings of nuanced and polarizing perspectives. For instance, concerns regarding crime as perceived safety and non-safety is used as an umbrella theme that captures similarities and differences in the interviewees' perspectives. Beyond assessing the physical conditions of the built environment from IMI checklist, data results help enrich another layer of understanding by demonstrating the nature of crime that poses as a safety and non-safety concern for parents and children.

As cities pursue New Urbanism and Smart Growth inspired policies for creating sustainable neighborhoods, ex-post evaluation and monitoring are critical components to inform the success or lack thereof in achieving plans. The mixed methodologies used in this empirical study demonstrates one of the many ex-post evaluation options for policy makers and municipal planners to understand the gaps between planning aspirations and reality for residents. Through the case study of East Clayton neighbourhood, this ex-post study helped illuminate shortcomings of a compact and walkable greenfield suburban development that may not be representatives and applicable for all sites, but useful for future studies. As discussed in Chapter 5, lessons learned from this study highlighted the importance of contextualizing general best practices from New Urbanism and Smart Growth inspired principles to grounding them in local values and needs of the residents. Rather than follow one-size-fits-all approach, policy makers and academic researchers should consider engaging the valuable lived experience and local knowledge of residents to formulate meaningful indicators for ex-post evaluation and change monitoring. Such meaningful indicators include understanding specific aspects of built environment characteristics that would promote physical activity and ground truth the subjectivity of walkability for local residents. For municipalities that are pursuing sustainable planning movements like compact and walkable neighbourhood, New Urbanism and Smart Growth, policy makers should focus on fostering social

connectedness to facilitate physical activity rather than focusing only on physical characteristics of built environment, which is important to provide holistic understanding on variables that influence physical activity for residents.

Overall, this study findings supports evidence of previous literature that support gaps between planning aspirations and practice. Thus, it may be important for future studies to focus research efforts on ex post evaluation and indicators derived from knowledge and lived experiences of the local residents. Aside from grounding the ex-post evaluation in local knowledge for policy response, planners, policy makers and academic researchers should pursue emphasis in social factors and connections in influencing the perceived built environment in encouraging pedestrian friendly neighbourhood.

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Appendix A.

Moderate Scale of Irvine Minnesota Inventory Checklist

Table A.1 Data Collection and Analysis for Irvine Minneosta Inventory Checklist

Answer questions based on this end of segment		**Segment Numbers at Katzie Elementary School**					**Segment Numbers at Hazelgrove Elementary School**						
Safe Street Connections and Crossing	**Modified IMI Scoring Scale**	1	4	7	8	10	5	10	24	21	17	1	27
3. Are there curb cuts at all places where crossing is expected to occur?	yes = 1; no = 0	1	1	1	1	1	1	1	1	1	1	1	1
4. What type of traffic/pedestrian signal(s)/System(s) is/are provided? Mark all that apply													
Traffic signal	yes=1;no=0	0	0	0	0	0	0	0	0	1	0	0	0
Yield sign	yes=1;no=0	1	0	1	1	1	1	1	1	0	0	1	0
Pedestrian activated signal	yes=1;no=0	1	1	0	1	1	0	1	0	1	0	0	1
Answer the following questions while standing at the beginning of the segment													
Neighbourhood Identification													
7. Does the segment have banners that identify the neighbourhood?	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Street Characteristics													
10. How many vehicle lanes are there for cars? (include turning lanes)	0 = no lanes & 3 or more lanes; +1 = 1&2 lanes	1	1	1	1	1	1	1	1	1	1	1	1

Begin walking along the segment to answer the following questions													
Diversity of Destinations													
12a. What types of land uses are present on this area? Mark all that apply													
Residential Homes	yes = 1; no = 0	1	1	1	1	1	1	1	1	1	1	1	1
School (elementary, high school)	yes = 1; no = 0	0	0	0	1	1	1	1	1	0	0	1	0
University/colleges	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Public space (plaza, park, playground)	yes = 1; no = 0	0	0	1	1	1	0	1	1	0	0	1	1
Recreational - Gym/fitness centre/yoga studios etc.	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Recreational - Movie theatre	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Public/civic building - community centre or library	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Public/civic building - Museum, concert hall, theatre	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Public/civic building - Post office, police station, court house	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Institutional - Religious	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Institutional - hospital, medical facility	yes = 1; no = 0	1	0	0	0	0	0	0	0	0	0	0	0
Commercial - retail stores/restaurant	yes = 1; no = 0	1	0	0	0	0	0	0	0	0	0	0	0
Commercial - bank/finacial service	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - hotel/hospitality	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - car dealership	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial - gas/service station	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Office - offices	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0

Office - service facilities (insurance office, dry cleaning)	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
Other - agricultural land, farming	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	1
Other - nature feature	yes = 1; no = 0	0	0	0	1	0	0	1	0	0	0	0	0
Other - undeveloped land	yes = 1; no = 0	0	0	0	0	0	0	0	0	0	0	0	0
12b. How many of the buildings in this segment contain **vertical-mixed use** that is, the building has different land uses on different floors of the building?	0 = absent; +1 = "few" or "some and a lot"	0	0	0	0	0	0	0	0	0	0	0	0
12c. Determine whether any of these distinctive retail types are present (focusing on the form of the building)													
strip mall/row of shops	0 = absent; +1 = present	0	0	0	0	0	0	0	0	0	0	0	0
15. How many of the following **gathering places** are on this segment?													
Restaurants	0 = absent; +1 = "few" or "some and a lot"	0	0	0	0	0	0	0	0	0	0	0	0
Coffee shops	1 = absent; +1 = "few" or "some and a lot"	0	0	0	0	0	0	0	0	0	0	0	0
Complete Sidewalk													
18a. How many sides of the street have sidewalks?	0 = absent; 1 = one or more sides	1	1	1	1	1	1	1	1	1	1	1	1
18b. Is the sidewalk **complete** on one or both sides?	0 = No; 1 = Yes	1	1	0	1	1	1	1	1	0	1	1	0

18c. What is the **condition** or maintenance of the sidewalk?	0 = "poor" or "under repair", or "no sidewalk"; +1 = "moderate" & "good" condition	1	1	1	1	1	1	1	1	1	1	1	1
18f. Is there a **buffer** (for exp, parked cars, landscape "buffer" strip, etc.) between sidewalk or street	0 = No; 1 = Yes	0	1	1	1	1	1	1	1	1	1	1	1
20a. Are there bicycle lanes on the segment?	yes =1; no =0	1	0	0	0	1	0	0	0	1	0	0	0
20b. How are the bicycle lanes demarcated?	on road physical separated by painted line/off road = 1; no demarcation = 0	1	0	0	0	1	0	0	0	1	0	0	0
Traffic Safety - Mid Block Crossing													
21b. What type of **marking** does the crosswalk have? Mark all that apply													
White painted lines	yes =1; no =0	1	0	0	1	0	0	0	0	1	0	0	0
Colored painted lines	yes =1; no =0	0	0	0	0	0	0	0	0	0	0	0	0
Zebra striping	yes =1; no =0	1	1	0	1	1	0	1	1	0	0	1	0
Different road surface or paving (e.g. tiles, colored concrete, marble, etc)	yes =1; no =0	0	0	0	0	0	0	0	0	0	0	0	0
Other	yes =1; no =0	0	0	0	0	0	0	0	0	0	0	0	0
Sidewalk Amenities													
22. How steep or hilly is this segment?	flat/moderate = 1; steep slope = 0	1	1	1	1	1	1	1	1	1	1	1	1

24a. Indicate how many of each of the following street furniture/sidewalk amenities are present on the segment.													
Benches	few or some or a lot = 1; absent = 0	0	0	0	0	0	0	1	0	0	0	0	0
Bus Stops with seating	few or some or a lot = 1; absent = 0	0	0	0	0	0	0	0	0	1	0	0	1
Bike racks	few or some or a lot = 1; absent = 0	0	0	0	0	0	0	0	0	0	0	0	0
Attractiveness													
33a. How many buildings have **garage doors** facing the street?	0 = present/few/some; 1 = not present	1	0	0	1	1	0	1	1	0	1	1	1
35. How many **driveways** are visible on the segment?	visible = 0; not visible = 1	1	0	0	1	0	0	1	1	0	0	1	1
Maintenance													
36. Describe the general **maintenance of the buildings** on this segment.	poor = 0; good = 1	1	1	1	1	1	1	1	1	1	1	1	1
41. Is there outdoor lighting on the segment? (include lighting that is intended to light public paths and public spaces)	yes =1; no = 0	1	1	1	1	1	1	1	1	1	1	1	0
Traffic Safety													
43. What is the **posted speed limit** on this segment? Only include those on the segment itself.	> 40km/h = or not posted 0; <40km/h = 1	0	0	0	1	1	1	1	1	0	1	1	0
44. Are there are measures on this segment that could **slow down traffic**? Mark all that apply.													

Angled/on-street parking (that runs along most or the entire segment - does not have to be on both sides of segment)	yes = 1; no = 0	1	1	1	1	1	1	1	1	1	1	1	1
Neighbourhood Identification (OTHER END OF SEGMENT)													
Safe Street Connections and Crossing													
3. Are there curb cuts at all places where crossing is expected to occur?	yes = 1; no = 0	1	1	1	1	1	1	1	1	1	1	1	1
4. What type of traffic/pedestrian signal(s)/System(s) is/are provided? Mark all that apply													
Traffic signal	yes=1;no=0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian activated signal	yes=1;no=0	0	0	0	0	0	0	0	0	0	0	0	0
Yield sign	yes=1;no=0	0	0	1	1	1	1	1	T	0	0	1	0

Appendix B.

Semi-Structured Interview Guide

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SEMI-STRUCTURED INTERVIEW SCRIPT AND QUESTIONS FOR PARENTS AND CHILDREN AGED 10 TO 12 YEARS OLD

INTERVIEW SCRIPT FOR IN PERSON RECRUITMENT

Hello, my name is Winnie Lee and I am a student researcher at Simon Fraser University. I am hoping to speak with you about your thoughts and experience about the physical built environment in encouraging physical activities for you and your child/children. I am interested in learning more about how children aged 10 to 12 years old play, walk and think about their physical environment such as crosswalk, trees when travelling to school or meet their friends at playground.

Would you be interested in participating in this 30-minute study? If so, I will ask you some questions to see if you are suitable for this study.

SCREENING QUESTIONS

1. Do you live in this East Clayton neighborhood? (show map with boundary)
2. Is your child aged between 10 to 12 years old?
3. Are you comfortable with me audio-recording this conversation for transcription purpose? The recording will be deleted after transcription and analysis of data are completed.

If you answered yes to the three questions, we can proceed with the next step of the study.

I wanted to remind you that you can choose to skip any questions that I ask and that you can ask to stop the interview at anytime with no consequences.

You will receive a $10 Starbucks gift card for participating and will also be entered into a draw to win a $50 local grocery gift card.

Before we begin, here is a copy of the consent and assent form for you and your child to understand what this research involves. We can also review the consent and assent form together to provide you a better understanding of this study.

Do you have any other questions about this study? If you are alright with the consent and assent form, can I get your name for the verbal agreement?

You can keep a physical copy of the consent and assent form for your record.

INTERVIEW SCRIPT FOR IN PERSON/ONLINE INTERVIEW ON ZOOM PLATFORM (RECRUITMENT FROM ONLINE SCREENING SURVEY QUESTIONNAIRE/SNOWBALL RECRUITMENT)

Hello, my name is Winnie Lee and I am a student researcher at Simon Fraser University. Thank you for taking the time to meet with me. As mentioned in the poster/social media post/introduced by our mutual friend, I am interested in learning what your experience and thoughts about the physical built

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environment in encouraging physical activities for you and your child/children. I am also interested in learning more about how children aged 10 to 12 years old play, walk and think about their physical environment such as crosswalk, trees when travelling to school or meet their friends at playground.

Before our meeting today, I sent you an email reminder of copy of the consent and assent form for you and your child to review. The purpose of this is to provide better understanding of what this study entails.

Do you have any questions about the consent and assent form? If you are alright with the consent and assent form, can I get your name for the verbal agreement?

The interview will take approximately 20 to 30-minute. You will receive a $10 Starbucks gift card for participating and also be entered into a draw to win a $50 local grocery gift card.

ONLINE INTERVIEW ONLY

Also, before we begin, do you have markers, crayons and a piece of blank paper ready at home? I sent you an email reminder on the supplies needed.

DRAWING EXERCISE (note: markers and paper will be provided for in person interview)

We will be conducting a fun 5-minute drawing exercise as icebreaker. If you and your child feel comfortable drawing, on a piece of blank paper, can you please use markers/crayons you have to draw how you get around in the neighbourhood? It can be stick figures or anything you like.

The drawing prompt: *When you walk, bike, play in your neighbourhood, what features first come to your mind? What stood out to you when you walk to school from home?*

We will have approximately 5 to 10 minute doing this fun drawing exercise and I will step out to provide you space to do this. I will prompt you when the time is up.

ONLINE INTERVIEW ONLY

I will turn off my camera to provide you space and feel free to turn your camera off when drawing if that makes you feel more comfortable.

When you are done with your drawing, can you please take a picture of your drawing and send it to my email? Or if it is easier for you, you can hold up the drawings, and I will take a screenshot over Zoom. We will be going over the drawing with some questions.

INTERVIEW QUESTIONS FOR IN PERSON/ONLINE PLATFORM

SEMI-STRUCTURED INTERVIEW QUESTIONS FOR PARENTS (note: as this is a semi-structured interview, some follow-up questions may not be included here but will be developed on the field)

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FOLLOW UP QUESTIONS

Based on the drawing....

- What did you draw first? Why was that?
- How do you usually get around in this neighbourhood?
- Do you often walk in this neighbourhood?
    - If yes, where are you walking to and from?
    - If not, why is that? What deters you from walking with your child?
- Who do you typically walk with?

DESTINATIONS

- Where do you typically walk or bike to in the neighbourhood?
- Are there any destinations that you like to walk/bike to around your home? If yes, what are those? If not, why is that?
- Can you show me what routes do you usually walk with your child to destinations such as shops, school or parks? I can highlight the pathways and you do not need to tell me where you live (Visual materials such as maps and pictures of the physical environment will be provided by researcher)
    - Is there a reason why you choose this particular route (i.e. shortest distance)?
    - What are some of the interesting features of built environment (i.e. benches, trees, destinations, even sidewalk, crosswalk, intersections) that motivates you to walk?
    - What are some interesting features of built environments (i.e. benches, trees, destinations, even sidewalk, crosswalk, intersections) that deters you from walking?
- Do you walk with your child to school? If not, who do they walk with to school?

SENSE OF COMFORT AND SAFETY

- How do you feel when walking, and biking with your child in this neighbourhood?
- Do you feel safe for your child to walk to school by themselves? If not, what would help to increase the safety for your children?
- How do you feel about your child walking or biking by themselves in the neighbourhood?
- If you do not walk with your child to school, how do you typically commute to school? Why is that?
- How safe do you feel when crossing the streets with your child?

SEMI-STRUCTURED INTERVIEW QUESTIONS FOR CHILDREN AGED 10 TO 12 YEARS OLD (note: as this is a semi-structured interview, some follow-up questions may not be included here but will be developed on the field)

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FOLLOW UP QUESTIONS

- What did you draw first? Why was that?
- Can you tell me what do you like about walking to school?
- What do you see on your journey to school?
- What are some of the interesting features do you remember when walking to school?
- Why do you draw a big turn here? Is it because there is big intersection here?
- Who do you typically walk with to school?
- What other places do you like to walk to other than school? Is it the playground or the park?
- What do you not like about walking or biking in this neighborhood?

Is it alright for me to keep the drawing and use this in my work?

END OF SEMI-STRUCTURED INTERVIEW

Thank you so much for taking the time to talk with me today. Just a final reminder that you can contact me via phone or email if you have any questions about today, have any information that you forgot to add and want to share, or have anything you want me to remove from my notes that you said.

Also, if you know any parents and children aged 10 to 12 years old who reside in this neighbourhood who may be interested in participating in this study, can you please pass on my contact information to them? Here is my contact card.

I will be sending you a $10 Starbucks giftcard over email and if you can please provide your name and email address, that would be greatly appreciated. For the draw to enter to win a $50 gift card at your local grocery store, would it alright if I use the same email provided?

The winner of the gift card will be notified through email by end of March.

Appendix C.

East Clayton Neighbourhood Concept Plan Seven Sustainable Principles

1.2.1 General Land Use Plan and Seven Principles of Sustainable Development

In July, 1998, City Council held a shirtsleeve session to raise discussion and obtain feedback on issues related to sustainable growth, efficient development and livable communities for Surrey. At this session the following seven principles of sustainable development were presented:

Principle No. 1
Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six-minute walk of their homes.

Principle No. 2
Provide different dwelling types (a mix of housing types, including a broad range of densities from single-family homes to apartment buildings) in the same neighbourhood and even on the same street.

Principle No. 3
Communities are designed for people; therefore, all dwellings should present a friendly face to the street in order to promote social interaction.

Principle No. 4
Ensure that car storage and services are handled at the rear of dwellings.

Principle No. 5
Provide an interconnected street network, in a grid or modified grid pattern, to ensure a variety of itineraries and to disperse traffic congestion; and provide public transit to connect East Clayton with the surrounding region.

Principle No. 6
Provide narrow streets shaded by rows of trees in order to save costs and to provide a greener, friendlier environment.

Principle No. 7
Preserve the natural environment and promote natural drainage systems (in which storm water is held on the surface and permitted to seep naturally into the ground).